Mid-Atlantic Regional Agronomist Quarterly Newsletter

June 2007

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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 coverpage.

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Corn Drydown

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Dry weather across much of Ohio during the past summer has accelerated maturation in many corn fields. Corn will normally dry approximately 3/4 to 1% per day during favorable drying weather (sunny and breezy) during the early warmer part of the harvest season from mid-September through late September. By early to mid-October, dry-down rates will usually drop to ½ to 3/4% per day. By late October to early November, field dry-down rates will usually drop to 1/4 to 1/2% per day and by mid November, probably 0- 1/4% per day. By late November, drying rates will be negligible.

Estimating dry-down rates can also be considered in terms of Growing Degree Days (GDDs). Generally, it takes 30 GDDs to lower grain moisture each point from 30% down to 25%. Drying from 25 to 20 percent requires about 45 GDDs per point of moisture. In September we average about 10 to15 GDDs per day. In October (as things cool down) the rate drops to 5-10 GDDs per day. However, note that the above estimates are based on generalizations, and it is likely that some hybrids vary from this pattern of drydown.

Some past Ohio research evaluating corn drydown provides insight on effects of weather conditions on grain drying. During a warm, dry fall, grain moisture loss per day ranged from 0.76 to 0.92%. During a cool, wet fall, grain moisture loss per day ranged from 0.32 to 0.35%. Grain moisture losses based on GDDs ranged from 24 to 29 GDDs per percentage point of moisture (i.e., a loss of one percentage point of grain moisture per 24 to 29 GDD) under warm dry fall conditions, whereas under cool wet fall conditions, moisture loss ranged from 20 to 22 GDD. The number of GDDs associated with grain moisture loss was lower under cool, wet conditions than under warm, dry conditions.

Agronomists generally recommend that harvesting corn for dry grain storage should begin at about 24 to 25% grain moisture. Allowing corn to field dry below 20% risks yield losses from stalk lodging, ear rots, and insect feeding damage. This year growers should be prepared for localized root lodging and stalk lodging that may slow harvest and contribute to yield losses.

Crop Germination and Emergence in Dry Soils

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Unusually dry soil conditions have resulted in delayed and uneven emergence in many Ohio corn and soybean fields. Moreover, weekend rainfall was highly variable across the state and soil moisture conditions remain inadequate for germination and emergence in some fields. What are the prospects for crop establishment in such fields? We've been receiving questions about the viability of soybean seeds whose germination was "suspended" due to drying soil.

Seeds that have swollen by taking up water, but cannot complete germination due to lack of adequate soil water, may be unable to resume germination, once water is available. The critical moisture content for germination of soybean seeds is 55%; for corn, it is 35%. When seeds are planted, they undergo a number of drying/wetting events that occur in the soil resulting from rainfall events. Once soybean seed moisture content exceeds 55% germination, it is committed to germinate. Any drying back at this point will result in death of the seed/seedling. Seeds in which the seedcoat is broken and a root emerges (i.e. radicle protrusion) would require a moisture content in excess of 55%. Any drying back below 55% moisture would be fatal. If the seed is hydrated to 70%, but dried back to 60%, germination would proceed and would not harm the seed. Once cell division occurs in the radicle tip (this is after cell elongation that causes the radicle to initially grow), the seed is committed to germinate. New cells need at least that much water to function or they will die.

To determine if seeds whose germination was suspended due to drying soil are still capable of germination, you can dig them up and wrap them in a moistened paper towel in a warm place to see if they germinate. Keep towels moist and count the number of seeds that germinate after 1-2 days.

If soybean seeds swell only slightly and the seed coat is not broken, they may be able to germinate if they get more water within a few days. One reason we are probably not hearing as much about swollen corn seeds failing to germinate is that the critical moisture content for corn is less than soybean although this is offset somewhat by the larger size of corn seed. Nevertheless, if the moisture content of the corn seed exceeds 35%, it will irreversibly initiate germination. Drying back below 35% would cause the corn seed/seedling to die.

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Reference: Nafziger, E. 2007. Seeds and plants in dry soils. the Bulletin: Pest mgmt & crop developmt information for Illinois. Univ. of Illinois. [On-Line]. Available at http://www.ipm.uiuc.edu/bulletin/article.php?id=740. (URL verified 5/29/07).

