Mid-Atlantic Regional Agronomist Quarterly Newsletter

December 2011

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

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

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

Dr. Pierce Paul, OSU

Dr. W. Bruce Clevenger, OSU

Dr. Glen Arnold, OSU

Mr. Matt Yancey, Va Tech

Dr. Joshua Faulkner, WVA

Dr. Chris Teutsch, Va Tech

Dr. Gordon Groover, Va Tech

Mr. Peter Callan, Va Tech

Mr. Kevin Spurlin, Va Tech

Dr. Richard Taylor, UD

Dr. Les Vough, MDFC, UMD

Table of Contents

Issue 6; Number 4

Moldy Corn and Upright Ears

Dr. Peter Thomison
Professor Horticulture and Crop Science
Ohio State University
Email: thomison.1@osu.edu

Dr. Pierce Paul
Assistant Professor Plant Pathology
Ohio State University
Email: paul.661@osu.edu

Dr. W. Bruce Clevenger
Assistant Professor Extension Education
Ohio State University
Email: Clevenger.10@osu.edu

and

Dr. Glen Arnold
Associate Professor Extension Education
Ohio State University
Email: arnold.2@osu.edu

As corn harvest nears completion across the state, moldy ear problems have been reported in northweat Ohio especially in certain corn hybrids planted late after June 1. The moldy ears have been attributed to Diplodia and Gibberella fungal infection (Figure 1). Vomitoxins (associated with Gibberalla) have been found in some of the later planted, wetter corn (>25 percent moisture). The few preliminary reports received to date suggest that vomitoxin levels are lower and vomitoxin problems far more limited in scope than those experienced in 2009. This is largely because, compared to 2009, conditions this year were relatively dry during the first few weeks after pollination, which restricted the development of Gibberella ear rot. Although some level of infection may have occurred at silking, conditions during early grain-fill were in general not favorable for widespread ear rot development and mycotoxin contamination, except in some of the later planted fields.

As was the case in 2009, molds have often been associated with upright ears (Figure 2). Ears that remain erect after physiological maturity (black layer development) are more likely to have ear molds because they trap water, especially at the base of the ear. These ears may also be affected by opportunistic saprophytic organisms taking advantage of the moist, nutritious environment at the base of the ear. These saprophytes are usually not associated with vomitoxin production, so not all moldy ears will be contaminated. It is important to first identify the ear mold you are dealing with to determine whether you will have a problem with mycotoxins.

There are several factors that determine whether a corn ear remains erect or “droops” (points downward) following physiological maturity. Ears of corn normally remain erect until sometime after physiological maturity has occurred (black layer development), after which the ear shanks eventually collapse and the ears droop (Nielsen, 2011). However ears may droop in drought-stressed fields that have not yet reached physiological maturity. A loss of turgidity in the ear shank due to water stress, possibly combined with some cannibalization of carbohydrates in the ear shank may eventually cause the ear shank to collapses, resulting in ear drooping. In certain hybrids, ears remain upright following physiological maturity (or remain erect for a longer duration) which can be related to a shorter ear shank. According to some seed company agronomists, prior to the development of Bt hybrids, corn breeders tried to reduce ear drop due to European corn borer damage by shortening ear shanks. Much of that germplasm has continued to be used in more recent hybrids. These agronomists acknowledge the concerns that upright ears are slower to dry or more prone to ear molds and indicate that companies are looking for more droopy shanks to help protect ears from water damage. However they contend that there are other genetic components to these traits and that the effects of upright ears on fungal infections may not be as pronounced as is widely thought.

In addition to genetic differences among hybrids, environmental conditions and cultural practices may affect ear orientation during the drydown period prior to harvest. In a 2010 OSU field study that compared 16 hybrids varying in maturity from 101 to 118 days relative maturity at two locations, differential responses to plant population for percentage ear erectness (at maturity) were observed. At S. Charleston, growing conditions were favorable and yields averaged 235 bu/A. At Hoytville, yields averaged 134 bu/A due to drought stress. At S. Charleston, the percentage erect ears decreased as plant population increased - 93%, 74% and 49% at 18,000, 30,000, and 43,000 plants/A, respectively. At Hoytville, the percentage erect ears remain basically unchanged with increase in plant populations (ranging from 88% to 86%). These results suggest that factors other than hybrid genetics can determine if an ear is in an erect or droopy position at harvest.

Reference

Nielsen, R.L. 2011 Are Your Ears (of corn) Sagging? Corny News Network, Purdue Univ. [On-Line]. Available at http://www.kingcorn.org/news/timeless/Droopy.html

Figure 1. Moldy ears from a 2011 northwest Ohio corn field that was associated which tested positive of vomitoxins (Source: Glen Arnold, OSU Extension)

Figure 2. Droopy and erect ears in OSU Defiance County 2011 test plot. Only 15% of the ears were erect at harvest but nearly all were moldy whereas no mold was visible in the droopy ears (Source: Bruce Clevenger, OSU Extension)

Understanding Corn Development as It Relates to Management Decisions in Irrigated Corn Production

Dr. Richard W. Taylor
Department of Plant and Soil Sciences
University of Delaware
Email: rtaylor@udel.edu

Corn plants follow a general pattern of development similar to that seen in many grass species although the time span between one stage and another and the total number of leaves produced before flowering varies among maturity groups, different hybrids, seasons, planting dates, and locations. Timing of development stages in large part is determined by the accumulation of growing degree days (GDD) or heat units that are usually based on maximum/minimum temperatures of 86/50° F. Please refer to the seed company's literature for the number of GDD required for a specific hybrid to advance from one growth stage to another.

I will divide corn growth/development into two phases, vegetative and reproductive. The vegetative stages begin when the planted corn seed has imbibed enough water to begin metabolic activity (germination) and ends after the tassel emerges from the last leaf (VT stage). The reproductive stages begin with silking which is called the R1 stage and end at physiological maturity or when the black layer has formed, the R6 stage.

When much of the first weed control work was begun on corn, the industry did not use a standard way of expressing the development stage of corn. For this reason, great care should be taken with old herbicides to understand exactly what development defining method was used. In the following discussion, I'll stick with the leaf-collar or fully-expanded leaf method. For this method, we use an easily visible portion of the corn plant, the leaf collar, to identify stages of corn development during the vegetative phase of growth. A corn leaf consists of three parts, the blade (that which we readily see), the sheath (a portion that wraps around the corn stem), and the collar (a pale greenish white area at the junction of the leaf blade and sheath). The sheath is split forming a V shape right at the collar when looking at the blade top surface (from the 'front' of the plant). When the newest leaf collar becomes visible from out of the next lowest leaf's sheath, then the leaf (blade) attached to that collar is considered fully expanded or a mature leaf.

The first stage called VE involves the germination and emergence of the corn plant. Although primarily temperature (and moisture) dependent, we can impact emergence in a number of ways. In-furrow or 'pop-up' fertilizer can either speed up early growth or result in loss of stand depending on factors such as the amount of fertilizer applied in furrow, the soil's texture with light sandy soils leading to more injury/stand loss, soil moisture level (dry or drying soil increases the risk of fertilizer injury with an in-furrow treatment, and soil compaction issues.

During emergence, a protective sheath called the coleoptile pushes up through the soil surface with the first corn leaves emerging through the coleoptile and therefore protected. At the same time, the initial root system (the radicle and forming the seminal root system) begins growth and supports the plant with water and nutrients up until about the V3 (three leaf collars visible) when the nodal (sometimes called secondary but really the primary functioning root system for the remainder of the plant's life cycle) root system takes over supplying physical support, nutrients, and water.

Planting depth is important for corn emergence and is related to soil temperature, soil moisture, and tillage system. Generally accepted planting depth is a minimum of 1-inch to prevent problems with nodal root development since planting <1-inch deep causes the first few nodes to be raised very close to the soil surface where hot or dry soil conditions can damage the initial nodal roots as they develop. Planting deeper delays emergence and leads to emergence failures.

The next important stage is V3 or three leaf collars visible and marks a time when the nodal root system takes over as the major source of nutrients, water, and physical support and the seminal root system begins to decline in importance. Root hairs begin to form on the nodal roots increasing their ability to take up nutrients and water. Additionally, all leaves and ear shoots are beginning to be formed at this stage and will be completed by V5. However, the growing point is still below ground if frost occurs. GDD required to reach V3 are about 210 depending on the hybrid. A new leaf emerges after the accumulation of 65 to 80 GDD.

At V6 or six leaf collars visible, corn has reached the cutoff stage for some post-emergence herbicides that now may cause injury to the ear shoot or tassel, tassel and ear formation is proceeding rapidly and in fact most ear shoots are completely formed by V6, five nodes now show nodal root formation, the corn stalk is expanding and will soon cause the oldest leaves to die and disintegrate, and the growing point is now above ground and susceptible to injury. Plants are usually 14 to 24 inches tall and about 420 GDD have accumulated. Sidedressing of nitrogen should be completed between V3 and V6. At this time, corn has taken up <20% of the potassium (K) and N and <10% of the phosphorus (P) that will be absorbed through the root system. By silking, 70% of the K, 60% of the N, and 40% of the P will have been taken up.

By V12 (12 leaf collars visible or countable), corn is at a stage when a temporary severe drought can reduce yield by 10 to 15% and ear size and potential kernel number are being determined. Row number has been about set by this time but kernel number won't be set until 1-week before silking. An objective of irrigation at this stage is to maintain soil moisture not just in the upper soil layers but also in the deeper subsoil layers so that when corn reaches its peak water demand, a water deficit buffer will be present preventing yield reductions due to an inability of the system or well in keeping up with the water demand.

At V15, corn has entered its most rapid growth phase and is most sensitive to water stress. The corn is about 10 to 12 days away from silking. Potassium, P, and N demand on the soil is at its maximum. Corn brace roots are forming from the nodes above the soil surface and these roots will serve to scavenge the upper soil layers for water and nutrients and supply support as the ears form and mature. Silks will soon begin rapid growth and grow from the basal kernels first, tips last. This leads into the final vegetative stage, VT, or tassel emergence where the last tassel branch is visible out of the last leaf sheath but silks have not emerged. Hail causing total leaf loss at VT results in total crop failure. Fungicide treatments are usually applied at VT. Earlier fungicide applications run the risk of not protecting the corn for long enough and have been shown to be associated with potential damage to silks (this may be related to surfactant injury).

The final stages are called R or reproductive stages and run from R1, silk emergence, to R6, black layer or physiological maturity. Silking is associated with rapid N and P uptake with as much as 50% of the N taken up after R1. Potash (K) uptake is almost finished. Consistent water availability is essential at this stage and water use per day may be as much as 0.35 inches. R2 is called the blister stage. Ear size is nearly complete at this stage, silks are drying out [only those (ovules) not fertilized will have silks still attached], and a new miniature corn plant has formed in each growing kernel. Milk stage or R3 remains a critical time when any moisture stress will severely impact yield potential. The dough stage (R4) occurs when kernels have accumulated about half their total dry weight. Nutrient uptake is nearly finished and water use is beginning to decline. By R5 (dent stage), most kernels show denting and have dried to near 45% dry matter and the starch layer is visible and proceeding down the kernel. Within about two weeks, the plant reaches physiological maturity (R6) and the blacklayer is visible at the bottom of the kernels and kernels have dried to about 30 to 35% moisture. Dry matter accumulation has stopped at this stage and from now on the plant and ear are only drying down. Irrigation is no longer needed.

