



Mid-Atlantic Regional Agronomist Quarterly Newsletter

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Dr. Richard W. Taylor, Editor
rtaylor@udel.edu
University of Delaware

Supporting Agronomists:
Dr. Wade Thomason, Va Tech
Dr. David Holshouser, Va Tech
Dr. Bob Kratochvil, University of Maryland
Dr. Greg Roth, Penn State
Dr. Peter Thomison, Ohio State University

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.

Contributors for This Issue

Dr. Peter R. Thomison, OSU

Allen B. Geyer, OSU

Dr. Wade Thomason, Va Tech

Dr. Mark Alley, Va Tech

Marvin Martz, CPS

Dr. Bob Kratochvil, UMD

Dr. José M. Costa, UMD

Dr. Chris Teutsh, Va Tech

Dr. Les Vough, UMD

Elmer Dengler, MD NRCS

Dr. Richard Taylor, UD

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Organic Corn Production Survey: Hybrid Selection and Management Practices Vary

Dr. Peter R. Thomison
Associate Professor—OSU Extension State Corn Specialist
The Ohio State University
Email: thomison.1@osu.edu

Organic farming is one of the fastest growing segments of U.S. agriculture. Following establishment of national organic standards in 2002, certified organic acreage doubled in 2005. However, adoption of organic farming differs considerably among crops. Organic fruit and vegetables comprise a much greater percentage of total U.S. crop acreage than field crops, e.g., in 2005, organic carrot production comprised 6 percent of total U.S. carrot acreage, whereas organic corn production comprised only 0.2 percent. One obstacle contributing to the low acreage of organic corn is a lack of information on the agronomic performance and grain quality of corn hybrids and varieties in organic cropping systems. Many organic grain farmers are seeking information and knowledge to help them identify organic hybrids and varieties that perform best under varying environmental conditions. This is becoming increasingly important as demand for organic corn increases locally, nationally and internationally, and as the number of organic farmers increase.

In 2006, the Organic Crop Improvement Association, Research and Education (OCIA-R&E), distributed a survey to OCIA – R&E farmer members in Ohio, Iowa, and Wisconsin to determine current organic management practices, especially those relating to corn hybrid and variety selection and management. Results of the survey served as the basis of a 2007 multi-state organic corn variety testing project initiated by corn and organic crop production extension specialists at The Ohio State University, Iowa State University, and the University of Wisconsin. This study was supported by a 2006 USDA North Central Region Sustainable Agriculture Research and Education grant.

Of the 260 questionnaires mailed to OCIA-R&E farmer members, 67 completed questionnaires were returned. The following are some of what the questionnaire revealed about current organic corn management practices in Ohio, Iowa, and Wisconsin. Eighty five hybrids were planted by respondents. Of these, 56 were organically produced, 29 were untreated conventionally produced hybrids. The average hybrid maturity was 102 days, with a range of 75-114 days. Ninety-one percent of the hybrids planted were used for animal feed (grain and silage); 9% were for food grade uses. The average planting date was 5/9/06 with a planting date range of 4/24/06-6/31/06. The surveys represented 4,198 acres of organic corn in the three states. Total certified organic acreage in Iowa, Ohio, and Wisconsin was about 44,200 A in 2005 (US total certified acreage was about 130,700 A in 2005). The average farm size was 65 acres, with a range of 3 to 392 acres. The average seeding rate was 28,218 with a range of 18,000-36,000 seeds per acre. Sixty-eight percent of the respondents indicated that corn was planted following a red clover, alfalfa, hay/pasture or some other unspecified cover crop. Seventy-two percent of the respondents used some form of manure to maintain soil fertility. With regard to harvest dates, 45% typically harvest during October, 30% harvest during November, and 3%

harvest during December. Drying methods varied with 16% of the questionnaire respondents relying on artificial grain drying, 6% air only, 1% harvesting hi-moisture corn, 45% relying on field drying, and 31% using a combination of field and artificial drying. With regard to storage, 90% of respondents had on-farm storage for the crop (with 1 response having storage for ear corn only). Organic farmer respondents indicated that effective weed control was their major concern in organic corn production (cited by 54% of the respondents). Weed control was accomplished with the use of tillage and multiple cultivations, with 4 respondents using flame weeding as part of their weed control strategy and 10 respondents utilizing some form of hand weeding.

2007 Ohio Corn Performance Test—Triple and Quadruple Stacks Predominate Entries

Dr. Peter R. Thomison
Associate Professor—OSU Extension State Corn Specialist
The Ohio State University
Email: thomison.1@osu.edu

Grain yields of hybrids entered in the 2007 Ohio Corn Performance Test (OCPT) were outstanding despite what appeared to be a less than ideal growing season at some locations. Test sites averaged more than 200 bu/A except for Hoytville, which averaged 180 and 182 bu/A for the early and full season trials, respectively. “Traited” hybrids (i.e hybrids with Bt insect resistance and herbicide resistance) now dominate the Ohio Corn Performance Test and more than half the entries are triple or quad stacks. In 2002, less than 15% of the hybrid entries were traited. In 2006, 59% were traited, and this year, at least 84% of the 237 entries were traited. Of these traited hybrids, 121 hybrids are triple or quad stacks, 46 are double stacks, 37 contain a single trait. Overall triple stack hybrids were associated with the highest yields for hybrids entered statewide. In the OCPT summary of hybrids entered in the western regions and statewide (see the table OCPT “Combined regional summary of hybrid performance, 2007” available online at:

<http://www.oardc.ohio-state.edu/corntrials/regions.asp?year=2007®ion=State>, then select "Single Year Trials - 2007 - All Regions in Ohio/Western Ohio") eight of the top ten yielding hybrids are triple stacks, one is a double stack, and one contains a single trait. However, stacked traits did not necessarily ensure the highest yields. Of the bottom ten hybrids, nine are triple stacks and one is a double stack.

“Abnormal Corn Ears” Poster Available

Dr. Peter R. Thomison
Associate Professor—OSU Extension State Corn Specialist
The Ohio State University
Email: thomison.1@osu.edu
and
Allen B. Geyer
Research Associate—Horticulture and Crop Science
The Ohio State University
Email: geyer.9@osu.edu

When we started getting reports of various ear abnormalities in corn this past summer, we prepared a poster for display at the Farm Science Review to help growers sort out various ear disorders and their possible causes. Since then we've had many requests for copies of this poster and we can now finally take orders for copies.