Tips for Assessing Corn Hybrid Demonstration Plots

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This is the time of year when many farmers visit and evaluate hybrid demonstration plots planted by seed companies and county Extension personnel, among others. When checking out these plots, it's important to keep in mind their relative value and limitations. Demonstration plots may be useful in providing information on certain hybrid traits, especially those that are usually not reported in state corn performance summaries. The following are some hybrid characteristics to consider while checking out hybrid demo plots.

Plant/Ear Height: Corn reaches it maximum plant height soon after tasseling occurs. Remember that although a big tall hybrid may have a lot of "eye appeal," it may also be more prone to stalk lodging in the fall. Unless your interest is primarily silage production, increasing plant height should not be a major concern. Generally later maturity hybrids are taller than earlier maturity hybrids. Big ears placed head high on a plant translate to a high center of gravity, predisposing a plant to potential lodging. The negative effects of stalk rot on stalk lodging in the fall may be worsened by high ear placement.

Stalk Size: Generally speaking, a thicker stalk is preferable to a thinner one in terms of overall stalk strength and resistance to stalk lodging. As you inspect a test plot, you will see distinct differences among hybrids for stalk diameter. However, also check that the hybrids are planted at similar populations. As population increases stalk diameter generally decreases.

Leaf Diseases: During the grain fill period, leaf diseases can cause serious yield reductions and predispose corn to stalk rot and lodging problems at maturity. The onset of leaf death shortly after pollination can be devastating to potential yield, since maximum photosynthetic leaf surface is needed to optimize grain yield. Hybrids can vary considerably in their ability to resist infection by these diseases. Demonstration plots provide an excellent opportunity to compare differences among hybrids to disease problems that have only occurred on a localized basis. Look for differences in resistance to northern corn leaf blight and gray leaf spot. Check to see if foliar fungicides have been applied and what crop rotation has been followed. Typically you'll encounter more severe foliar disease problem in no-till, continuous corn.

Stalk Rots: Hybrids will likely differ widely when faced with strong stalk rot pressure. Begin checking plants in late August or about 6 weeks after pollination by pinching lower stalk internodes with your thumb and forefinger. Stalks that collapse easily are a sure indicator of stalk rot. Remember that hybrids with thicker stalks may be in plots having thin stands.

Lodging: Perhaps as important as stalk rot resistance is the stalk strength characteristics of a hybrid. Sometimes, superior stalk strength will overcome the effects of stalk rot. If your variety plot is affected by stalk rot in late August and early September, be certain to evaluate the stalk lodging resistance of the different hybrids. Most agronomists characterize plants with stalks broken <u>below</u> the ear as 'stalk lodged' plants. In contrast, corn stalks <u>leaning 30 degrees or more</u> from the center are generally described as 'root lodged' plants; broken stalks are not involved. Root lodging can occur as early as the late vegetative stages and as late as harvest maturity. Both stalk and root lodging can be affected by hybrid susceptibility, environmental stress (drought), insect and disease injury.

Root lodging is frequently attributed to western corn rootworm injury. However, much root lodging in Ohio occurs as the result of other factors, i.e. when a hybrid susceptible to root lodging is hit by a severe windstorm. A hybrid may be particularly sensitive to root lodging yet very resistant to stalk lodging. A cornfield may exhibit extensive root lodging in July but show little or no evidence of root lodging at harvest maturity in September (except for a slight "goose necking" at the base of the plant).

Demonstration plots also provide a good opportunity to evaluate another stalk related problem, green snap (a.k.a. brittle snap). Green snap damage in Ohio has usually been limited to localized areas where severe windstorms occur prior to pollination. Although green snap is not a major problem in Ohio, as it is in the western Corn Belt, there are differences in susceptibility among hybrids that growers may want to consider to avoid risks.

Transgenic Traits: Because damage from European corn borer (ECB) and western corn rootworm (RW) can be distinctly localized, strip plot demonstrations may be one of the best ways to assess the advantages of ECB Bt and RW Bt corns. The potential benefit of the ECB Bt trait is likely to be most evident in plots planted very early or very late; the potential benefit of the RW Bt trait is likely to be most evident in plots planted following corn or in a field where the western corn rootworm variant is present.

Husk Coverage/Ear Angle: Hybrids will vary for completeness of husk coverage on the ear as well as tightness of the husk leaves around the ear. Ears protrude from the husk leaves are susceptible to insect and bird feeding. Husks that remain tight around the ear delay field drydown of the grain. Hybrids with upright ears often associated with short shanks may be more prone to ear and kernel rots that those ears that point down after maturity. Under certain environmental conditions, some hybrids are more prone to drop ears, a major problem if harvesting is delayed.