Annual Ryegrass as a Component of Forage-Livestock Systems in the Mid-Atlantic Region

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

Introduction

Annual ryegrass (*Lolium multiflorum*) is a cool-season annual bunchgrass that is indigenous to southern Europe, northern Africa, and western Asia (Fig. 1). It is widely adapted and can be found throughout the world. In the United States, annual ryegrass is grown on close to 3 million acres annually. The majority of this acreage is found in the southeastern United States where it is utilized for winter pasture. Most annual ryegrass is sodseeded into permanently established warm-season grasses to extend the grazing season. However, annual ryegrass can be grown following corn silage or other row crops or in rotation with a summer annual that is used for grazing or hay. Annual ryegrass is both highly digestible and extremely palatable making it a desirable species to include in forage systems.

Figure 1. Diploid annual ryegrass at the late boot-early head stage of growth.

Selecting an Annual Ryegrass Variety

Climatic adaptation. Annual ryegrass varieties exhibit a wide range of winterhardiness. In Virginia, cold tolerance as indicated by winter survival and subsequent yield is an important consideration in variety selection especially as you move north and west of the Coastal Plains and Southern Piedmont regions. Choose varieties that have been tested in Virginia. Varieties that have performed consistently well in Virginia are listed in Table 1.

Table 1. Annual ryegrass varieties recommended for use in Virginia.

Variety	**Seed Company**	**Ploidy**[1]	**Relative Maturity**[2]	**Rust Resistance**[3]
Jackson	The Wax Company	Diploid	M	H
Marshall	The Wax Company	Diploid	L	M
Passerel Plus	Pennington Seed Inc.	Diploid	L	M

[1]Ploidy refers to the number of chromosome sets within a cell.
[2]E, early, M, medium or L, late.
[3]H, high, M, medium or L, low.

Disease resistance. Crown rust (*Puccinia coronata* Corda) is a major disease impacting annual ryegrass grown in the southeastern US. This disease can significantly decrease forage yields and is best controlled by selecting varieties that are rust resistant.

Yield. Choose a high-yielding variety and manage for optimal forage quality. Although expected yield for annual ryegrass depends on many factors, including rainfall and fertilization, Virginia Tech data shows that with good management yields are normally 3 - 4 tons/A (Figure 2 and Table 2). Use an improved variety that backs production claims with yield data from independent replicated trials. Although catchy names and producer testimonials help to sell seed, they are not always an accurate representation of actual performance. *Selections of an annual ryegrass variety should be based on at least three years of independent testing, preferably at locations in your region.*

Figure 2. Harvesting annual ryegrass plots at Virginia Tech's Southern Piedmont AREC, Blackstone, VA.

Table 2. Yield of recommended annual ryegrass varieties in trials held at Virginia Tech's Southern Piedmont Agricultural Research and Extension Center, Blackstone, VA from 2002 to 2010.

Year	Jackson	Marshall	Passerel Plus
		lb DM per acre	
2002-03	8322	9369	9348
2003-04	10996	10964	9487
2004-05	7886	8173	8236
2005-06	6445	6512	6479
2006-07	9085	9423	8234
2007-08	6159	5823	6018
2008-09	6363	7753	6717
2009-10	5758	6282	5811
2010-11	8646	9094	9619
CV(%)[1]	22	21	20
Standard Deviation	1717	1720	1540
Average	7740	8155	7772

[1]CV, coefficient of variation, is a measure of variability. In this case, varieties with a lower CV. possess a more stable yield form year to year than varieties with a higher CV.

Forage quality. There are many definitions for forage quality. Probably the single best definition is "the ability of a forage to produce a desired animal response." The ability of forage to produce this response is impacted by a number of factors including plant species, temperature, fertilization, time of day harvested, and stage of maturity at harvest. Of these factors, stage of maturity at harvest is the single most important factor impacting forage quality. As forage plants mature forage quality decreases (Figure 3). Research conducted at Virginia Tech's Southern Piedmont AREC located near Blackstone, VA, indicates that annual ryegrass harvested at the early boot-head stage can have crude protein concentrations ranging from 10 to 20% and energy values of 60 to 75% (Table 3).

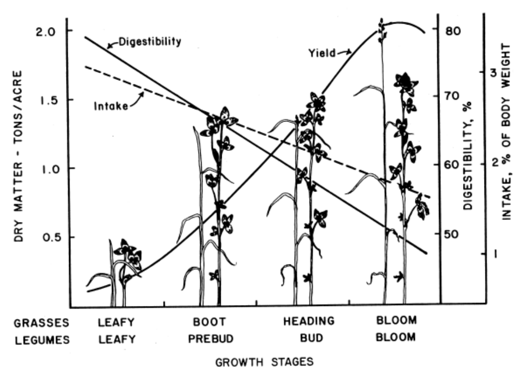

Figure 3. The relationship between forage quality and plant maturity.

Table 3. Yield of recommended annual ryegrass varieties in trials held at Virginia Tech's Southern Piedmont Agricultural Research and Extension Center, Blackstone, VA from 2002 to 2010.

	First Harvest					Second Harvest				
Year	ADF[1]	NDF	CP	TDN	NEL	ADF	NDF	CP	TDN	NEL
	------------------%------------------				Mcal/lb	------------------%------------------				Mcal/lb
2002-03	33	54	10.5	64	0.63	38	65	11.9	58	0.57
2003-04	26	45	13.4	72	0.72	30	52	18.5	67	0.66
2004-05	22	40	20.7	76	0.76	25	48	20.3	73	0.73
2005-06	-	-	-	-	-	-	-	-	-	-
2006-07	20	38	22.2	78	0.78	32	54	14.8	65	0.64
2007-08	24	42	15.0	74	0.74	33	55	13.4	64	0.63
2008-09	32	50	10.9	65	0.64	38	59	13.1	58	0.57
2009-10	26	43	11.8	72	0.71	34	60	15.2	63	0.62
CV(%)[2]	19	13	32	7	8	14	10	20	8	9
Standard Deviation	5	6	5	5	0.06	5	6	3	5	0.06
Average	26	45	15	72	0.71	33	56	15	64	0.63

[1]ADF, acid detergent fiber, NDF, neutral detergent fiber, CP, crude protein, TDN, total digestible nutrients, and NEL, net energy for lactation.
[2]CV, coefficient of variation, is a measure of variability. In this case, variability in forage quality was likely caused by differing stages maturity at harvest between years.

Ploidy. This term refers to the number of chromosome sets within a cell. Diploid and tetraploid cultivars of annual ryegrass are commercially available. Tetraploids possess twice as many chromosome sets as diploids. They have wider leaf blades and appear to be more succulent. Recent data suggests that there is little difference in yield or nutritive value between diploids and tetraploids. Selecting a cultivar adapted to the conditions in Virginia is more important than ploidy level.

Seed quality. Buy high-quality seed of a known variety. Seed should be free of weeds and possess a high germination rate. Buying certified or proprietary seed will ensure that you are getting the genetics you are paying for. Order seed early to ensure availability and timely planting.

Establishment

Annual ryegrass has high seedling vigor, making it well-adapted to either conventional, minimum-tillage or no-tillage establishment. Seeding rates are shown in Table 3. Pure stands should be planted at a rate of 20 - 30 lb/A. In mixtures with small grains or other winter annual legumes or forbs, seeding rate should be reduced to 10 - 15 lb/A. Seeding depth should be ¼ - ½ inch. Annual ryegrass can be planted from late summer (mid-August) to late fall (mid-November). However, plantings after October 1 produce little fall growth, are more susceptible to winter injury, and may not be as productive the following spring. If fall grazing is desired, seeding after the first good rain in August is a good general rule. Areas in northern Virginia and west of the Blue Ridge Mountains have a shorter growing season. The earlier seeding date should be used in these areas.

Table 3. Seeding rates for annual ryegrass grown in pure stands and in mixtures with small grains, brassicas, and winter annual legumes.

Mixture	Seeding Rate
Annual ryegrass alone	20 to 30 lb/A
Annual ryegrass + oats	15 lb/A + 50 lb/A
Annual ryegrass + wheat	15 lb/A + 90 b/A
Annual ryegrass + rye	15 lb/A + 85 lb/A
Annual ryegrass + barely	15 lb/A + 70 lb/A
Annual ryegrass + tritcale	15 lb/A + 70 lb/A
Annual ryegrass + kale or rape or turnips	15 lb/A + 2 lb/A
Annual ryegrass + swede	15 lb/A + 1 lb/A
Annual ryegrass + crimson clover	15 lb/A + 10 lb/A
Annual ryegrass + Austrian winter pea	15 lb/A + 25 lb/A
Annual ryegrass + hairy vetch	15 lb/A + 10 lb/A

Sod suppression is important when no-till seeding into an existing sod. This may be accomplished by close grazing, mowing or light tillage prior to establishment. A burn down herbicide such as paraquat at or prior to establishment can also be used to suppress sods. However, fall application of paraquat to tall fescue is not recommend since it can seriously injure or even kill tall fescue sods. When overseeding annual ryegrass into an established sod, seeding just prior to a rain event can improve the chances of successful establishment. Annual ryegrass can also be broadcast or drilled into a conventionally prepared seedbed. Broadcasting seed onto completely or partially tilled seedbed followed by cultipacking produces excellent stands in most years.

In some cases, drilling cool-season annuals such as annual ryegrass into drought stressed sods can be cost effective. In this situation, sods are normally in very poor condition and there are simply not enough remaining plants to actively compete with the cool-season annuals. However, interseeding cool-season annuals into a dormant sod that was well managed prior to the drought does not work as well as expected in many cases. This is because the ground is very dry and when the rain finally comes the seed not only starts to germinate and grow, but so does the dormant sod. An established tall fescue sod has an extensive root system that competes well for limited moisture. On the other hand, newly established seedlings have a very small root system and are at a serious disadvantage when competing for water, sunlight, and nutrients, when compared to an established tall fescue sod.

Fertilization

Annual ryegrass is moderately tolerant to low soil pH, but is most productive on sites with a pH of 6.0 or above. At seeding, apply phosphorus, potassium, and lime according to soil test results. If major changes in soil pH are needed, lime should be applied 6 months prior to seeding. Annual ryegrass is highly responsive to nitrogen (N) fertilization. If seedings are made before October 1 and fall grazing is desired, apply 40 to 60 lb N/A at seeding. If planting takes place after October 1, apply 20 to 40 lb N/A at seeding. In late winter or early spring, apply 50 to 75 lb N/A to stimulate early growth. If regrowth is desired, an additional 40 to 60 lb N/A can be applied after grazing or cutting in early April and May. Do not apply N after early May.

If a legume is used in a mixture with ryegrass, apply the 40 to 60 lb N/A at seeding and 30 to 40 lb N/A in late winter or early spring if the legume makes up 30 to 40% of the stand. As long as the legume continues to provide 30 to 40% of the available forage, no further N applications will be necessary.

Note: Fertilization is only profitable if the forage produced is utilized.

Grazing

Under good growing conditions, annual ryegrass can produce grazable forage in as little as 45 to 60 days after establishment. New seedings should be allowed to reach a height of 8 to 10 inches before grazing. Plantings made in late summer or early fall can produce significant growth and should be grazed to 3 to 4 inches to prevent matting during the winter months. In the spring, grazing should be started when plants are 6 inches tall. Starting to graze early will help to stagger the growth stage of ryegrass pastures, establishing a grazing wedge. Animals should be rotated to a new pasture when ryegrass has been grazed to height of 3 to 4 inches in the early spring. Once the warmer sunny days of April arrive (and a good grazing wedge has been established), ryegrass can be grazed as short as 2 to 3 inches with minimal effect on the system. Pastures should be allowed to regrow to a height of 6 to 8 inches before grazing again. During peak growth in the spring, rest periods between grazing events can be as little as 7 to 14 days. If stocking rate is not sufficiently high, some paddocks should be removed from the rotation and be harvested as conserved forage.