A reduced 11 x 14 inch version of the poster is available for online at:
<http://agcrops.osu.edu/corn/documents/AbnormalCornEarsPoster.pdf>

Our Communications & Technology section (contact information below) has 26 x 33 inch copies of the poster available for distribution. Ask for “Abnormal Corn Ears” poster” ACE-1. Poster cost is \$10 plus shipping.

The Ohio State University
Communications and Technology
Media Distribution
216 Kottman Hall, 2021 Coffey Road
Columbus, OH 43210-1044
E-mail: pubs@ag.osu.edu
Phone 614-292-1607
Fax 614-292-1248

Ohio residents can contact their local county Extension office to place orders for the poster.

Increasing Early Season N Fertilizer Efficiency in Corn

Dr. Mark Alley
W. G. Wysor Professor of Agriculture
Virginia Tech
Email: malley@vt.edu

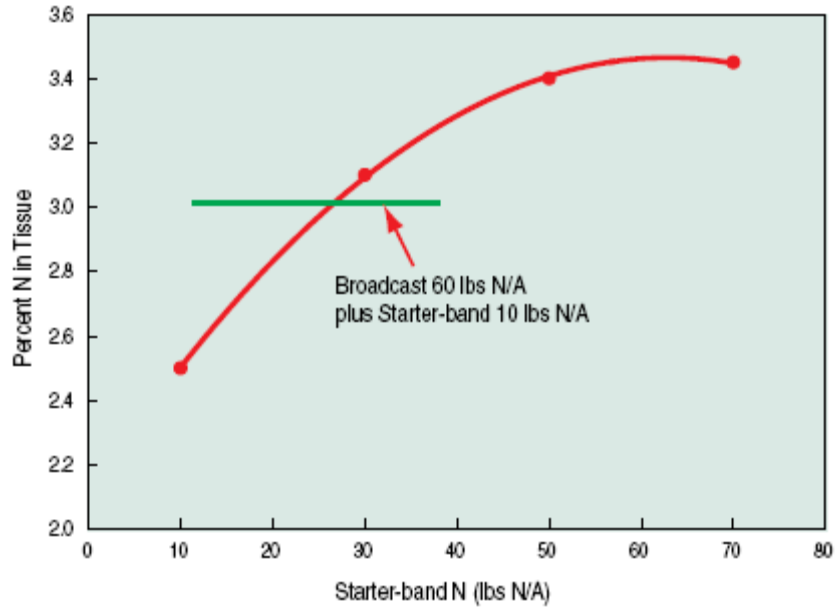
Marvin Martz
General Manager, Mid-Atlantic Division
Crop Production Services

and
Dr. Wade Thomason
Extension Specialist – Grain Crops
Virginia Tech
Email: wthomaso@vt.edu

Early season nutrient availability to corn is influenced by fertilizer placement. Germination and emergence of the corn seedling usually occurs in six to ten days with reasonable temperatures and moisture. The corn seedling can be expected to develop two fully-expanded leaves and a primary root system that obtains needed nutrients from the soil within seven days after emergence. The supply of nutrients in the seed will be exhausted by this time. Corn plant roots generally do not reach the row middle until the corn plant has eight fully emerged leaves. Therefore, during approximately the first six weeks after planting, nutrients that are band-placed close to the corn row are more likely to be available for corn plant uptake than if the same amount of nutrients were broadcast over the entire soil surface.

We conducted nine field experiments with corn to determine the optimum starter-band N rate in conjunction with the optimum sidedress N rate. Our research used blends of urea-ammonium nitrate (UAN at 30% N) solution as the N source and 10-34-0 as the P source. We varied N rates from 10 to 70 lbs/acre placed in a 2 x 2 band. Soil test P levels in these studies were all high and the banded P rate of 34 lbs/acre of P₂O₅ would be expected to provide for any P fertilizer needs. In addition, we conducted starter band P application rate studies of 0, 20, 40, and 60 lbs/acre of P₂O₅ at each site to measure corn response to varying P application rates.

An example of enhanced N availability from starter-band placement is shown in the figure below. The percent N in whole corn plant tissue samples collected six weeks after planting was approximately the same with either a starter-band application of 30 lbs N/acre or a surface broadcast application of 60 lbs N/acre plus 10 lbs N/acre in a starter-band. The starter band N was more efficient in supplying N to the young corn plants.



Efficient plant nutrition programs are a yield building component of a profitable and environmentally sound crop production system. Early season nutrient availability is essential for establishment of a vigorously growing crop that is positioned for maximizing yield potential for a specific site. To this point, some growers have chosen to forego the increased efficiency of starter band-applied fertilizer in favor of broadcast applications because of the cost of starter application equipment and the additional time required. In the face of higher fertilizer prices, growers and advisors should re-evaluate the potential benefits of corn starter-band fertilizers.

Wheat Production Basics IV: A Different Tactic for Fall Nitrogen

Dr. Robert Kratochvil
Extension Specialist – Grain and Oil Crops
University of Maryland
Email: rkratoch@umd.edu

Successful wheat production requires attention to a number of factors. One of utmost importance is supplying adequate, but not excessive, nitrogen to the crop at important stages of growth. Nitrogen used by the newly planted crop is supplied either from residual soil nitrogen not used by the preceding crop or from an at-planting fall application. The focus of this article is this first stage for supplying nitrogen. And, since a large portion of the wheat grown in this region follows corn, this discussion will be limited to that rotation.

The amount of residual N available can vary significantly depending upon the yield of the corn crop, amount and timing of fertilizer N supplied, the form (i.e. commercial fertilizer, manure, legume) of N supplied, precipitation received during corn growing season, following corn harvest and prior to and after wheat planting, and the field soil type. Since nitrogen is

highly soluble nutrient that is subject to movement (leaching) out of the root zone, many farmers routinely apply 20-40 lb acre⁻¹ N at wheat planting. Considerable research has been conducted that supports fall nitrogen use as well as many farmers experiencing better wheat yields has made fall nitrogen use a standard production practice for many.