Additional Points to Consider: The following are some additional points to consider during your plot evaluations:

1. Field variability alone can easily account for differences of 10 to 50 bushels per acre. Be extremely wary of strip plots that are not replicated, or only have "check" or "tester" hybrids inserted between every 5 to 10 hybrids. The best test plots are replicated (with all hybrids replicated at least three times).

2. Don't put much stock in results from ONE LOCATION AND ONE YEAR, even if the trial is well run and reliable. This is especially important this year given the tremendous variability in growing conditions and crop performance across the state. Don't overemphasize results from ONE TYPE OF TRIAL. Use data and observations from university trials, local demonstration plots, and then your own on-farm trials to look for consistent trends.

3. Initial appearances can be deceiving, especially visual assessments! Use field days to make careful observations and ask questions, but reserve decisions concerning hybrid selection until you've seen performance results.

4. Walk into plots and check plant populations. Hybrids with large ears or two ears/plant may have thin stands.

5. Break ears in two to check relative kernel development of different hybrids. Use kernel milk line development to compare relative maturity of hybrids if hybrids have not yet reached black layer. Hybrids that look most healthy and green may be more immature than others. Don't confuse good late season plant health ("stay green") with late maturity.

6. Differences in standability will not show up until later in the season and/or until after a windstorm. Pinch or split the lower stalk to see whether the stalk pith is beginning to rot.

7. Visual observations of kernel set, ear-tip fill ("tip dieback"), ear length, number of kernel rows and kernel depth, etc. may provide some approximate basis for comparisons among hybrids but may not indicate much about actual yield potential.

8. Find out if the seed treatments (seed applied fungicides and insecticides) used varied among hybrids planted, e.g. were the hybrids treated with the same seed applied insecticide at the same rate? Differences in treatments may affect final stand and injury caused by insects and diseases.

Low Cutting Height Can Result In Loss of Orchardgrass Stands

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Cutting height may be resulting in the loss of orchardgrass stands as much as insect and disease problems. Insects such as grubs and billbugs and leaf diseases are certainly contributors to loss of stands but the advent and popularity of disc mower-conditioners somewhat coincides with the shorter stand life and slower recovery of orchardgrass fields after cutting. There is a tendency to set disc mower/conditioners to cut closer to the ground than with sickle bar mower/conditioners. I see much more scalping of the ground where disc mower-conditioners are used than where sickle bar mower-conditioners are used. With disc mower-conditioners, some farmers are cutting as close as an inch or inch-and-a-half, sometimes even lower. This is analogous to overgrazing of pastures and if done repeatedly the outcome can be the same – loss of stands.

In contrast to alfalfa which has large taproots and stores its reserves (nonstructural carbohydrates) primarily in the roots, orchardgrass stores its reserves principally in the lower 3 to 4 inches of the stem bases or tillers. When growth begins in late winter or after cutting or grazing, leaf area for photosynthesis is low and stored carbohydrates are used to support new growth. In the case of alfalfa, depletion of carbohydrates in the roots continues until the topgrowth is about 6 to 8 inches tall, at which point there is usually enough leaf area to produce sufficient photosynthate to meet growth and respiration needs.

Grasses store relatively little carbohydrates in the roots. The highest concentration of carbohydrates in grasses is in the leaf sheaths and stem bases in the vegetative stages of growth and in the lower stem in the reproductive stages of growth. Therefore it is critical in cutting or grazing management to leave enough stubble to retain sufficient stored carbohydrate and basal leaf area to support regrowth. Production of the first 1 to 3 leaves requires a substantial amount of stored energy (carbohydrates). If mowing or grazing removes too much of the lower stems and sheath area of tillers, too much of the stored carbohydrates can be removed, not leaving enough to support root maintenance and shoot regrowth. In addition, with summer regrowth cuttings, higher temperatures usually increase respiration rates, so less storage often occurs in midsummer.

If mowing or grazing removes too much leaf area and too much of the stem bases where carbohydrates are stored, growth rate is slowed substantially. Because there is not much leaf area for photosynthesis and manufacture of carbohydrates, additional reserves may be required for regrowth. If much of those reserves have been removed by cutting too low, ultimately the point may be reached where reserves are totally depleted and the plant dies.