Hay and Silage

Although annual ryegrass is widely used for grazing, it can be used for dry hay, baleage, and silage. Harvest for hay and silage should be delayed until it has reached the boot to early head stage. This will provide enough yield to justify harvest while maintaining forage quality suitable for higher producing animals such as stocker calves or dairy cows. Producers conserving forage for beef cows may want to consider delaying harvest until seedheads have fully emerged. Although forage quality will be lower, it is suitable for brood cows and yields will be increased by 10 to 20%. Since annual ryegrass matures in early spring, curing it as dry hay can be difficult. In most cases, conserving annual ryegrass as baleage or silage is often a better choice. It is important to wilt annual ryegrass prior to ensiling, since moisture levels often exceed 80% in early spring. It should be wilted to a moisture concentration of 50 to 60% for baleage and 60 to 70% for silage. Recent work from the University of Wisconsin indicates that using inoculants that contains *Lactobacillus plantarum* and *buchneri* will in many cases increase the rate of pH decline during fermentation, decrease losses of silage DM, enhance the aerobic stability of silage, and improve animal performance.

Cautions

Hay fires. Barn fires can occur when forage is baled before it is sufficiently dry. Since it is difficult to cure annual ryegrass in early spring, it is critical that producers check moisture levels prior to baling. In many cases, annual ryegrass may feel dry enough to bale (and may even read dry on a hay moisture probe) but may not be sufficiently dry (<18%). Ensure that annual ryegrass hay is dry enough for baling by performing a moisture test that physically dries down the forage. To learn more about determining the moisture of forage crops and preventing barn fires read the following publications Determining Forage Moisture Concentration, VCE Publication 442-106 and Hay Fire Prevention and Control, VCE Publication 442-105.

Annual ryegrass as a weed. Annual ryegrass can be serious weed problem in row crops, especially small grains harvested for grain. Annual ryegrass should NOT be planted in fields that will be used for small grain production. For more information on the weed potential of annual ryegrass read Identification and Control of Annual Ryegrass in No-Till Corn in Virginia VCE Publication, 427-001.

Summary

Annual ryegrass is well adapted to Virginia and other transition zone states. When properly managed, it can supply forage for late fall and early spring grazing. It can also be conserved as high quality silage or baleage that is suitable for high producing ruminant livestock. Successful annual ryegrass production includes selecting an adapted variety, timely planting, proper fertilization, and good harvest management. For more information on forage management, contact your local extension office or visit the Virginia Cooperative Extension website at http://www.ext.vt.edu/.

How Phosphorus is Lost from Farmland

Dr. Joshua Faulkner
Agricultural Engineering Specialist
West Virginia University Extension
Email: jwfaulkner@mail.wvu.edu

Introduction

While phosphorus (P) is an essential nutrient for plant growth, P runoff from the landscape can also lead to degradation of surface waters. Enrichment of streams, lakes, and rivers with P leads to algal growth and subsequent decay, which depletes the water of oxygen necessary for fish and other aquatic organisms. Not only does this process (known as 'eutrophication') result in degraded aquatic habitats, it makes surface waters unfit for recreation or as a drinking water source.

Common sources of runoff P are eroded soil and surface applied manure or fertilizer, but it can also originate from fields without these obvious P sources. Soils having high P levels also produce runoff that contains high concentrations of P. These high-P soils are typically the result of field or farm level nutrient imbalances; these imbalances often extend to the regional scale. Phosphorus that is mined in Florida and used as fertilizer in the Midwest is commonly shipped to Eastern farms in the form of livestock feed. Only a fraction of the P in the livestock feed leaves the farm in the form of food, fuel, fiber, or live animals. The majority of the P is distributed on the land in the form of manure, often at rates selected to meet the nitrogen need of the crop but exceeding the P need of the crop. Phosphorus accumulates in the soil until the soil cannot absorb anymore; runoff P concentrations tend to increase as this accumulation occurs.

P Loss Pathways

Phosphorus has two forms in runoff, soluble and particulate. Soluble P comes from the release of P from soil and plant material and is completely dissolved in runoff, while particulate P is attached to eroding sediment or associated with organic material. Erosion always occurs on the soil surface, but the other P-loss pathways can take place both on the surface and through the subsurface.

Surface:

Tilled fields and overgrazed pastures are especially susceptible to the P loss that is associated with erosion. Phosphorus binds very strongly to soil particles, and the erosion of these soil particles can be a significant source of P loss even if the soil P level is low. Particulate P is the dominant form of P in runoff from cultivated lands.

Dissolved P can also be carried in surface runoff from tilled or untilled fields. Although different soils can adsorb different amounts of P, for a given soil the higher the soil P level is in the field, the higher the P concentration is in the runoff. The soil P level is more uniform in tilled soils because of mixing, but is highest in the uppermost soil layer of pastures and hayland. As runoff flows through a field and interacts with surface soils, P is released in a dissolved form. This release results in the dominant P loss pathway from grassland.

Highly-soluble P in manure and fertilizer, and the manure and fertilizer itself, can be readily washed off of the soil surface by runoff from rainfall or snowmelt. Application rate and timing are important factors in how much P is lost through this pathway. A couple runoff events following nutrient applications can represent the bulk of the surface runoff P for the entire year.

Subsurface:

Dissolved P can move from upper soil layers into shallow groundwater with percolating water. This is more common in sandy and gravelly soils, but can be enhanced by large pores (e.g. wormholes) in other soils. Once P is in shallow groundwater beneath a field, it can flow to a bordering stream or ditch. Drainage tile can increase the magnitude of this P loss pathway.

A little-recognized P loss pathway is the movement of manure or fertilizer P from the surface directly into drainage tiles through large soil pores or cracks. This process has been observed and demonstrated in many agricultural soils, but is more likely to occur when applying liquid manure sources.

Management to Limit P Loss

The risk of P-loss from a field can be divided into two categories: 1) source factors and 2) transport factors (Table 1). Source factors are directly related to the amount of P that water interacts with as it passes through a field, and can often be controlled with management efforts. Transport factors are related to the volume of water leaving a field and the likelihood of that water reaching a stream. Various management and conservation practices are also helpful for controlling transport factors.

Phosphorus source control is achieved primarily by managing the rate, timing, and method of P applications to fields. Additionally, the type of P amendment (e.g., inorganic fertilizer vs. poultry litter) should also be considered to account for varying proportions of water-soluble P that can be readily lost to runoff.

The rate of P additions to a field should be based on the agronomic need of the crop being fertilized. When P is applied at rates greater than the agronomic need of the crop, P will accumulate in the soil. As P accumulates in the soil the risk of P loss increases. Annual soil testing allows for informed and economical use of P to meet crop needs.
The timing of P application can have a large influence on the amount of P in runoff. Phosphorus sources should not be applied to frozen or saturated soils. Probability of runoff in many areas of the Mid-Atlantic is greatest in the winter with snowmelt and in the spring with rain on saturated soils. Large rain events in the summer can also produce significant runoff. Weather predictions can be used to select application times when the forecast is for relatively dry weather.

The method of P application can be on the surface, on the surface followed by incorporation, or injected into the subsurface. Injecting or incorporating P sources can reduce P loss if it can be done without increasing the risk of erosion. Injection and incorporation also forces P into deeper soils and reduces P-enrichment of surface soils that interact with runoff.

Phosphorus transport control relies on a number of management and conservation practices that serve to reduce the risk of runoff P from reaching a water body. Even with proper P transport control measures, some fields and soils inherently have a greater risk of P loss. In these fields, source control measures become more important.

Soils that are more likely to produce large amounts of runoff have an increased risk of P loss. Several management practices can be implemented in these fields to help reduce runoff volumes. Cover crops, reduced or no-till, and contour farming all help precipitation to infiltrate and reduce runoff.

Concentrated flow paths (ditches, natural swales, etc.) increase the risk of P loss by greatly reducing the opportunity for runoff to infiltrate into down-slope soils and for sediment-bound P to settle out or be trapped by vegetation. If concentrated flow paths do exist in a field and cannot be avoided, making sure they are well vegetated and are not eroding will help to reduce P loss.

As the distance from a field to a stream becomes shorter, the risk of P loss increases. This risk can be reduced by leaving forest or grass buffers between the field and the stream. These buffers trap sediment-bound P in runoff and help prevent stream bank erosion, another potential source of P loss. In general, the wider the buffer, the more effective it is at trapping P.

Erosion control methods are also very effective at reducing P transport. Avoiding overgrazing, maintaining vegetative cover, and reduced or no-till practices limit the amount of sediment-bound P that can be moved with runoff.

Phosphorus transport through the subsurface is difficult to control. Excessively drained soils increase the risk of transporting P through the subsurface; drainage tile can also enhance this risk in less well-drained soils. If possible, construct wetlands at tile outlets to slow runoff and help reduce P loss through adsorption, sedimentation, and plant uptake.

Table 1: Summarized Phosphorus Transport and Source Factors

	Factor	**Description**
Source Factors	Soil P	As the soil P increases, so does the risk of P loss
	Application rate	Higher application rates increase the chance of P loss
	Application timing	Applying during wet times or before rain increases risk of P loss
	Application method	P injection or incorporation decreases risk of P loss
	Source of applied P	Some P amendments contain more water-soluble P that can be transported with runoff
Transport Factors	Surface runoff	Runoff serves to transport P from agricultural fields
	Concentrated flow paths	Concentration of runoff increases risk of P loss
	Distance to stream	Buffers allow for infiltration or filtering of runoff
	Erosion	Erosion is a significant source of P loss from tilled fields and damaged pastures
	Subsurface flow	Subsurface drainage, preferential flow, and highly permeable soils can enable leaching of P

P-Index

The P Index is a tool that was introduced in the 1990s, and is now a widely used method for evaluating the risk of P loss from agricultural fields. The P Index rates the source and transport factors of a particular field, with the understanding that the risk of P loss is highest when there are interactions between P sources and transport pathways. Conservation practices and management are considered when evaluating risk of P loss. Each state has developed their own version of the P Index based on their local soils, climate, and landscape. Most versions are straight-forward, and are designed to help nutrient management planners and producers evaluate the effects of alternative management practices on P loss.

For More Information:

SERA-17, *Organization to Minimize Phosphorus Losses from Agriculture*: http://www.sera17.ext.vt.edu/

USDA-ARS, *Agricultural Phosphorus and Eutrophication, Second Edition*: http://www.ars.usda.gov/is/np/Phos&Eutro2/phos&eutrointro2ed.htm

eXtension and Livestock and Poultry Environmental Learning Center, *Animal Manure Management*: http://www.extension.org/animal+manure+management

Soybean Planting Population and Spacing Study

Matt Yancey
Crop and Soil Environmental Extension Agent
Virginia Cooperative Extension, Rockingham Unit
Virginia Polytechnic Institute and State University
Email: mayancey@vt.edu

With the ever increasing price received for soybeans, more acres are being planted and growers are looking more critically at how they are planted. Soybeans are planted with both corn planters and grain drills, oftentimes out of the sake of convenience. It is not uncommon to see soybeans planted in rows from 30 inches down to 15 inches with corn planters, and down to 7.5 inches with grain drills. Corn planters typically ensure more even spacing and hence a more uniform stand. A drill is often referred to as a "controlled drop" machine. However, newer machines have improved technology that offer more precisely placed seed. Planting rates that are employed are also across the board.

A demonstration plot comparing planting machinery performance, spacing, and rates was established in Augusta County, Virginia. The plot was planted with Pioneer brand 93Y92 under excellent conditions June 15, 2011 into oat stubble, and harvested using a John Deere 9500 combine equipped with a 25 foot head on November 7, 2011. The combine head was set up with an Air Reel, which ensured less harvest loss. The field was turbo-tilled prior to planting and received 35 lbs of nitrogen per acre as urea.