Residual nitrogen loss to ground and surface water after corn was identified many years ago as a non-point source of nutrient supply to the Chesapeake Bay that caused water quality decline. The planting of winter cereal cover crops was recognized as a way to reduce the loss of residual nitrogen. The Maryland Cover Crop Program was created to encourage, via monetary incentives, the planting of cover crops by farmers. In 2006, the Maryland Cover Crop program was expanded with the inclusion of a Commodity Cover Crop component. Under this aspect of the Cover Crop Program, farmers can plant any small grain (wheat in this case) and manage it with intention to harvest the grain. But, they must follow two criteria for nitrogen use to qualify for payment. First, no fall nitrogen, other than residual amounts, in the soil can be used. And, spring nitrogen cannot be applied until March 1. The incentive for participation in this program is \$20 acre⁻¹.

The question asked by many farmers about participation in Commodity Cover Crop program is “How much wheat yield will I lose with no fall nitrogen?” This question has been the basis for field research conducted by my program the past two years. During spring 2005 and 2006, corn research plots were planted at three Maryland locations (different soil types) each year. To establish different soil residual nitrogen amounts following the corn, three nitrogen treatments (deficient, optimal, and excessive) were used for the corn. Following corn harvest, wheat was planted into the plots for each of the corn nitrogen treatments with ½ of each plot getting fall N (30 lb acre⁻¹) and ½ getting no fall N. Spring nitrogen for the wheat was supplied as a split application of 80 lb N acre⁻¹ with the first half applied on or as soon after March 1 as possible and the second half supplied when the wheat began to joint.

Wheat yield in 2006, averaged over the three locations and three corn nitrogen treatments, was nearly 6 bu acre⁻¹ greater for wheat that received fall N. The fall N fertilized wheat in 2007, averaged over all locations and corn N treatments, produced only 1.4 bu acre⁻¹ more than wheat that did not get fall N. The wheat yield advantage attained with fall nitrogen for each location/year by corn nitrogen treatment is shown in Table 1.

Table 1. Wheat yield advantage following corn when using fall N compared to no fall N at three Maryland locations and for three corn nitrogen treatments during 2006 and 2007.

Corn Nitrogen Treatment	Wye Research and Education (R&E) Center Silt loam soil		Central Maryland R&E Center - Beltsville Sandy loam soil		Central Maryland R&E Center – Upper Marlboro Sandy loam soil	
	-----Wheat yield advantage with fall N (bu acre ⁻¹)-----					
	2006	2007	2006	2007	2006	2007
Deficient (60 lb N acre ⁻¹)	+8	+3	+4	+1	+3	+3
Optimum (150 lb N acre ⁻¹)	+3	+1	+8	+2	+9	+1
Excessive (240 lb N acre ⁻¹)	+9	+2	+4	-2	+5	+2

Though a consistent yield response with the use of fall N for wheat was observed during the first two years of this research, an economic assessment of the profitability when not using fall N per the criteria for participating in the Commodity Cover Crop program is worthy of consideration. The assumptions used for the economic analysis were: 1) cost of nitrogen at \$0.50 lb⁻¹ or \$15 acre⁻¹; 2) application cost of fall N at \$7 acre⁻¹; and 3) participation in the Commodity Cover Program netted \$20 acre⁻¹ for a combined \$42 acre⁻¹ input savings and cash received by participating in the program. At different selling prices for wheat, the yield response required to break even when either using fall N or not using fall N and participating in the Commodity Cover Crop program can range from 3 to 14 bushels acre⁻¹ (Table 2).

Table 2. Yield response necessary to recoup costs associated with either using fall N or not using fall N and participating in Maryland's Commodity Cover Crop Program.

Wheat N management program	Wheat Price (\$ bu ⁻¹)				
	\$3	\$4	\$5	\$6	\$7
	Wheat yield necessary to recoup costs with fall N ----- bu acre ⁻¹ -----				
30 lb acre ⁻¹ fall N (cost = \$22 acre ⁻¹)	+7.3	+5.5	+4.4	+3.7	+3.1
Commodity Cover Crop Program (savings + incentive = \$42 acre ⁻¹)	+14	+10.5	+8.4	+7	+6

Based upon the results observed to date with this research, I don't expect farmers to be overwhelmingly convinced that planting wheat without fall nitrogen should become a standard practice. I do believe that there will be field and year situations that will make this a successful practice. My challenge to farmers is to do some strip plot comparisons on their farms. All that would be required to do this is to establish 4-6 strips per field that will not get fall nitrogen when the rest of the field is fertilized. Then, manage the entire field for the rest of the season with your normal nitrogen practices with the exception of not applying spring nitrogen on the no fall N strips until March 1. At harvest, use your yield monitor to determine how the no fall N strips compare to those that received fall N. And, in order to make the comparison complete, assess the profitability for each of the systems.

Variety Performance and Production Management for Hulless Barley

Dr. Robert Kratochvil
Extension Specialist – Grain and Oil Crops
University of Maryland
Email: rkratoch@umd.edu

and
Dr. José M. Costa
Small Grain Breeder
Dept. of Plant Science and Landscape Architecture
University of Maryland
Email: costaj@umd.edu

Since 2004, the University of Maryland has investigated hulless barley as a potential feedstock for fuel ethanol production with grant support from both Maryland Grain Producers Utilization Board and Harry R. Hughes Center for Agro-Ecology Inc. During 2006-2007, Dr. Costa conducted performance evaluations for the two Virginia Tech derived hulless varieties currently available, ‘Doyce’ and ‘Eve’ in comparison tests with a number of hulled varieties and elite breeding lines. Average grain yield at four Maryland locations for those two hulless varieties was only 77% of the average (91 bu/A) for the thirteen hulled varieties tested. ‘Doyce’ produced significantly better than ‘Eve’, 76 vs. 65 bu/A. ‘Thoroughbred’ was the best yielding (102 bu/A) hulled barley variety tested. Continued breeding and selection of hulless barley for the Mid-Atlantic will likely close some of this production gap in the future. To learn more about the Maryland Small Grain Variety tests visit www.mdcrops.umd.edu.

Dr. Kratochvil’s research has emphasized a number of management questions for hulless barley (i.e. harvest-induced seed damage, seeding rate, nitrogen management, planting date, and seeding depth). Replicated studies conducted during 2007 and the three previous years have addressed these management questions.