Root growth is also affected by heavy defoliation (either mowing or grazing), which makes the plant less competitive and more vulnerable to heat, drought, insect and disease stresses. Orchardgrass plants that are repeatedly cut at 1 to 1½ inches will have shallower and less extensive root systems, thus less able to obtain adequate moisture from the soil, than plants cut at 3 to 4 inches.

Grasses can withstand greater defoliation during early and rapid growth stages in the spring and early summer than they can later in the growing season when less opportunity for growth exists. Forage researchers and farmers in Missouri have observed less damage to plants from summer heat and drought when the first harvest is made early and plants have time to re-grow before the stress occurs. Some farmers in southern Missouri have reported almost 100 percent loss of stands when harvest was delayed to the late bloom stage. When little opportunity for regrowth exists during midsummer or drought, sufficient leaf material should be left after cutting or grazing to maintain carbohydrate levels within the plant.

Farmers have commented to me that their orchardgrass does not come back now as fast as it used to and wonder what has happened to orchardgrass varieties today. Well, we are still using some of the same varieties that were used 10, 15 and 20 years ago and today's newer varieties are better than they have ever been, so such comments are a signal that something else like the management practices have changed, not the varieties. One of the most likely reasons that the orchardgrass is not coming back as quickly is that the cutting height is too low.

If you are presently having problems with slow regrowth and loss of stands and want to see if increasing the cutting height will improve regrowth and stand longevity, try several different cutting heights in the same field this year (do it within the same field, not different fields due to differences between fields and stand conditions). Use a relative new stand, preferably one only a year or so old. Make several rounds around the field cutting at your usual height. If your usual cutting height is 1½ inches, after several rounds readjust the cutting height to 2½ or 3 inches. After several more rounds readjust the cutting height again to 3½ or 4 inches. Record the number of rounds made at each cutting height so that the same heights can be used in the same areas of the field for subsequent cuttings the rest of this year and next year. This will show you what impact cutting height has on performance and persistence.

I think you will find that cutting at a height of 3 to 4 inches will help maintain strong root reserves, leading to faster recovery of regrowth and better stand persistence. While we will still face problems from insects and diseases, more healthy and vigorous plants that are not stressed from low cutting heights will be better able to withstand the impacts of the insects and diseases and should help improve yield and stand persistence.

Cut the Residue - Penetrate to the Proper Depth - Insure Soil-to-Seed Contact

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One of the most enjoyable experiences of serving as an Extension Specialists in Nebraska was interacting with Mr. Paul Jasa, agricultural engineer and one of the world's foremost authorities on setting planters and drills in reduced- and no-tillage conditions. It seems he could take any planter or drill, modify it slightly, and then set it to plant through nearly any amount of residue. While in Nebraska and with Paul's help, we planted through 10+ tons/acre of switchgrass residue that has accumulated from 10 years of CRP and through nearly the same amount of residue left from 220 bushel corn. Simple adjustments allowed the same planter or drill to plant in any soil, regardless of clay content or hardness/compaction. Paul stressed three principles (or steps) for no-till planting: 1) cut the residue; 2) penetrate the soil to the proper seeding depth, and 3) insure good soil-to-seed contact. When you think about it, these principles are intuitive. But, performing each of them (in order) is sometimes a challenge. To some, the steps are easier said than done. But, by keeping these principles constantly on our mind, we've found them to greatly assist us when modifying or adjusting a planter/drill for difficult no-till conditions.

With continued dry weather, planting soybean into high-yielding barley or wheat may present a challenge. There could potentially be a lot of residue and the soil might be hard. But, following the three principles above and understanding how to achieve them will result in good soybean stands.

Step 1: Cut the Residue

Condition of the Field and Residue. Management of the small grain residue and weed control are key factors for successful no-till equipment operation. If residue and weed issues are not managed, then the ability of the planter or drill to perform its functions is greatly limited.

The residue has to be uniformly spread behind the combine. The planter/drill will not perform correctly if the combine has left a narrow swath of thick residue and chaff. The first step of cutting the residue cannot be accomplished under these conditions. Therefore, spread the residue! Better yet is to use a stripper combine header. Less residue on the surface means there is less to cut. Even with a stripper header, the chaff must be spread. We don't really cut through the piles of chaff. Instead we till it into the seed slot; thereby fouling up the third step of insuring good soil (not chaff)-to-seed contact. Chaff in the seed zone will only pull moisture away from the seed.

Another key is weed control. If standing weeds exist, the planter/drill must cut and move extra living plant material through the system. Weeds that have a head start on the crop will compete for light, water, and nutrients more than weeds emerging with the planted crop. Therefore, weeds need to be controlled before crop emergence or soon afterwards to prevent yield loss.