The yield results are shown in Figure 1. When reviewing the Relative Yields, which is grain yield relative to the average yield across treatments, the 15” row spacing appears to produce the highest yields. In particular, the 100,000 seeds/acre rate was 14 points above the average. All other treatments were within six points of the average. Across seeding rates, the 15” rows averaged 68 bushels per acre (bu/ac) while both the 30” and 7.5” averaged about 60 bu/ac. This is consistent with the 5 bu/ac increase found in several long term research studies. *Note that this was a non-replicated study, with one individual strip per treatment at one location.*

Planter	Row Spacing	Planting Rate (seeds/acre)	Yield (bu/acre)	Relative Yield	Percent Moisture
Kinze corn planter	15"	100,000	70.8	114	12.8
Kinze corn planter	15"	150,000	66.0	106	13
		median yield	*64.6*	-	
		average yield	*62.3*	100	
Sunflower 9421 drill	7.5"	150,000	61.8	99	12.7
Kinze corn planter	30"	150,000	61.7	99	13.4
Sunflower 9421 drill	7.5"	100,000	60.3	97	12.6
Vermeer Haybuster drill	7.5"	150,000	60.0	96	12.8
Vermeer Haybuster drill	7.5"	100,000	59.2	95	12.7
Kinze corn planter	30"	100,000	58.5	94	13.5

Figure 1 – Yields from various planting rates, spacing, and equipment.

Another consideration would be the hybrid choice planted. This particular hybrid has a bushiness rating of 6, (out of 1-9, 9 being the bushiest). A grower planting on wider spacing may opt for a bushier hybrid, as weed control is a more critical consideration as the ground will be shaded more slowly.

Sorghum Usage in the Shenandoah Valley

Matt Yancey
Crop and Soil Environmental Extension Agent
Virginia Cooperative Extension, Rockingham Unit
Virginia Polytechnic Institute and State University
Email: mayancey@vt.edu

Sorghum can be a good alternative to corn as a silage crop in many livestock operations, particularly for beef cattle or dairy heifers. Although it typically does not have as much nutritional energy as corn, it can be planted much later, behind a harvested small grain crop, and is very forgiving of droughty conditions like those seen across much of the Valley this past year. Furthermore, in times of high seed corn and fertilizer prices, the opportunity to produce a high yielding forage inexpensively is found with sorghum.

We determined yields and nutritional quality of several fields in Augusta and Rockingham Counties this year. Most of these producers harvested barley silage at the soft dough stage followed by sorghum. Two key points were repeated by several producers, as indicated above. Sorghum, unlike corn, will wait patiently for rain.

The second point was that it is a very inexpensive crop to produce. With a price per unit bag at around $90, planted at an average of 9 lbs/acre (most growers said even this was too high), your seed cost per acre would be $16. Compare that to corn, priced at $200 per unit. When planting 3 acres per unit, the cost is $67 per acre just for seed.

Most of the growers used a standard manure or litter application with minimal use of other fertilizer. One field had no nutrients applied. Grass weed control options are limited, but herbicide safeners are available as a seed treatment and are effective at protecting the sorghum. Plant lodging was also an issue for some, but dwarf varieties are available too.

The following table shows yields found at those farms surveyed and the accompanying forage analyses for each. Each crop followed soft dough barley unless otherwise noted. Recently compiled forage analysis values for corn silage are provided as a reference point.

Brown mid-rib sorghum (BMR) is a type of sorghum that has a special genetic trait where a genetic mutation changes the way cell walls are built and causes the mid-rib to turn brown and reduces the lignin content of the forage by 40 to 60 percent. This changes the strength of the cell walls and can result in greater susceptibility to lodging but the resulting silage is more digestible and contains more net energy for the animal consuming the silage. As seen in Table 1 below, the net energy of lactation and TDN were similar although slightly lower than average values for corn silage as reported by Cumberland Lab but the crude protein content was higher. With the much reduced input costs for sorghum, this crop may be an alternative crop to corn silage especially in situations where drought is common or expected.

Yield (tons/acre)	Dry Matter	CP	TDN	NEL	NDF	Pounds of Nitrogen Applied	Planting Method	Planting Date	Notes
23.5	* * * * * * * *unavailable* * * * * * *					150 lbs N	30" @ 10 lbs	6/8	Dwarf BMR
unavailable	21.6	8.6	66.5	0.69	57.5	50	15" @ 6 lbs	early May	BMR
unavailable	27.1	7.7	66.4	0.69	51.8	50	15" @ 15 lbs	early May	
12.7	28	9.0	66.3	0.68	52.8	none	30" @ 9 lbs	mid June	followed barley grain
16.6	24.3	8.7	65.4	0.67	58.7	60	15" @ 9 lbs drilled	6/9	
17.8	29.3	8.9	67.0	0.69	49.2	160	30" @ 7 lbs	6/27	
19.6	25.3	9.3	66.4	0.68	54	160	30" @ 7 lbs	6/27	
17.5	* * * * * * * *unavailable* * * * * * *					100	30" @ 8 lbs	6/10	planted w/ corn on row splits
17.95	**25.9**	**8.7**	**66.3**	**0.68**	**54.0**	***Averages of above samples***			
N/A	33.8	7.9	71.2	0.75	42.5	*Average corn silage analysis from Cumberland Lab*			
N/A	30	9.39	60.0	*Unreported*		*Average grain sorghum analysis reported from VATech*			

Table 1. Pounds of nitrogen estimated from manure and litter application. All forage analyses are presented on a dry matter basis. All sorghum followed soft dough barley unless otherwise mentioned.

How Much Does That Hay Cost and What Should I Charge?

Dr. Gordon Groover
Associate Professor, Extension Economist Farm Management
Virginia Tech
Email: groover@vt.edu

Introduction

Popular press and other media outlets are saturated with simple and very complex strategies on how to price a product or service. Yet they all start with four basic concepts: 1) know your cost of production; 2) know the prevailing market price; 3) produce what your customer wants; and 4) sell quality products at reasonable prices and with quality service. Producing hay as a cash crop is a challenge to meet all the items above when weather, labor shortages, high land costs, and so on work to reduce both the quantity and quality of the hay you have for sale. This paper is designed to help you consider some of the major issues in developing a hay enterprise and to target those of you who are looking to diversify or add another part-time enterprise to your farm operation. If you plan to make hay sales the major/full-time enterprise of your farm business, you should develop a detailed business plan.

Know Your Cost-of-Production

My uncle was quoted saying, “that guy could sell snowballs to Eskimos,” about someone he knew. The obvious implication was that the man was a salesman and could find a way to convince a customer that his product, snow, regardless of it abundance, had special characteristics and the customer must buy this product. Even the best salesperson cannot overcome the problem of costs. The best marketing and pricing strategies and the ultimate customer service will eventually fail if you do not know and control your cost of production and price your product accordingly. Bankrupt airlines, booksellers, and banks are excellent examples.

Cost of production starts with a sound production and financial record keeping system. To determine the costs per ton of hay, you need to know the yield and costs. Knowing yield sounds simple, yet keeping accurate yield records requires that hay from each field be recorded and that you weigh loads or estimate weights. Consider ways to weigh wagons. If you live near a site with truck scales, weigh a few sample loads and use the results to better estimate yields. Consider purchasing a set of portable scales (less $2,500) that you can use to weigh all hay crops. A side benefit of accurate yields is that you can document nutrient removal for your nutrient management plan. Producing just small rectangular bales requires more labor, but with the aid of a bale counter you know how many bales you’ve produced and can weigh a random sample of say 5% (on small farm scales) to estimate the average bale weight. You’d multiply the average weight times the bales per acre to give total tonnage.

Acreage -- For fear of seemingly being out of touch, I ask this simple question. "Do you know how many acres are in each field you farm?" Production recommendation (fertilizer, pesticides, and seeding rates), cost, returns, and profitability measures are all based on the assumption that acreages are known. So if you do not know your current acreages or if you are leasing a new farm make sure to measure the acreage. Then use these acreages to determine yield, costs, returns, and profit per acre for each field and for the farm's hay enterprise.

Defining a few words and explaining how they are used when making decisions will aid your understanding.

> **Fixed costs** (also known as sunk costs) are items that do not vary with level of use. The most common are 1) depreciation[1], interest, taxes, and insurance on equipment and machinery; and 2) depreciation, insurance, taxes, and maintenance on buildings. Fixed costs do not change with the level of use. For example, if hay equipment is used on an additional 30 acres, the interest, taxes, or insurance charge do not change. However, fixed cost measured on the basis or either per acre or per ton of hay harvested decreases as more hay is harvested.
>
> **Variable costs** (also known as out-of-pocket costs) increase with use: an increase in the tons of hay harvested will certainly result in more fuel consumed and higher repair costs. If a farmer stops making hay altogether, variable costs will drop to near zero, but fixed costs will remain essentially unchanged.
>
> **Long-run** decisions are made based on all costs being covered; that is, the income from hay sales will exceed the fixed and variable costs of machinery and equipment, hay production, storage, labor, management, and return on investment. These costs are important when you start a new venture requiring additional investments.
>
> **Short-run** decisions are made day-to-day, year-to-year to help improve the profitability or reduce the losses of an on-going venture. Short-run decisions consider only variable costs: as long as the income from hay sales are greater than the total variable costs to produce that hay, the farmer is better off continuing to produce hay. What happens when the income from hay sales no longer cover the variable costs to produce that ton of hay? Then the farm business has reached the "**shut down**"or the "**I quit**" point. This situation implies that continuing to produce hay will lead to insufficient funds to pay for fuel, labor, fertilize, and so on.

The question that you should be able to answer after reading this article is, "Have I reached the 'I quit' point for nitrogen fertilized grass hay, given the current costs of fertilizer and fuel?"

---

[1] Depreciation in this document will refer to a reduction in value or obsolescence of an asset over time (not tax depreciation).

Man Verses the Machine

Many farmers would prefer to substitute machinery for labor as when you look at the adoption rate of large round balers over the last 30 years. Yet almost all hay sold to the horse industry is in small bales. This begs the question, “Do I have to hire and manage labor to put up hay?” The answers are you could or you could use some of the bale automation systems. There are three main classes of bale automation systems.

1. In-field bale pick-up systems that are PTO driven or self-propelled. Bales are accumulated in a large stack (four or more tons) that are transported back to a barn or dropped in the field as a unit. If the bale wagon is not used to dump the bales in the barn as a unit, the bales must be mechanically loaded using a hay grapple unit and hauled back to storage. This equipment complement can cost from $55,000 to over $150,000 and may not be the best choice with small fields distributed over a large distance. Due to costs, I choose not to discuss this system.
2. Bale accumulators – this unit is towed behind the baler and catches each bale and assembles them into a small unit (less than 1,000 lbs). The bale-unit is then discharged into the field for pick-up with a front-end loader attachment (grapple unit) and each unit is placed on a wagon for transport to storage. The grapple unit is used to stack the hay in the barn. Costs for grapple and accumulator range from $15,000 to $25,000.
3. Bale accumulator/bander – this unit is also towed behind the baler and catches each bale consolidating the bales into a unit (21-18 bales about 1,000 lbs). The unit is bound using metal bands, like bundles of 2x4’s at the lumber yard. The bale unit is approximately 8' long x 4.5' tall x 3.5' wide. Units are loaded and unloaded using a fork lift attachment for a front-end loader. The units will fit in most 6 and 8 foot pickup beds making sales to end-consumers less time consuming. Costs for the unit and fork lift attachment are around $80,000.

Do these types of investments make sense? Push the pencil or spreadsheet to estimate annual costs and labor saving.