- For seed production, proper combine adjustment is needed to minimize harvest-induced damage to the germ. Combine cylinder speed should be slower than the speed used for hulled barley. In research trials, seed germination improved over 15 percentage points with a cylinder speed of 700 rpm compared to the commonly used setting of about 1000 rpm for hulled barley.
- Hulless barley seedlings do not have the same seedling vigor as hulled barley. Following two years of seedling emergence counts taken three weeks post-planting, ‘Doyce’ had an emerged population that averaged approximately 60% of the emerged population for ‘Thoroughbred’.
- It was believed that increasing the seeding rate for hulless barley would partially compensate for its seedling vigor and stand emergence problems. ‘Doyce’ and ‘Thoroughbred’ were compared over a range of seeding rates (0.75 to 2.5 million seeds/A) at a total of seven locations during 2005-2007. Yield for ‘Doyce’ was

maximized at 1.75 million seeds/A, the same rate observed for ‘Thoroughbred’. Increasing hulless barley seeding rate above this level to compensate for seedling vigor problems is not necessary.

- Nitrogen fertilizer requirement for hulled barley has been well documented. However, little was known about hulless barley response to nitrogen. Doyce has been evaluated at one location per year (Wye-2005 and Beltsville-2006 and 2007) to assess its response to a range of nitrogen rates and dates of application. To date, this research has indicated that optimal hulless barley yield is attained with ~105 lb N/acre. Tests conducted at additional locations and/or years will be necessary to fine-tune these recommendations.
 - When no fall nitrogen is used, it is important to supply hulless barley approximately 60 lb N/A at spring greenup (or as soon after March 1 as possible if grown within the MACS cover crop program guidelines). It has also been observed over the three years that an additional 45 lb N/A be supplied with a second spring application when the crop reaches jointing stage.
 - When 20 lb/A nitrogen was used at planting, the best spring greenup response has been with 40 lb N/A followed by a second application of 45 lb N/acre at jointing.
- Hulless barley should be planted within a timeframe between the last 10 days of September and mid-October. Because hulless barley seedlings do not have the same seedling vigor of hulled barley, planting during the latter part of October and early November should be avoided.
- Hulless barley seed will establish seedlings more easily if planted shallow rather than deep. Two planting depths (0.75” and 1.5”) for ‘Doyce’ were compared at two locations each year during fall 2006 and 2007. Seedling emergence three weeks after planting was nearly 35% better for the shallow treatment. ‘Thoroughbred’ hulled barley was evaluated at the same two depths and had 15% better seedling emergence at the shallow depth. Shallow seeding of hulless barley does not allow it to compensate for its lack of seedling vigor as it attained a seedling emergence that was 70% of ‘Thoroughbred’.

Drought Offers Opportunity to Get Legumes Back into Your Pastures

Dr. Chris Teutsch
Associate Professor
Southern Piedmont AREC
Blackstone, VA
Email: cteutsch@vt.edu

One good thing about this year’s drought is that it has given many of us a chance to get legumes back into our pastures. Sods have been grazed close, in some cases really close and while this may not be ideal pasture management, it is ideal for pasture renovation. Close and

frequent grazing reduces the competitiveness of sods and the amount of residue on the soil surface, both of which are essential for successfully frost seeding or no-tilling legumes.

Having legumes in your pastures have always been important, but as a barrel of oil reaches \$100 and nitrogen prices approach \$0.70 lb, healthy and vigorous stands of clover and other legumes become even more important. Incorporating legumes into your pasture increases forage quality and animal performance, dilutes the endophyte in tall fescue, brings nitrogen into your grazing system, and improves summer growth. The following steps will help to ensure successful renovation:

- *Control Broadleaf Weeds.* Broadleaf weeds must be controlled prior to seeding legumes. This is best accomplished by controlling weeds the season prior to renovation.
- *Soil Test and Adjust Fertility.* In order for pasture renovation to be successful proper soil fertility is required. Lime and fertilize pastures according to soil test results. Lime should be applied six months prior to renovation if possible.
- *Suppress Sod and Decrease Residue.* The existing sod must be suppressed and plant residue reduced prior to seeding. The reduction in plat residue facilitates good soil-seed contact. This can be accomplished by hard grazing in late fall and early winter or by using herbicides.
- *Ensure Good Soil-Seed Contact.* Regardless of what seeding method is chosen, good soil-seed contact is required for seed germination and emergence.
- *Seed on Proper Date.* Frost seeding or drilling legumes back into pastures is usually best accomplished in late winter. Frost seeding is accomplished by simply broadcasting the seed on the soil surface and allowing the freezing and thawing cycles to incorporate the seed into the soil. Success with frost seeding can be enhanced by dragging your pasture after or as you broadcast the seed. This simply gets the seed in better contact with the soil. Prior planning and preparation are important so that seeding can be done in a timely manner.
- *Use High-Quality Seed of an Adapted Species.* Choose forage species that are adapted to the area and end use. Use either certified or proprietary seed to ensure high germination, seed genetics, and low noxious weed content. Cheap, low quality seed often cost more in the end due to lower production and thin stands. In Virginia, a good mixture for renovating pastures with is 4-6 lb red clover, 1-2 lbs of ladino or grazing white clover, and 10-15 lb of annual lespedeza per acre.
- *Use correct seeding rate.* Calibrate your seeder prior to planting. Seeding at too high of a rate needlessly results in higher seed costs. On the other hand seeding at too low a rate results in weak stands and lower productivity.
- *Inoculate Legume Seed.* Always use inoculated legume seed or inoculate it with the proper strain of nitrogen fixing bacteria prior to seeding. This is relatively inexpensive insurance that legume roots will be well nodulated and efficient nitrogen fixation will take place.

- *Control Seeding Depth.* Small seeded forages should never be placed deeper than ½ inch. When using a drill always check seeding depth since it will vary with seedbed condition and soil moisture status. Placing small seeded forages too deep will result in stand failures.
- *Check seed distribution pattern.* When using a spinner type spreader/seeder make sure and check your spreading pattern. In many cases small seeded forages are not thrown as far as fertilizer. This can result in strips of clover in your pastures rather than a uniform stand. Also check your seed distribution pattern. Single disk spinners often throw more seed to one side.
- *Control Post-Seeding Competition.* Failure to control post-seeding competition is one of the most common causes of stand failures. Clip or graze the existing vegetation to a height just above the developing seedlings. This must be done in a timely manner to ensure that the competing vegetation does not get ahead of the seedlings.