What Does It Cost to Grow Mixed-Hay and Alfalfa Hay?

Budgeting: To answer the question, “What does it cost to grow mixed-hay and alfalfa hay?” some of the basics of budgeting must be explained. The purpose of a budget is to list the annual qualities and prices of inputs involved in the production of hay. The sum of the income items less total expense leaves an estimate of net income or returns to land, risk, and management. Since the sales price is often the most variable, most budgets concentrate on the cost of inputs like fertilizer. The breakdown of major budget categories and explanations are listed in Table 1.

Table 1. Example Abbreviated Budget for 1 Acre
1. **Gross Receipts** = quality sold * price
Bales of hay * $/ton (120 bales * $4.00/bale = $480)
2. **Pre-Harvest Variable Costs**
Units of inputs * $/unit (150 lbs of N * $0.75/lb)
3. **Harvest Variable Costs**
Fuel, Lubrication, and Repairs per acre * $/ac ($65/ac * 1 ac)
4.**Total Variable Costs** – sum of lines 2-3
Sum of all costs
5. **Machinery Fixed Costs** (Based On New Equipment Cost)
Ownership costs per acre – prorated to over the typical life of the equipment (depreciation taxes, insurance, interest on investment)
6. **Other Costs**
General Overhead Costs
7. **Total Costs –** sum of lines 4, 5, & 6
8. **Projected Net Returns –** line 1- line 7 Returns to land, risk, and management

Gross Receipts: Gross receipts are the sales price of a bale or ton of hay times the estimated production units. Hay sold into the equine industry will have to be marketed based on quality, so that hay from different fields may not have the same value and should be reflected as separate items or as an average price representation quality from poor to excellent (Table 2). The yield should indicate long-term average yields, not just the best of the last 10 years.

Table 2. Example Gross Receipts for Mixed-Grass and Alfalfa Hay							
		Mixed-Grass - 3 ton yield			**Alfalfa - 5 ton yield**		
Gross Receipts	Units	Yield	Price	Total	Yield	Price	Total
Lower quality hay	Ton	1.25	$90.00	$112.50	1.25	$125.00	$156.25
Higher quality hay sold in 50 lb bales	Bales	70	$5.00	$350.00	150	$5.00	$750.00
Total Receipts				**$462.50**			**$906.25**
Average Receipts per ton				**$154.17**			**$181.25**

Pre-harvest Variable Costs

The current budget estimates of pre-harvest variable costs for mixed-hay are shown in Table 3 and alfalfa in Table 4. The level of complexity increases when you move to the pre-harvest costs. In the case of hay, the cost of establishing the crop is more expensive than the year-to-year maintenance and needs to be prorated over the life of the crop. Calculating establishment costs requires a separate budget (please see the Virginia Cooperative Extension web site for hay establishment budgets (www.pubs.ext.vt.edu/category/enterprise-budgets.html). The total is prorated over seven years for grass hay and five years for alfalfa. The remaining items are a listing of the estimated units of inputs like fertilizer, lime, herbicides, and so on, priced at rates that are reflective of 2011. Most farmers use a line-of-credit to finance the needed cash flow in the spring before crops are sold in the summer and or fall. The production interest charged on the line of credit is calculated on the total pre-harvest costs for six months at the going short term interest rate. The total of these expenses yields the total pre-harvest expenses per acre, per ton, or per bale, depending on what units are used to measure production.

Comparing Tables 3 and 4, the first item you should notice is the very high cost of fertilizer making the variable costs per ton for alfalfa ($50) less than mixed-hay ($91.38). Normally, alfalfa hay would cost more to produce than mixed-hay. Given the reversal in costs, many assumptions or commonly held beliefs no longer hold true with these major changes in prices of fertilizer inputs. However, from a prospective of efficient management, the use of legumes in grass hays to provide adequate levels of nitrogen would drop the costs of grass hays to a level lower than alfalfa. Producing mixed hay to reduce total costs versus pure grass or alfalfa may be a limiting factor in selling mixed hay to the equine industry. The remainder of the pre-harvest costs for mixed-hay makes up a small proportion of the costs. For alfalfa additional inputs, e.g. pesticides, herbicides, and higher levels of lime to maintain a higher soil pH, are required to maintain a healthy and quality stand over the 5 year life.

Table 3. Mixed-hay Pre-harvest Variable Costs - Based on 3 ton/A yield from 2 cuts

Pre-Harvest Variable Costs	Units	Per Acre	Price $	Total $
Prorated Establishment Cost	7 yrs	1.00	37.64	37.64
Nitrogen	Lbs	150.00	0.77	115.50
Phosphate	Lbs	51.00	0.74	37.74
Potash	Lbs	186.00	0.65	120.90
Fertilizer Application	Acre	1.00	7.25	7.25
Other Costs	Acre	1.00	15.00	15.00
Production Interest[2]	Dollar Rate	148.20	0.06	8.89
Total Pre-Harvest Costs				**342.92**
Total Pre-Harvest Costs per Ton				**114.31**
Total Pre-Harvest Costs per 50 lb Bale				**2.86**

[2] Production interest is calculated on costs that are used prior to fall at the annual interest rate to reflect only 6 months of interest the total costs are divided in half.

Table 4. Alfalfa Hay Pre-harvest Variable Costs - Based on 5 ton/A yield from 4 cuts

Pre-Harvest Variable Costs	Units	Per Acre	Price $	Total $
Prorated Establishment Cost	5 yrs	1.00	83.41	83.41
Nitrogen	Lbs	0.00	0.77	0.00
Phosphate	Lbs	75.00	0.74	55.50
Potash	Lbs	300.00	0.65	195.00
Fertilizer Application	Acre	1.00	7.25	7.25
Lime prorated	Ton	0.33	42.50	14.03
Pesticides & Herbicides	Acre	1.00	54.61	54.61
Other Costs	Acre	1.00	14.89	14.89
Production Interest[5]	Dol.	212.35	0.06	12.74
Total Pre-Harvest Costs				**437.43**
Total Pre-Harvest Costs per ton				**87.49**
Total Pre-Harvest Costs per 50 lb Bale				**2.19**

Harvest Variable Costs

The first step in addressing the fixed costs is to select the harvest equipment. Then the costs must be annualized over the life of each piece of equipment. Calculating annual fixed costs for the machinery complements requires allocating those costs over the life of the farm machinery. Allocation of fixed costs is accomplished by using the capital recovery method. The capital recovery method sets up a payment schedule to fully recover the value of the machinery and interest on the investment over the life of the equipment. Capital recovery is based on the assumption that when the machinery is worn-out or obsolete, enough money will be available to fully replace the machinery with equivalent but updated technology. This paper is not intended to give you all the details of calculating all fixed costs, so check with your local extension office about machinery costs resources. Contact me at groover@vt.edu if you would like a capital recovery form to help in calculating machinery fixed costs. Table 5 shows the fixed harvest and total fixed costs for mixed-grass and alfalfa hay.

Table 5 provides a summary of the fixed and variable costs discussed in the previous sections. Costs are based on current input prices and **new** machinery. Used machinery may cut the total fixed costs as much as 40 percent. Conversely; used machinery may increase annual repair costs. As pointed out, alfalfa hay has lower total costs than mixed-hay in this example. For mixed-hay, total costs are higher because of the higher fertilizer (mostly nitrogen) costs per ton of forage harvested. Thus, with current prices and yields alfalfa is a more profitable crop over mixed hay.

Table 5. Example Harvest and Fixed Costs for Mixed-Grass and Alfalfa Hay		
Harvest Costs	**Mixed-Grass - 3 ton yield**	**Alfalfa - 5 ton yield**
Fuel and Lube	21.38	42.76
Repairs	11.86	23.72
Harvest labor	38.86	77.29
Twine	5.25	8.75
Total Harvest Costs	$77.35	$152.52
Total Harvest Costs per ton	$25.78	$30.50
Total Variable Costs	$382.63	$589.95
Total Variable Costs per ton	$127.54	$117.99
Total Fixed Costs	$65.91	$125.28
Total Costs	$448.54	$715.23
Total Costs per ton	$149.51	$143.05
Returns to all budgeted costs	13.97	191.02

Estimating Labor Costs

An important factor for farmers selling small square bales is labor costs and availability. Table 6 provides estimates of labor across the spectrum from round balers to hand labor. The results in Table 6 point the labor savings you would have to help pay for the bale handling equipment. For example, if you are currently hand harvesting hay and want to consider a bale bander, the savings per acre of mixed hay harvested is $70.20 ($90-$19.80). Thus, if you harvested 100 acres annually you would have $7,020 per year to help cover the capital costs of owning the bander. Is that true? Well depends on what you pay your workers, if they are family, salary workers, etc.

Table 6. Labor Costs Estimates*	**Round baler**	**Accumulator**	**Bale Bander**	**Hand labor**
Harvest and storage hours per ton	0.58	1.2	0.66	3.0
Labor costs $ per hour	10.00			
Total harvest labor costs per ton $	**5.8**	**12.00**	**6.6**	**30.00**
Mixed-hay labor costs per acre based on 3 ton yield $	17.4	36.00	19.80	90
Alfalfa labor costs per acre based on 5 ton yield $	29.00	60.00	33.00	150
*Labor usage estimates are driven by many factors and local conditions; for example, field size, experience, training, skills, and so on. The values in this table are rough estimates derived from machinery time in field.				

Know the Prevailing Market Price

The prevailing market price is a question not a fact. You can say with a fair amount of certainty what market price of #2 yellow corn grain allows both buyers and sellers to gauge the market conditions and know the prevailing price. Yet when you ask, “What’s the price of a ton of hay?” the certainty quickly diminishes. Some regions have well established hay markets and some do not. There is also the problem of Eastern hay markets not reporting prices based on established grades and standards. In addition, hay is a bulky (specifically round bales) product that makes transportation costs by traditional methods higher than for grains.

In contrast, Great Plains and West have established markets for hay based on specific standards and hay packages (large square bales) that make transportation less costly. Yet in the East, the cost of hay to either the buyer and/or seller is not clearly communicated. The terminal or local market price reflects the long-run efficient cost on making a ton of hay. Therefore, farmers cannot easily look on the internet and see both the local price and historical prices of hay and say, “I can grow hay for less than that” or the converse, “I cannot grow hay for that price.” In both cases you are making choices based only on your knowledge of your own costs of producing a ton of hay.

To get an estimate of local hay prices, check all sources of information, e.g. newspapers, local feed dealers, local hay brokers, internet sales for large loads from the west, and so on. The asking price may not be the sale price, so you’ll need to check as many sources as time permits. Also, pay close attention to all the attributes that effect price and costs; for example, quality measures (relative feed value, crude protein, TDN, net energy, NDF/ADF), delivery charges or discount if picked up at the farm, who unloads, quantity for sale, payment requirements, cutting time 1st, 2nd, etc., bale packages (rectangular, square, or round), customer satisfaction policy, and priced by bale or ton. When you sell hay, you are assuming all the functions of a commodity market. That is, specific grades and standards regulated by a third party; for example, corn grain - 56 lb. bushes at 15.5 percent moisture with less than a specific percentage of foreign matter, broken kernels, and so on. The current market structure for hay does not provide these services; therefore, as a hay seller, you must address many of these functions for your customer base. Now you have an estimate of what the long-term costs are in your area, the break-even price. If you cannot produce hay for less than this price, your hay enterprise will not make profit.

Setting a Price[3]

Okay, you know your total cost of production and have estimated the prevailing market price for alfalfa hay at $5.00 per 50 lb. bale and you now want to know how you should price that hay. The first step is to know your breakeven prices. Total variable costs (fertilizer, repairs, fuel, etc) are $117.99 per ton (Table 5). This amount defines your rock bottom price. What does this mean? This is the cash cost of producing that ton of hay. Unless you can average more than

[3] Included in this article is an excerpt from chapter 8 of the 2006 publication, "Direct Answers for Direct Marketing.” This paper provides an excellent discussion of pricing and breakeven pricing.

$117.99 per ton, you are losing more money by growing hay rather than by letting the farm lie idle.

What about the other costs--machinery and equipment and storage? Both of these items are associated with capital investments and will be an expense to your farm business regardless of the enterprise. In the long-run, you must cover these costs for the farm business to remain viable; however, in the short-run these fixed costs may or may not be paid each year. The breakeven costs for all costs (fixed and variable) in this alfalfa example must average more than $143.05 per ton or $2.87 per 50lb. bale. This estimate is for hay at the farm. Getting the hay to the customer (loading, transportation, marketing, phone calls, bad checks, collecting sales tax, etc.) will add to this cost.

Produce What Your Customer Wants

The old adage in sales is "the customer is always right." Knowing your customer is the most important factor in marketing. First, start local; do your homework on the type of hay wanted and in what form and quantities (weekly, monthly, annually). Contact local horse owners who buy hay; contact smaller feed dealers and tack shops. Ask if they are satisfied with their local supplier and what services are very important from a supplier; for example, monthly delivery and/or forage test results. Analyze this information to determine if you can supply the hay and additional services and still cover your costs.

The customer is always right is a good goal but is not always achievable. In the horse business, timothy is the sought-after hay. Many Mid-Atlantic farmers growing timothy have difficulty maintaining viable timothy stands compared to other forage crops like orchardgrass. The result is simply that your costs of producing a ton of timothy hay will be greater than other hays. Know your breakeven costs and other prevailing prices, then push the pencil to see if your breakeven timothy costs are greater than the prevailing prices. This comparison should give you an estimate of net returns from timothy—at least on paper. Do the same for other hays (orchardgrass, orchardgrass/clover, alfalfa) that might be somewhat less desirable than timothy. Compare the estimated breakevens and net returns from all the hay crops, and choose the crop that will have the greatest potential net returns. You must also consider the risk of failure or shorter stand life of each crop and discount your estimated breakeven costs to reflect that. For example, if an orchardgrass stand averages a useful life of seven years on your farm and timothy may last only three years and the risk of an establishment failure for timothy is greater, you should think about increasing prorated establishment costs by 40 – 50 percent. The final issue is to work with your customers to demonstrate that there is little to no difference between timothy and other hays grown locally. This long-term educational effort may require discounting or the "try it and you might like it" approach. The focus should be on service that meets the needs of your customers so that they are willing to forego the "timothy only" demands.

Establishing and Keeping a Sound Customer Base

Unlike other commodities, there is no structured market for hay. If you do not create and maintain a customer base, it is unlikely that you will survive in the hay business. Other than "the customer is always right," the next major issue is to provide service to the customer. Services need to be tailored to the individual customer and might range from individuals who buy only on price to individuals that want hay delivered only on Friday afternoons and stacked in the barn. The real question is, "Can you find a way to meet each customer's need without excessive cost?" Ask your customers to comment on what's important to them by sending them a thank you note and include a stamped postcard with a few questions that will help you understand their hay needs. Depending on their technological adoption, consider using text messages, Tweets, Facebook, etc., as a means to follow up on the sale. To create a client base, offer your current customers a discount on their next load if they help you get new customers near their farm. Think creatively about how to meet your customers' needs.

To meet the needs of your customers make sure you maintain a quality product and have documentation, which may include a forage test. Be honest about the product and your policies and expect the same from your customers. To make sure your customers understand your business practices, write them down and give them to all potential and new customers. You will help reduce any misunderstandings. In your business policy, also discuss how you would resolve problems of dissatisfaction with your hay or service. It could be a simple statement that your customers have a right to inspect the hay at your farm, and once it is delivered full payment is required before unloading.

Finally, "the customer is always right," but you do not have to sell to them. If you have a written statement of business practices, you can also have a statement of customer expectations. A bounced check now requires full payment with interest in cash before you load the truck with the next load to that customer.

Summary

How much should I charge for a bale of hay? First know your costs of production and charge accordingly. Identify customers, know their needs, strive to meet the product quality and service required to keep and expand your customer base.

The above article was reprinted with permission from the December 2011 - January 2012 issue of Farm Business Management Update which is electronically accessible via the Virginia Cooperative Extension World Wide Web site (www.ext.vt.edu/news/index.html).

Corn Planter Unit Calibration Recommended to Maximize Profits

Peter Callan, Extension Agent—Farm Business Management
Virginia Tech
Northern District
Email: peter.callan@vt.edu

Corn growers are constantly looking for ways to maximize profit. Planter condition is one of the most controllable variables that influence profitability. Research studies have shown that planter maintenance impacts the quality of stand establishment. In 2000, Doerge and Hall conducted a study which showed an average yield improvement of 4.2 bu/acre due to planter calibration. At some locations, the advantage for calibration exceeded 20 bu/acre.[4] A research study conducted at Purdue showed yield losses in the range of 7 to 15 bu/acre were observed in uneven stands.[5]

One way for corn growers to potentially increase yields with minimal input costs is by improving within-row plant spacing uniformity. Proper planter maintenance, adjustment, and speed result in optimal seed placement. Replacement of worn-out parts e.g. finger sets, brushes, backing plates, disks, coulters, etc., and the calibration of planter units play a major role in maintaining consistent seed placement and depth which impact spacing between plants. Uniform stands reduce competition between plants and take advantage of sunlight to maximize yields.

Fine tuning planter seed meters will position producers to grow uniform stands that will maximize profits. The yield increase needed to just offset the cost of planter meter calibration for a 600-acre corn grower using a 12-row planter is only 0.5 bu/acre (Doerge and Hall, 2000). Table 1 shows that recalibration management decision is valid over a range of corn prices and calibration costs. Industry representatives recommend that planter units be recalibrated every 75-100 acres/row unit or every three years.

Table 1. Increased Yield Required to Cover Recalibration

	Cost of Recalibration per Unit				
	$60	$90	$120	$150	$180
Corn Value $/Bu.	Increased Yield Needed to Cover Costs Bushels				
$3.00	0.20	0.30	0.40	0.50	0.60
$4.00	0.15	0.23	0.30	0.38	0.45
$5.00	0.12	0.18	0.24	0.30	0.36
$6.00	0.10	0.15	0.20	0.25	0.30
$7.00	0.09	0.13	0.17	0.21	0.26

The farm level impact on profitability can be quite significant. A producer who plants 300 acres of corn each year with a six row planter should calibrate his planter every two years. The following example shows the benefits of recalibrating a corn planter.

Assumptions for this example are:

- 6 row planter
- 300 acres corn planted
- Recalibration cost $35/unit
- Replacement parts $85/unit

[4] Doerge, T.A. and T.E. Hall. 2000. The value of planter calibration using the MeterMax system. *Crop Insights* 10(23):1-4, Pioneer Hi-Bred International, Inc., Johnston, IA.

[5] Nielsen, R.L. 1997. Stand establishment variability in corn. AGRY-91-1 (rev. 1997), Department of Agronomy, Purdue University, West Lafayette, IN.

- Corn price $5.50/bu
- Increased yield due to unit recalibration 4 bu/acre

<u>Revenue</u>	
($5.50/bu X 4 bu/acre increased yield) * 300 acres =	$6,600
<u>Expense</u>	
(Calibration $35/unit + repairs $85/unit) * 6 units =	<$720>
<u>Net Profit</u>	**<u>$5,880</u>**

Non-uniformity in corn stands places a grower's sizable investment in their planter, seed and other inputs at risk of lower returns. Many times producers forget the impact that skips (missing plants), doubles, triples, and inconsistent plant spacing have on reducing corn yields. Replacement of worn-out parts and recalibration of planter units is an easy way to minimize production risk and maximize yields and profits. Best wishes for a safe and profitable 2012!

The above article was reprinted with permission from the December 2011 - January 2012 issue of Farm Business Management Update which is electronically accessible via the Virginia Cooperative Extension World Wide Web site (www.ext.vt.edu/news/index.html).

Should Farmers Invest in IRA's to Save Income Taxes?

Peter Callan, Extension Agent—Farm Business Management
Virginia Tech
Northern District
Email: peter.callan@vt.edu

USDA estimates average net cash income for farm businesses is projected to be $82,800 in 2011, nearly 17 percent above the 2010 estimate of $71,000. With prices expected to approach record levels for major crops and some livestock, farmers are anticipating high income tax liabilities when they file their 2011 tax returns. Farmers have routinely prepaid operating expenses (seed, fertilizer, chemical, feed etc.) and purchased new equipment as a means of reducing their tax liabilities. Historically, farmers have reinvested in their businesses with little thought of diversifying their investments into nonfarm assets. An Individual Retirement Account (IRA) is a savings plan that provides the taxpayer (farmer) with tax advantages for setting aside money for retirement and diversifies investments.

There are two types of IRAs for retirement saving. Traditional IRAs are funded with before-tax contributions and the Roth IRAs are funded with after-tax contributions. A taxpayer can open and make a contribution to a traditional IRA and/or a Roth IRA if the taxpayer (or if filing a joint return, their spouse), receives taxable compensation (e.g. earned income - wages, salaries, commissions, self-employment income – net earnings from schedule F or C) during the year. The Internal Revenue Service (IRS) has stated that the following types of income are not considered compensation: earnings and profits from property (e.g. rental income), interest and dividend income, pension or annuity income and Conservation Reserve Program (CRP) payments reported on Form 1040SE, line 1b. A taxpayer whose age is more than age 70 ½ years by December 31, 2011 cannot make a contribution to a traditional IRA. Regardless of the age of the taxpayer, contributions can be made to a Roth IRA. Contributions to traditional and Roth IRAs can be made at any time during the year and up to the due date for filing a tax return for that year, not including extensions. For tax year 2011, contributions must be made by April 17, 2012.

The amount contributed to an IRA is based on the amount of taxable income received by the taxpayer during the year. In 2011, the maximum contribution for a traditional IRA and Roth IRA is the lesser of $5,000 or 100% earned income ($6,000 age 50 or older). For example, a farmer with $4,000 in earned income (net schedule F after depreciation) would be limited to a maximum contribution of $4,000 to an IRA. The maximum contribution to a spousal traditional or Roth IRA (for a spouse with little or no earned income in 2011) is the lesser of $5,000 or 100% of combined earned income ($6,000 age 50 or older). A taxpayer may contribute 100% of earned income to either a traditional IRA, a Roth IRA, or split between both types of IRAs up to the annual contribution limit.

The benefit of a traditional IRA is that the contributions are tax-deductible in the year that the taxpayer makes the contribution. For example, the taxable income for a couple is $90,000 in 2011 and each spouse contributes $5,000 in a traditional IRA. They will be able to deduct the contributions from their income taxes. Thus they will pay tax on $80,000 in income to the IRS. Assuming that the couple is in the marginal 25% tax bracket (Federal) and their IRA contributions are $10,000, they will save $2,500 in Federal income taxes in 2011. The earnings generated by a traditional IRA are tax differed. The tax deductible contributions and earnings are taxable as ordinary income when they are withdrawn from the account after age 59 ½. The IRS will assess a 10% early withdrawal penalty for distributions made before the farmer reaches age 59 ½ from the IRA.