Using What the Good Lord Gave Us

Dr. Chris Teutsch
Associate Professor
Southern Piedmont AREC
Blackstone, VA
Email: cteutsch@vt.edu

As we go through life we often try to go against nature and the results are normally disastrous. This also holds true for forage species. We often see flashy full-page advertisements for the latest and greatest in forage species and varieties. Some are OK and some are all advertisement. So the question becomes what species should we use and where do we get that information from? You could call me or your extension agent or even your seed representative, but a better place to start may be your backdoor. Walk out and take a look around. What species are growing in your yard? How about your hayfield or pasture? How about in that overgrazed area? Why not take a look at that bottomland along the creek or river? The species that you see are there for a reason, they are well adapted. These naturalized species have been selected under local conditions for years or maybe even decades.

In Southside Virginia pastures we often find a mixture of species that include things like tall fescue, Kentucky bluegrass, crabgrass, bermudagrass (often called wiregrass), white clover, lespedezas, and maybe a little orchardgrass. We could buy perennial ryegrass or timothy and plant it, but there is a reason we don't see them occurring naturally, they are not well adapted to our conditions. The question we really need to be asking is how do we manage the complex mixtures that naturally occur in our pastures to meet our needs. The remainder of the article is dedicated to discussing how the management decisions that we make in our grazing systems impacts the botanical composition and production of our naturalized pastures.

Liming pastures. How we manage our soil acidity can influence what forage species are present in our pastures. For example in a mixed sward adding lime to a soil with a low pH would encourage the clover. If we did not add lime we might expect grasses and acid tolerant legume species such as annual or sericea lespedeza to be present in greater quantities. Recent work at Virginia Tech's Southern Piedmont AREC found that crabgrass was very tolerant of soil acidity. This means that on rented land where the application of lime can not be justified, crabgrass and annual lespedeza may be a great choice for summer grazing.

Fertilizing pastures. Generally speaking, improved grasses and legumes like orchardgrass, clovers and alfalfa need good soil fertility to persist and be productive. This means not only adjusting soil pH with lime, but also adding phosphorus and potassium. If soil fertility is low it will favor species that are more efficient at extracting and using nutrients from the soil. A good example of this is tall fescue and sericea lespedeza on reclaimed mineland in southwest Virginia. These species are present because they are better adapted to poor fertility.

Nitrogen application rate and timing can shift the botanical composition of pastures. In mixtures of grasses and legumes, nitrogen fertilization will tend to encourage grass growth shifting the composition toward grasses and away from legumes. So if your goal is to introduce and maintain a higher percentage of legumes in your pasture then you may want to minimize nitrogen fertilization.

The timing of nitrogen applications can also influence the balance of warm- and cool-season grasses in your pasture. Early spring and late summer applications will encourage cool-season grass growth (tall fescue and bluegrass). In contrast, summer applications will shift the pasture composition toward crabgrass and bermudagrass in mixed stands. So the optimal time to apply nitrogen depends on what you want and need. If you desire more naturalized warm-season species in your pasture for summer grazing, then apply your nitrogen in early summer. If your goal is to maintain a healthy stand of tall fescue for stockpiling then applying nitrogen in early spring and late summer would be a better choice.

Grazing management and forage plant growth. How we graze our pastures has a profound impact on botanical composition. To fully understand the effects of grazing management we need to talk a little bit about forage plant growth. After defoliation (grazing or cutting), plants need energy to regrow. In grasses this energy comes from two places. The first is leaf area remaining after grazing. The remaining leaf area is like a solar panel that captures sunlight and converts it into energy (sugars and carbohydrates) that the plant can use for regrowth. The more leaf area we leave, the larger the solar panel and the faster pastures will regrow.

The second place that energy comes from for regrowth, is stored carbohydrates. The location of these stored energy reserves depends on the plant species. For example orchardgrass stores its energy in the stem bases, while bermudagrass stores energy in its stolons and rhizomes (modified stems that grow just above or below the soil surface). So grasses that store their energy in the stem base are more susceptible to close and frequent grazing compared with grasses that store their energy in stolons and rhizomes that are safely below the grazing height of livestock.

The amount of stored energy in pasture plants depends on whether or not we rest our pastures between grazing events. Resting pastures allows leaf area to regrow and carbohydrate reserves to be stored up. In general, tall growing legumes are more dependent on stored energy for regrowth. For example alfalfa is completely dependent on stored energy in the tap root for regrowth. This means that it needs time to rest and replenish its stored carbohydrates between grazing events. That is the reason that alfalfa does not persist well in continuous grazing systems.

Grazing height. In our naturalized pastures, close grazing will tend to favor grass and legume species that have leaf area and energy stores close to the soil surface. This results in a shift toward low growing species such as bermudagrass, Kentucky bluegrass and white clover. A higher grazing height would tend to shift the botanical composition back toward our tall growing cool-season grass species such as tall fescue and orchardgrass.

Grazing frequency. How often we graze or if we utilize rotational stocking can influence the botanical composition of our naturalized pastures. Most pasture species benefit from rotational stocking. Some species are more tolerant of frequent grazing. These species tend to have leaf area close to the soil surface that is retained even under close grazing and include bluegrass, white clover, and bermudagrass. This means that grazing naturalized pastures closely and frequently will tend to shift the botanical composition toward these species.

Grazing timing. The time of the season when pastures are grazed can also influence the botanical composition. Grazing a mixture that includes both cool- and warm-season species during the summer months will tend to shift the botanical composition toward the warm-season species. This commonly occurs in pastures in Southside. Grazing these pastures hard during the summer months favors the bermudagrass and crabgrass, especially during and after droughts.

Putting it all together. How we manage our pastures can have profound effects on the botanical composition. I would like to give several examples for different regions of the state. The first example is for pastures west of the Blue Ridge Mountains. In this example a cattle producer notices that his pastures are becoming dominated by Kentucky bluegrass and common white clover. While these species have some positive attributes, they tend to be lower producing when compared to ladino clover and tall growing grass species (orchardgrass and tall fescue). To shift the botanical composition back toward tall growing cool-season grasses and ladino clover he needs to raise his grazing height and allow his pastures to rest between grazing events. This will favor the taller growing species in this mixture by leaving more residual leaf area and allowing them time to store energy up between grazing events.