Like traditional IRAs, Roth IRAs offer tax-deferred earnings. Earnings grow tax-free. There is no tax upon withdrawal, so long as the taxpayer held the account for at least five years and is over the age of 59½. Contributions to a Roth IRA are never tax deductible. The taxpayer must have earned income equal to or greater than their contribution. In order to contribute to a Roth IRA, their Adjusted Gross Income (AGI) must be below certain income levels, e.g. $177,000 for married filing jointly or qualifying widow(er) in 2011. Withdrawals of earnings in a Roth IRA prior to age 59½ are generally subject to ordinary income taxes and an additional 10% penalty.

IRA contributions can be used to purchase a variety of investments (stocks, bonds, certificates of deposits etc.) which are sold by banks, insurance companies, brokers and mutual funds. Tax advisors, loan officers and friends are excellent sources of references to find an investment advisor who will help the farmers meet their goals and risk tolerance. Frequently, investment advisors will discuss the topic of compound interest (return) with their clients in making a plan to invest IRA contributions.

Compound interest occurs when interest is earned on a principal sum along with any accumulated interest on that sum. In other words, you earn interest on interest. Time magnifies the effects of compounding. Thus, you will make more money the longer your investment is able to work for you. Table 1 illustrates the impact of compound interest rates on the future value of a $5,000 deposit to an interest bearing account. Example: $5,000 invested today could increase in value ten-fold if invested for 30 years at 8 percent.

Table 1. Future Value of a $5,000 Investment in an Interest Bearing Account

	Interest Rates				
	2%	4%	6%	8%	10%
Years					
5	$5,520.40	$6,083.26	$6,691.13	$7,346.64	$8,052.55
10	$6,094.97	$7,401.22	$8,954.24	$10,794.62	$12,968.71
20	$7,429.74	$10,955.62	$16,035.68	$23,304.79	$33,637.50
30	$9,056.81	$16,216.99	$28,717.46	$50,313.28	$87,247.01
40	$11,040.20	$24,005.10	$51,428.59	$108,622.61	$226,296.28

IRA accounts provide farmers the opportunity to diversify and invest in income- producing assets (e.g. certificates of deposit, mutual funds etc.), and not depend entirely on their farm assets for retirement income. Farmers who make IRA contributions early in their careers are afforded the opportunity to reap major increases in the value of their contributions through the impact of compound interest. Income tax savings may occur in either the current tax year or when withdrawn during the retirement years. For more information on IRA's, see IRS publication 590 http://www.irs.gov/pub/irs-pdf/p590.pdf or contact your tax advisor.

The above article was reprinted with permission from the December 2011 - January 2012 issue of Farm Business Management Update which is electronically accessible via the Virginia Cooperative Extension World Wide Web site (www.ext.vt.edu/news/index.html).

Influence of Continuous No-till Corn for Silage Production on Soil Quality and Fertility

Mr. Kevin Spurlin
Extension Agent, Agriculture and Natural Resources, Animal Sciences
Southwest District, Virginia Tech
Email: spurlink@vt.edu

Background

Grayson County, Virginia has approximately 1,200 acres of corn for silage. Most of the corn silage is used for dairy operations with small amounts used in beef herds. Due to the mountainous terrain and high elevation in the county, most of the county lands qualify as highly erodable. To protect soil productivity, farmers have adopted continuous no-till corn production with the use of winter small grains as winter cover. Much of this land has high levels of animal manure applications, and with the adoption of erosion-reducing practices, many of these fields have accumulated non-leaching nutrients such as phosphorus and potassium. Also, with increases in commercial fertilizer prices, finding ways to strategically reduce fertilizer needs warrants investigation.

Nitrogen applications are most needed in corn production because it does not accumulate over time. Nitrogen is more volatile and leaches more than the other nutrients. For that reason, it is the nutrient of most concern when trying to maintain appropriate soil fertility for corn production.

Corn growers have developed many ways of application of nutrients, both commercially and from manure. Commercial products can be applied pre-plant, at planting and post-planting. Post-plant applications may include broadcast applications over the entire field or side-dress applications in the root zone of the plants. The goal of this project is to identify those practices that reduce costs of providing nutrients for corn production.

Phase I. Characterizing Soils

Soil samples were collected on June 3, 2011 from six no-till corn fields (>10 years) for pre-sidedress nitrate testing (PSNT). Five of six sites were chosen because they had not received pre-plant nitrogen at burndown, which occurred from early to mid-April. Burndown herbicide was a mixture of glyphosate, rimsulfuron, and thifensulfuron-methyl. Sites were also chosen that would have received varying levels of manure application, and two sites that had a legume cover crop. Department of Conservation and Recreation Nutrient Management Specialists conducted the PSNT. A second sample from each site was sent to the Virginia Tech soil testing lab. Analysis included pH, phosphorus, potassium, and organic matter.

Results

Table 1. Soil test results for continuous no-till corn for silage fields.

#	Description	PSNT[a] (ppm)	lb/acre N Recommend[b]	pH	P lb/A	K lb/a	OM %
1	Heavy manure	17	60	6.6	85 H	354 VH	7.6
2	Average manure	4	100	6.6	36 H-	223 H	5.4
3	Vetch + N pre-plant	30	0	6.9	102 H+	435 VH	6.0
4	Vetch only	23	25	6.7	64 H	423 VH	5.9
5	Heavy manure	19	45	6.9	101 H+	487 VH	5.8
6	Limited manure	6	100	7.0	52 H-	215 H	5.4

[a] *Soil sampled for pre-sidedress nitrogen on June 3, 2011*
[b]*Nitrogen recommendations for Department of Conservation and Recreation Nutrient Management Specialist who conducted PSNT tests.*

Results demonstrate that phosphorus and potassium levels are generally adequate on these fields that receive at least some manure application and where no-till practices have limited loss of nutrients from erosion. Heavy manure application did lessen the amount of nitrogen required at sidedress. Fields with only average or less manure required significant nitrogen application. Upon visual inspection of the fields, the average and low-manure coverage fields showed no signs of nitrogen deficiency for the first 30 days post-plant.

A soil's ability to hold nutrients can be improved by higher organic matter content. In past trials locally, levels above 8% were found in intensively managed pasture, levels from 5-6% were common in hay fields, levels around 3.5% were found in conventional tilled areas with manure applications, and fill dirt was less than 1.5%. All these samples were from the same soil types in close proximity. From Table 1, no-till production alone places these corn fields at a similar OM content to permanent sods common in our cool season hay land. This higher OM content may contribute to better nutrient retention on these fields relative to corn grown under heavy tillage.

Phase II. Demonstration Plot

In a no-till field with average manure application, a demonstration plot was conducted to evaluate three rates of sidedress nitrogen. Dynagrow brand 58Z24 (114 day, VT3) corn was planted on approximately May 10[th] and sidedress was conducted on June 13 following determination of the PSNT results. The rates were based on the PSNT for that location at 0, 1x, and 2x rates which were equivalent to 0, 100 and 200 lb N/acre as liquid UAN (30%). The farmer chose to sidedress all fields at the 100 lb N/acre rate in place of his typical 200 lb N/acre at burndown. Spreading was done by a local fertilize supplier with 50' boom width using drop nozzles. Hand-cut yields were taken out of each plot, weighed, chopped and sampled fresh. Cumberland Valley Analytical handled the forage analysis.

Results

Table 2. Nitrogen rate response trial results.

	Yield[a] (T/acre)		Forage Analysis[a]		Cost @ $25/T base (no N)[b]		
N Rate	As Is	DM	NE_L	CP	+ N	¢/Mcal NE_L	¢/lb CP
0	13	4.6	0.69	5.4	$25.00	1.81	23.1
1x	17.6	7.2	0.85	6.2	$28.29	1.66	22.8
2x	23	8.8	0.87	6.9	$30.03	1.73	21.8

[a] *Yield determinations and fresh forage samples collected on September 15, 2011*
[b] *Costs may not have fully captured benefits of higher yield at reducing fixed costs of those fields.*

As expected, the control plot without any nitrogen suffered in both corn silage yield and nutritive quality. Figure 1 shows corn ears from the separate plots. Of particular note, while the 2x rate had a higher yield and numerically higher NE_L and CP%, the cost of the additional fertilizer between 1x and 2x ($3.29/T vs $5.03/T) does not appear to offset on a unit of energy basis. Using a flat rate cost per ton of silage less the nitrogen cost may undervalue the yield benefits of the higher nitrogen rates for the 1x and 2x treatments, especially relative to fixed costs. Easily, the most expensive feed is the one with the lowest initial out-of-pocket expense due to the low yield and poor nutritive value.

Figure 1. Ears from nitrogen rate trial.

"Other Observations"

- Nitrogen depletion on heavily manured fields was not visually apparent until mid-July. By July 4th, one field with no N application had head-high corn with exceptional color. Visually apparent deficiencies began to show up a week or so later.
- There was some nitrogen burn on the leaves of plants, but this was minimal and could be better managed by proper equipment set-up. This did not appear to impact yield.
- Corn remained greener later into the season than previous years. While this could be attributed to the growing season, it raises the question of whether 200 lb N/acre of N applied in early to mid April at burndown will persist until early September as effectively as an early June sidedress application at ½ the rate (Figure 2).
- The farmer reduced total nitrogen use on 225 acres by 20 gallons of UAN per acre at $1.93/gal for a total savings of $8,685. When accounting for the added costs of hiring a local company to sidedress the nitrogen at $10/acre, the net benefit was $6,435 or $28.60/acre

Next Steps

1. Compare yields from an early spring burndown application of 200 lb N/acre with split applications of nitrogen via starter band + sidedress or sidedress only.
2. Evaluate the contribution of legume nitrogen into no-till corn silage systems, and determine the cost effectiveness of this practice relative to burndown nitrogen and/or sidedress nitrogen.

Figure 2. Visual appearance of corn at harvest (September 14, 2011). From left to right treatments 0, 1x, 2x.

Have You Seen This Problem on First Year Timothy? Timothy Decline Reminiscent of the Mid-Atlantic Region's Orchardgrass Decline Syndrome

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

I recently was called out to visit a field of timothy that was planted in the late-summer/early-fall of 2010. The previous crop was a three year stand of timothy which had been plowed under during the summer of 2010 and a new seeding of timothy established in late summer/early-fall of 2010. The late spring first harvest of the new seeding was about half the expected crop. The timothy in the stand appeared to be about half the height normally expected and lacked vigor. No pesticide was applied to the crop in the spring of 2011 and the grower did not specifically observe the crop for leaf rolling during the early part of the growing season since weather conditions (rainfall) were favorable.

After the first harvest, the crop went into a severe decline losing a large percentage of the stand (see Photo 1) and then developed a number of interesting symptoms (see Photos 2-8 below) including tiller die-back, browning/yellowing leaves, bronzing of leaves, and some leaf spotting. The grower is very concerned since he has experience losses from the orchardgrass decline syndrome that has appeared in the mid-Atlantic region. Many of his hay customers would prefer either orchardgrass or timothy hay and these stand losses are making it difficult to provide the hay his customers require. To complicate the story, the field on the other side of the farm lane from the timothy field was planted to orchardgrass at about the same time as the timothy was planted in the fall of 2010. The orchardgrass in that field continues to not only look very good but produced excellent yields during the 2011 growing season despite a very hot and dry mid-summer period.

Photo 1. Declining stand of timothy (the slightly green scattered plants) with invasion by crabgrass (tan colored plants). Green grass in the background was identified as a type of bromegrass invading the shady areas along the woods line. (Photo by R. Taylor)

Following the first harvest of 2011 around early- to mid-June, the timothy in the field in Photo 1, failed to make any significant regrowth and was not cut again. The growth seen in the photo above is all that the grass made from mid-June through October despite significant rainfall from mid-August to the current time.