The second example is for the Southern Piedmont Region of Virginia. A producer has a mixture of tall fescue and bermudagrass, but would like to have more summer grazing. In this situation he can shift the composition of the sward toward the bermudagrass (warm-season grass) by applying nitrogen fertilizer in early summer and utilizing his pastures heavily during the summer months. This will tend to suppress and weaken the cool-season species and encourage the bermudagrass.

Using improved varieties. After you determine what species are well adapted to your area and management practices, you may want to consider using improved varieties. These varieties may offer considerable benefits in terms of improved yield, animal performance, and persistence. For example improved varieties of clover, orchardgrass, alfalfa, and even sericea lespedeza have been selected for greater tolerance to grazing, making them a better choice for pastures.

Regardless of what you are doing, in most cases working with nature greatly improves your chances of success. Grazing is no different. Successful grazing systems are based on forage species that are well adapted to your local conditions and managing those species to meet your specific needs.

Understanding a Hay Analysis Report

Dr. Richard W. Taylor
Extension Agronomist
University of Delaware
Email: rtaylor@udel.edu

Dr. Les Vough
Forage Crops Extension Specialist Emeritus
University of Maryland
Email: vough@umd.edu

and
Elmer Dengler
Resource Conservationist
Maryland Natural Resource Conservation Service
Email: elmer.dengler@md.usda.gov

Why is a hay analysis important? Hay provides important nutrients (energy, protein and minerals as well as some fats and vitamins A, E, K, and D) that help horses grow as well as maintain health. Hay also provides bulk (fiber) that maintains the muscle tone and activity of the intestinal tract. This can help reduce the incidence of such clinical problems as colic, founder, wood chewing, and other vices. Without a hay analysis report, the equine manager is reduced to guessing what nutrients are present in adequate quantities and what nutrients are deficient.

There are two types of analyses that can be performed on hay – visual/sensory and chemical. In visual/sensory analysis, one uses the senses of sight, smell and feel (see accompanying fact sheet on evaluating hay). Visual/sensory analysis does not provide objective or hard numbers on which to base ration formulation and feeding decisions. Ideally the buyer should perform a visual/sensory analysis of the hay before delivery, but it is typically not done until the time of delivery and is often a casual glance rather than a detailed inspection.

Chemical analysis is performed by specialized analytical laboratories, either through wet chemistry methods or near-infrared reflectance spectroscopy (commonly referred to as NIRS or

NIR). It is recommended that laboratories certified by the National Forage Testing Association be used. A list of certified labs is available at <http://www.foragetesting.org>.

Even if chemical or NIR analysis is conducted on a lot of hay, a visual/sensory analysis can be a useful addition when it includes inspection for foreign objects, weeds, dust, mold, leaf shatter, etc. Visual/sensory inspection combined with chemical analysis gives a much more reliable indication of hay quality and nutritional value. Routine chemical analysis does not reveal defects such as dust, musty odor, mold, foreign material and leaf shatter.

A lot of hay can be defined as hay from a single cutting of a single field that is cut, handled, baled, and stored under uniform conditions. Several small fields located in close proximity to each other, of the same forage species or mixture of species, and managed and cut and stored identically also can be considered a single lot.

To have hay analyzed by a laboratory using wet chemistry or NIR, you need to obtain a sample that is representative of each lot. A hay sample is obtained by using a hay core sampler and taking samples from a minimum of 20 different randomly selected bales (whether small square or large square or round bales) for each lot of hay (see definition above). The samples obtained using the hay corer should be mixed well before placing a pint sample in a tight, clean, plastic bag (one per lot of hay) and submitting it to a certified forage testing lab. The lab will send you an analysis report for each sample submitted.

To take cores from hay bales, core from the end of a small rectangular bale so you will be sampling as many flakes or pads of hay within the bale as possible. For large or medium round bales, core from the side of the bale to sample as many of the layers as possible.

The interpretation of a hay analysis can be confusing with the mass of data presented on a report. Generally, the report lists a number of parameters on an *As Is*, *As Received*, *As Sampled*, or *As Fed* basis (based on the moisture level of the hay which can change from lot to lot) and on a *Dry Matter* basis (all water (moisture) removed). To accurately compare one hay sample to another, always use the column labeled *Dry Matter Basis* rather than the *As Is*, *As Received*, *As Sampled*, or *As Fed* basis. These values are used when figuring what weight of actual hay will be needed to supply a given amount of a nutrient.

Of all the values reported on a hay analysis, the hay producer and equine/livestock owner should pay particular attention to certain parameters. First, keep in mind that a horse consumes from 1.5 to 2.5 percent of its body weight in dry matter. If a 1,000 pound (454 kg) horse is fed only hay, the horse will consume from 15 to 25 lbs of hay per day (6.81 to 11.35 kg/day) depending on hay palatability, quality, energy content, and the maintenance requirements (is this horse just standing around, exercising a lot, a high performance horse, etc.).

The first parameter to look at is one of the measures of the energy content of the hay. This may be listed as digestible energy (DE), metabolizable energy (ME), net energy of maintenance (NE_m), net energy of lactation (NE_l), net energy of gain (NE_g), total digestible nutrients (TDN), or relative feed value (RFV). For example, the DE requirement for a light working horse is about 20 Mcal/day. Hay often has 0.76 to 0.94 Mcal/lb (1.67 to 2.07 Mcal/kg) or higher. At a

hay intake of 25 lbs/day (11.35 kg/day) and a DE of 0.80 Mcal/lb (1.76 Mcal/kg) for a given lot of hay, the hay will provide 20 Mcal/day or enough to meet the energy requirement for the light working horse. To use these energy values, you will need to find out the energy needs for your animals. Keep in mind that the energy needs are higher for a lactating mare or a growing foal or for a high performance race horse. Energy needs are lowest for pleasure horses that are only infrequently ridden.

The NE_m estimates the amount of energy available from the hay for normal animal maintenance or activity. NE_l estimates the amount of energy available to a lactating animal consuming the hay while NE_g estimates how much energy is in the hay that can go towards weight gain in the animal (most frequently used with cattle and sheep).

Of the energy parameters listed above, the two that can cause the most confusion are TDN and RFV. TDN is an older term and is most appropriately used for ruminant animals and not horses. TDN is calculated from acid detergent fiber (ADF) and expresses the differences in digestible material between forages. The term RFV has no units but is a way to compare the potential of two or more similar forages for energy intake. This term is an index of forage quality calculated from percent ADF and NDF (neutral detergent fiber). For comparison purposes, the RFV of mature, full bloom alfalfa with a NDF value of 53% and an ADF of 41% was set at 100. Second or third cutting alfalfa with fine stems and many leaves may have a RFV of 140 or more whereas first cut orchardgrass hay may have a RFV of around 75 depending on the growth stage when it was cut. Hay with a relative feed value of 125 theoretically contains 25% more energy than mature alfalfa. Note that although crude protein is not included in the actual calculation of RFV, forages high in RFV will almost always be high in protein.

Lignin is important because it effectively binds with cellulose and hemicellulose to make them unavailable to digestion by the microbes that inhabit the horse's gut. The higher the lignin content of forage the lower the quality. The actual impact of lignin is reflected in the RFV number reported by the forage testing laboratory. The hay purchaser should understand that forages that are harvested at a more mature growth stage [full bloom legumes or headed grasses versus prebloom legumes or boot stage grasses (the seed head is still within the sheath of the last leaf to emerge before the head)] have a higher lignin content than those harvested at a less mature stage.

The RFV for different hay lots is especially important for comparing hay lots during the purchasing process. However, equine owners should keep in mind that because one hay contains more energy than another it may not translate into reduced hay needs or monetary savings. Since the horse digestive anatomy requires the animal to eat frequently, the horse will likely consume the same quantity of hay regardless of RFV. In the case of the hay with a higher RFV, the horse can gain weight and become over-conditioned.

Protein is another important parameter but as with energy, hay protein content is more critical for the pregnant mare, lactating mare, growing foal, and for the maintenance of muscle mass in performance horses. Protein content of hay can range from the low single digits for mature or under-fertilized grasses to 20% or more with some high-quality alfalfa and even some second/third cutting grass hay. The protein content of the hay plays a major role in the amount

and type of supplement fed to horses. Usually, no protein supplementation is required unless the hay protein levels are below 8 to 9%. A hay protein level above that needed to supply the protein requirement of the horse is an unnecessary expense and will be broken down and used for energy. Some German research with endurance horses suggests a negative impact on fluid balance when high protein diets were fed. Excess protein causes horse digestive systems to work harder and can lead to kidney and other internal organ problems, while at the same time increasing nutrient loading to the land in urine and manure that often becomes a pollution problem.

Another set of parameters that is important is the mineral content of hay. Of all the minerals listed on a hay report, the important ones are calcium (Ca), phosphorus (P), and potassium (K). Potassium is only important for horses that suffer from hyperkalemic periodic paralysis (HYPP), an inherited disease of the muscle caused by a genetic defect. The most critical value is the ratio between Ca and P. The reason the ratio is important is that Ca and P are laid down in bone in about a 2:1 ratio.

Ca and P levels in forages differ greatly between legume and grass forages and vary somewhat based on the level of maturity of the forage. For most classes of horses, a Ca:P ratio of 1.5:1 to 2:1 in the total diet is recommended. The National Research Council (NRC) guidelines (1989) suggest that if P is adequate, the Ca:P ratio can be as high as 5:1 to 8:1 for mature horses although more recent research indicates that for young, growing horses the ratio should not be above 2.5:1. Legumes, especially alfalfa, can have very high Ca:P ratios (up to 15:1) while grasses will be much closer to the desired Ca:P ratio. Grasses sometimes can have too little Ca or P to supply all that is needed. Hence, there is need for a forage analysis and an understanding of the Ca and P requirements based on your animal's breed, age, and activity level.

Occasionally, other micronutrients such as copper and selenium may be deficient in some forage but these minerals are not often included on a forage analysis report. Supplementation with these elements, and sodium which almost always is deficient in forages in this region, will occur based on experience.

Vitamins are another important requirement for the maintenance of mature horses. Vitamins are not usually reported on a forage analysis report. Instead, the visual analysis of hay can help by looking for hay with some green color and by asking when the hay was produced. Most vitamins are no longer effective if hay is more than a year old although the other nutrients are stable in well-cured hay. If an animal is grazing pasture and receiving hay as a supplement, the pasture should provide the needed vitamins and the old hay, as long as it is not too dusty or not moldy, will be an adequate feed.

Also not included in a routine hay analysis is nitrate concentration. A high nitrate level can be toxic to horses as well as cattle although horses are less susceptible. If a hay sample has more than 0.5% nitrate, precautions should be taken. These precautions can include exclusion of the affected hay or dilution of the affected hay using pasture, concentrates, or a different lot of hay with a lower level of nitrate. To be safe, pregnant mares and young horses should not be fed forages with high levels of nitrate.

Nitrogen Applications to Wheat in a Cover Crop Program that Restricts Fertilization until mid-March 2008

Dr. Richard W. Taylor
Extension Agronomist
University of Delaware
Email: rtaylor@udel.edu

A number of fields were seeded this past fall to winter wheat after being enrolled in cover crop programs that excluded fall applied nitrogen (N). Some fields were seeded quite early in the fall and tillered profusely while other fields were seeded late enough or in dry soil so fall growth and especially tiller production was very limited. As late-planted or untiltered fields begin to emerge from winter dormancy, N availability will be critical to encourage rapid growth and tiller development in the spring of 2008 for those fields that will be allowed to be harvested for grain. Virginia Tech's publication entitled "Intensive Soft Red Winter Wheat Production" provides some valuable information to access the N status of wheat fields in early spring.

To use the information, growers need to determine the average number of tillers (a tiller is a shoot showing at least three leaves visible) per square foot. At normal planting populations, plants often only have two or three tillers present (counting the primary shoot). To access the tiller count in your field, take a yard stick or dowel rod cut to a 3-foot length and randomly place it next to a typical looking row in at least five (preferably 10 to 20) places well-spaced out around the field. In each section of row, count and record the number of tillers with three or more leaves that are found within the 3-ft section of row. After you've counted and recorded the number of tillers in 3-ft of row from at least five locations, add up the number of tillers and divide by the number of locations to get average tiller count (per 3-ft of row). To calculate tiller density multiply the average tiller count by 4 and divide the result by the row width in inches and this will give you tiller density (tillers per square foot). For example in 5 locations you find there are a total of 450 tillers, so 450 divided by 5 equals 90 tillers on average per three feet of row. If you multiply 90 by 4 and divide this by the row width (7 inches), your tiller density comes to 51.4 tillers per square foot.