The soil at this location is a Greenwich sandy loam (previously this was called a Sassafras sandy loam) with a pH in the low 6s and high levels of phosphorus and potash and micronutrients according to a recent soil test report so fertility should not be the issue. In past years, this field has produced excellent hay yields even in somewhat droughty growing seasons. Several years ago there was another problem with this same field and also with timothy. I believe at the time we found that there was inadequate sulfur available for the shallow rooted timothy crop even though a deep soil test showed sufficient sulfur in the soil.

Photo 2. A closer view of the declining stand of timothy (the slightly green scattered plants) with invasion by crabgrass (tan colored plants). Green grass in the background was identified as a type of bromegrass invading the shady areas along the woods line. Broadleaf weed control had just been applied to the field. (Photo by R. Taylor)


Photo 3. Timothy is showing purpling and reddening of leaves in mid-fall after severe stand loss. (Photo by R. Taylor)

Quite a variety of leaf symptoms were visible on the timothy ranging from yellowing, purpling, reddening leaves to dying or dead leaves and tillers. I was not called until mid-fall of 2011 so was not able to access insect feeding as a possible contributing factor but the stand loss did occur rapidly following the first harvest although the farmer did not remember significant insect feeding during that time frame. Even after significant rainfall during August and September, forage regrowth from the remaining timothy plants was minimal especially when compared with the orchardgrass stand immediately to the northwest across the farm lane.


Photo 4. Both yellowing or bleaching of leaves and purpling of leaves is another fall symptom of the declining timothy. (Photo by R. Taylor)


Photo 5. In this photo, the leaf symptoms are showing yellowing and necrosis of the leaf tips moving back along the leaf margins but it should be noted that potassium levels in the soil are high using a Mehlich III soil test. (Photo by R. Taylor)

Part of my concern is the wide range of symptoms visible on the plants. The purpling or reddening of the older leaves could indicate phosphorus deficiency or, more likely, the accumulation of free sugars due to the lack of any new growth. The yellowing symptoms mimic potassium deficiency symptoms and the general lack of vigor may suggest nitrogen deficiency. The lack of chlorosis on the newest growth seemed to rule out sulfur deficiency that we thought might have been involved in a previous timothy problem in this field. Since the soil test reported sufficient levels for all nutrients and the farmer reported adequate nitrogen fertilization, fertility should not be one of the causative factors. This was partially confirmed with application of a number of fertilizer combinations on very small areas in the field. Although nitrogen did seem to improve the green color of those leaves still alive, neither the other major nutrients (K, P, and S) nor the micronutrients (Fe, Mn, and Zn) seemed to have any effect on plant symptoms.

Several plants were checked for cereal rust mite and both eggs and larvae were found to be present in late November. It has been speculated that this situation could have been caused by cereal rust mite as the symptoms are similar to those seen in second year stands of timothy which had high levels of cereal rust mite infestations in the second year spring harvest. Although not as often observed in first year timothy, it may be that with timothy rotated with timothy the mite population was able to build up the population to a point that caused the observed symptoms and stand loss in this first harvest year crop.


Photo 6. Another view of the timothy plants showing both green at the site of new growth, purple to red on older leaves, yellowing and necrosis from the leaf tip back along the leaf margins, and dead or dying young tillers. (Photo by R. Taylor)


Photo 7. A photo indicative of the stand and tiller die-off in the timothy field. (Photo by R. Taylor)

I have another dozen or more photos available that illustrate the various symptoms seen in the field. If you would like to view the remaining photos, please email me with your name and email address and I'll post them on our university DropBox website for you to download. It will send you an automated message when they are available.

In summary, I doubt we'll be able to prove what happened to the crop causing the stand loss, the visual symptoms, or the very poor vigor but it would be nice to know how often this does occur in first year timothy stands. If you've seen a problem similar to this on timothy or have any suggestions of what the problem or problems might be, please contact the author.

Forages in Your Future Focus of Hay and Pasture Conferences

Dr. Les Vough
President
Maryland-Delaware Forage Council
Email: vough@umd.edu

Presentations at a series of three Hay and Pastures Conferences in Maryland and Delaware will challenge you to think about your farming operation and how forages can be part of your future. Have you thought about what your farm operation will look like in five to ten years? What is the mission or purpose of your farm? What are you in the business to do? Have you evaluated your resources – land, forages, water, buildings, fencing, livestock, and labor? If you are in the forage business (grow hay, silage or pasture) you need to understand how plants grow and how soil type and properties impact forage production and grazing systems.

Ways to grow and harvest more forage from the same land, including evaluating soil fertility and selection of forage species will also be covered. The fertility management of pastures and hay fields is a continuous process that is often only a consideration of producers during establishment but managing fertility for the maintenance of the stand and continued productivity is important. The advantages and disadvantages of pure stands and mixtures of grass-forbs-legumes will be discussed. Proper management results in profitable yields and high quality forage. The end result of mismanagement is low, unprofitable yields and low quality forage.

These are highlights of two presentations to be made by Bob Hendershot, retired Natural Resources Conservation Service (NRCS) state grassland conservationist and state Grazing Lands Conservation Initiative (GLCI) coordinator in Ohio. Hendershot provided leadership and technical guidance to conservation programs that use grasses and other forages. He was named the nation's Outstanding Pastureland Conservationist by NRCS in 1999, He was inducted into the Ohio State Conservationist Hall of Fame in 1998 and was presented the NRCS Regional Grazing Lands Conservation Initiative Support Award in 1996.

Hendershot has a pasture based sheep operation near Circleville, Ohio, and occasionally grazes stocker cattle. He has served two terms on the board of directors of the American Forage and Grassland Council and is the immediate past president. He helped develop the Pasture for Profit Grazing Schools, the Ohio Forage for Horses and the Equine Environmental and Liability Awareness Program and continues as an instructor and pasture walk leader. He was presented the Ben Stinner Memorial Award in recognition of his excellent contribution to sustainable agriculture in 2009 by the Innovative Farmers of Ohio. He has been described as a knowledgeable and dynamic speaker who can assist any interested operator in improving their forage management.

These conferences will be held at three locations in Delaware and Maryland so choose a location near you.

- **Delmarva Hay & Pasture Mini-Conference,** January 16, 6:00 – 9:00 pm, Delaware State Fairgrounds, Harrington, De

- **Delmarva Hay & Pasture Conference,** January 17, Delaware State Fairgrounds
- **Southern Maryland Hay & Pasture Conference,** January 18, Izaak Walton League Outdoor Education Center, Waldorf, Md
- **Tri-State (Md., Pa., and W. Va.) Hay & Pasture Conference,** January 19, Garrett College, McHenry, Md

A variety of other topics and speakers will round out the programs at each location. Certified crop advisor and pesticide and nutrient management certification credits will be offered.

There is no registration fee for the Delmarva conference and lunch will be available on site for purchase.

Registration fee for the Southern Maryland conference will be $15 per person by January 13 and $20 after the 13th. Checks should be made payable to University of Maryland and sent to Hay & Pasture Conference, University of Maryland Extension, PO Box 663, Leonardtown, MD 20650 (phone: 301-475-4484).

Registration for the Tri-State conference will also be $15 per person by January 13 and $20 after the 13th. Checks should be made payable to Garrett EAC and sent to Hay & Pasture Conference, University of Maryland Extension, 1916 Maryland Highway, Suite A, Mtn. Lake Park, MD 21550 (phone: 301-334-6960).

For more information or to obtain the complete program agenda and registration materials, contact your local extension or soil conservation district office or go to http://www.mdforages.umd.edu/UpcomingEvents.htm.

Notices and Upcoming Events

January 9, 2012
Shenandoah Valley Professional Crop Advisors Update, Weyers Cave Community Center, Weyers Cave, VA. CE/recertification credits in VA Nutrient Management, VA Commercial and Private Pesticide Applicators, and Certified Crop Advisors available. $20 fee includes lunch and materials. Contact Matt Yancey at mayancey@vt.edu or call the office at 540-564-3080 or email vantage@vt.edu

January 10-11, 2012
Eastern Shore Ag Conference and Trade Show, Belle Haven, VA. For more information, contact Josh Freeman at 757-414-0724 ext. 15 or by email: joshfree@vt.edu

January 16, 2012
Delmarva Evening Hay and Pasture Conference, Ag Commodities Building, Delaware State Fairgrounds, Harrington, Delaware. Contact Dr. Richard Taylor at 302-831-2395 or by email: rtaylor@udel.edu or visit the Delaware Ag Week website at: http://www.rec.udel.edu/AgWeek/home.htm

January 17-19, 2012
2012 Atlantic Coast Ag Convention & Trade Show and the NJ Agricultural Convention, Trump Taj Mahal, Atlantic City, NJ. For more information, contact Dr. Melvin R. Henninger at 732-932-9711 or by email: Henninger@aesop.rutgers.edu

January 17, 2012
Delmarva Hay and Pasture Conference (All Day), Dover Building, Delaware State Fairgrounds, Harrington, Delaware. Contact Dr. Richard Taylor at 302-831-2395 or by email: rtaylor@udel.edu or visit the Delaware Ag Week website at: http://www.rec.udel.edu/AgWeek/home.htm

January 18, 2012
Southern Maryland Hay & Pasture Conference, Izaak Walton League Outdoor Education Center, Waldorf, MD. Contact: Ben Beale at 301-475-4484 or by email: bbeale@umd.edu

January 19, 2012
Agronomy/Soybean Day, Dover Building, Delaware State Fairgrounds, Harrington, Delaware. Contact Dr. Richard Taylor at 302-831-2395 or by email: rtaylor@udel.edu or visit the Delaware Ag Week website at: http://www.rec.udel.edu/AgWeek/home.htm

January 19, 2012
Tri-State (Md., Pa., and W. Va.) Hay & Pasture Conference, Garrett College, McHenry, Md. Contact: Willie Lantz at 301-334-6960 or by email: wlantz@umd.edu

January 23-25, 2012
Virginia Grain and Soybean Conference, Richmond, VA. For more information, contact by email VACPA@earthlink.net

February 6, 2012
Making No-Till Work on your Farm, Franklin Center, Rocky Mount, VA. Featuring Joel Gruver, Univ. W. IL. The program is free. For more information, Contact Matt Yancey at mayancey@vt.edu or call the office at 540-564-3080 or email vantage@vt.edu

February 7, 2012
Virginia No-Tillage Alliance Annual Conference, Rockingham County Fairgrounds, Harrisonburg, VA. Featuring Missy Bauer, Farm Journal and Corn College and Joel Gruver, Univ. W. IL. $10 fee includes lunch and materials. For more information, Contact Matt Yancey at mayancey@vt.edu or call the office at 540-564-3080 or email vantage@vt.edu

February 8, 2012
Conservation Tillage Conference, Keystone Tractor Museum, Colonial Heights, VA. Featuring Missy Bauer, Farm Journal and Corn College. $10 fee includes lunch, materials and museum tour. For more information, Contact Matt Yancey at mayancey@vt.edu or call the office at 540-564-3080 or email vantage@vt.edu

February 10-11, 2012
Virginia Biological Farming Conference, Richmond, VA. For more information visit http://www.vabf.org/

February 16, 2012
Delaware Dairy Days, Hartley Fire Hall, Hartly, DE. Topics to include: Parlor Management, Lowering SCC Counts, Crop Management. For more information, contact Susan Garey at truehart@UDel.Edu

February 23, 2012
Virginia Grain and Soybean Conference, Williamsburg, VA. For more information visit http://www.virginiagrains.com/

March 1-3, 2012
Commodity Classic, Nashville, TN. For more information visit http://www.commodityclassic.com/

March 2-3, 2012
Maryland Cattle Industry Convention & Hay and Pasture Conference, Hagerstown Hotel & Convention Center, Hagerstown, MD. Contact Scott Barao at 410-795-5309.

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