If the tiller density is 60 or less, you need at least 60 lbs N/acre applied as early as the cover crop contract permits. Split applications—one at green-up or around Zadoks' stage GS 25 and one at Zadoks' GS 30-31 or Feeke's GS 4-5 or pseudo stem erection or first node detectable—can increase yields by 5 to 10 bushels per acre but the site characteristics often limit a growers options for N splitting. If you have a tiller density of 100/ft² or more, no N is needed at this stage (green-up or GS 25); but if the tiller count is 75/ft², you will need 40 lb N/acre. A N rate of 25 lb/acre will be needed if the tiller count is 85/ft². You will need to evaluate each field for the likelihood that you will have time and the ability to return and apply a second application of N to the field. If a second split is not possible, you may decide to apply all required N as early as permitted by the cover crop contract. With the high price of N fertilizer, you should consider the likelihood that the stand will produce maximum yields or whether the yield goal should be

adjusted down to a realistic level. The lower the tiller count late in the season, the less likely the field will produce maximum yield for the variety and soil type.

Notices and Upcoming Events

January 7-12, 2008

Delaware Ag Week, Harrington, DE. Contact Ed Kee at 302-856-7303 or email: kee@udel.edu
Delaware—Maryland Hay and Pasture Day, Evening Program for Part-time Hay and Pasture Producers, Dairy Day, and Agronomy/Soybean Day, Equine Pasture Program, Poultry Nutrient Management, and many more offerings. Visit our web site at:
<http://www.rec.udel.edu/AgWeek/home.htm>

January 9, 2008

Southern Maryland Pasture and Hay Conference, Waldorf, MD, Izaak Walton League.
Contact Ben Beale at 301-475-4484 or by email at bbeale@umd.edu

January 9, 2008

20th Annual Five County Ag Conference, St. Stephens Church, VA, Upper king and Queen Ruritan Club Building. Contact Keith Balderson at 804-443-3551 or by email at thbalder@vt.edu

January 15, 2008

Delmarva Agricultural Pesticide Conference, Harrington, Delaware, Harrington Fire Hall.
Contact Mike Pochop at 302-875-7511 or by email at m pochop@growmarkfs.com

January 17, 2008

Maryland Crop Improvement Association 2008 Annual Meeting, Ruthsburg, Maryland, Ruthsburg Community Hall. Contact Mark Sultenfuss at 410-827-7388 or by email at msulten@umd.edu

January 15, 16, and 17, 2008

2008 New Jersey Annual Vegetable Meeting and Trade Show, Atlantic City, NJ. Trump Taj Mahal Casino-Resort. Contact Mel Henninger at 732-932-9711 x 120 or by email at henninger@aesop.rutgers.edu

January 15, 16, and 17, 2008

PAES Conference (formerly the Lime, Fertilizer Conference), Penn State Conference Center.
Contact Mary Johnston, 814-234-8771 for more information.

January 24-25, 2008

2008 Annual Regional Women in Agriculture Conference, Dover Downs Hotel and Conference Center, Dover, DE. Contact Laurie Wolinski at 302.831.2538 or by email at Lgw@udel.edu

January 28, 29, and 30, 2008

Virginia Crop Production Association 2008 Annual Meeting, Richmond, VA Holiday Inn, Kroger Center. Contact Jim Oliver at 804-370-5104 or by email at vacpa@earthlink.net

February 4, 2008

Kent County Crop Masters—Being a Master Irrigator, Dover, Delaware, Kent County Cooperative Extension Office, Paradee Center. Contact Gordon Johnson at 302-730-4000 or by email at gcjohn@udel.edu

February 6-8, 2008

25th Mid-Atlantic Direct Marketing Conference and Trade Show, Harrington, DE. Sheraton Inn, Dover, DE. Contact Carl German at 302.831.1317 or by email at clgerman@udel.edu

February 11, 2008

Kent County Crop Masters—Diagnosing Crop Problems, Dover, Delaware, Kent County Cooperative Extension Office, Paradee Center. Contact Gordon Johnson at 302-730-4000 or by email at gcjohn@udel.edu

February 18, 2008

Kent County Crop Masters—Recent Advances in Breeding Field Crops and Vegetables, Dover, Delaware, Kent County Cooperative Extension Office, Paradee Center. Contact Gordon Johnson at 302-730-4000 or by email at gcjohn@udel.edu

February 26 and 27, 2008

Northeast and Northcentral Corn Improvement Conference, Linthicum, MD, The Conference Center at the Maritime Institute. Contact Bob Kratochvil at 301-405-6241 or by email at rkratoch@umd.edu

March 3, 2008

Kent County Crop Masters—Advanced Soil Fertility and Plant Nutrition, Dover, Delaware, Kent County Cooperative Extension Office, Paradee Center. Contact Gordon Johnson at 302-730-4000 or by email at gcjohn@udel.edu

March 4, 2008

New Castle County Crops Meeting, Blackbird, Delaware, Blackbird Community Center. Contact Anna Stoops at 302-831-8860 or by email at stoops@udel.edu

March 4, 5, and 6, 2008

Pennsylvania Professional Crop Producers Conference, Penn State Conference Center. Contact Marvin Hall, 814-863-1019, mhh2@psu.edu or Jeff McClellan at 814-863-4260, jtm23@psu.edu

March 10, 2008

Kent County Crop Masters—Enterprise Alternatives for Farms—Organic Production, Sod Farms, and Specialty Grains, Dover, Delaware, Kent County Cooperative Extension Office, Paradee Center. Contact Gordon Johnson at 302-730-4000 or by email at gcjohn@udel.edu

April 12, 2008

Annual Equine Conference, Dover, DE. Kent County Cooperative Extension Office, Paradee Center. Contact Susan Garey at truehart@udel.edu or 302.730.4000 or Dr. David Marshall at davidlm@udel.edu or 302.831.1340

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/grains/Articles/articles.htm>

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