Allow the residue to dry and become crisp before planting. Planting too early in the morning is one of the biggest mistakes that we make. Regardless if the planter is set right or not, cutting wet or tough residue is a challenge that might not be overcome. Remember, 75% of the yield is established when you put the seed into the ground. Don't get in a big hurry; allow the residue to dry.

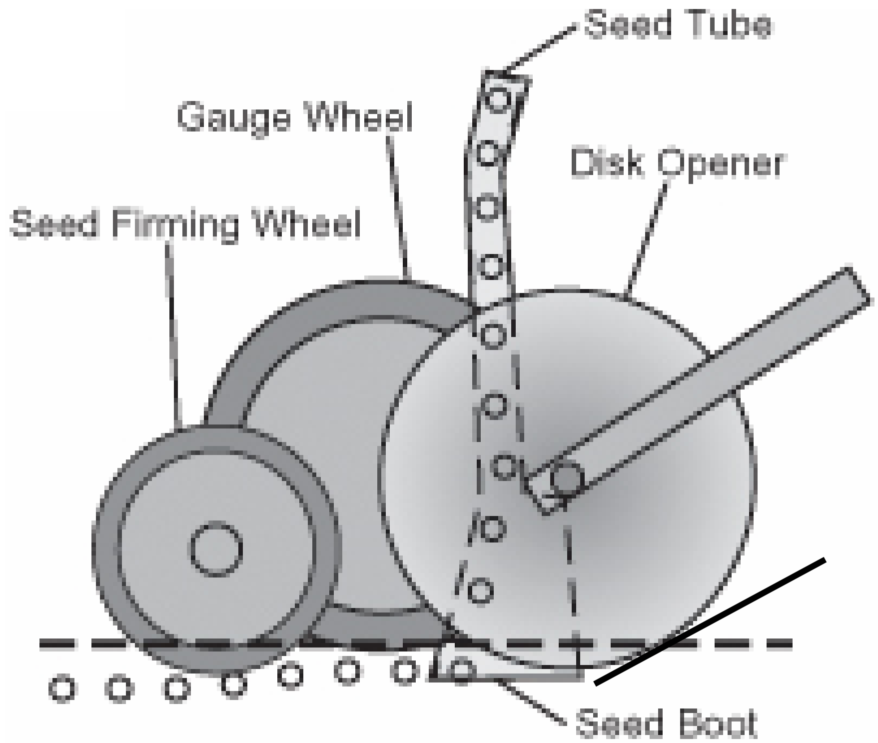
A final comment about residue management, that shouldn't have to be spoken, is warranted– **Don't burn the straw!** The straw is a valuable resource. Burning will remove any nitrogen and carbon and send it up in the air. This adds to pollution and throws away probably our two most important resources in producing a good crop and improving soil quality. If you don't have the planter to perform the steps to be listed, then consider bailing the straw. And, please don't underestimate your or your planter/drill's ability to get the seed into the ground.

Adjust the disk openers. For double-disk openers, maintain approximately 1 to 1½ inch of contact between the two disks. Adjustment washers are found in the double-disk opener assembly, which allow some adjustment to compensate for wear. Machine bushings located on the spindle between shank and disc blade can be added or removed as required to maintain contact. As the blade diameter decreases because of wear, it will be necessary to remove the machine bushings. If 1 to 1½ inch of blade-to-blade contact cannot be maintained after removing machine bushings, if blade diameter is worn below the manufacturer's recommendations, or if the blade edge is bent, chipped, or jagged, the blade should be replaced.

Operators of no-till planters/drills with offset double-disk openers need to watch the leading edge of the double-disks for significant wear. Single-disk openers are also subject to similar wear. Essentially, the leading edge of the disk takes the abrasion and wear of cutting straw or stalks and penetration into the soil. The leading and trailing disks typically are two different parts and cannot be interchanged. As the double-disk openers wear, check the gap between them. If a gap opens between the double-disks, they will push residue into the furrow and have less ability to cut the residue. For offset double-disk openers, a business card-width gap should be maintained to prevent the trailing disk from cutting into the leading disk blade.

Check end play of the disk opener by shaking it from side-to-side. With the single-row ball bearings, some end play will be normal. The disc is stabilized by the contact between the double-disk openers. However, if end play is excessive and the bearing sounds dry when turned, replace bearing/hub assembly or complete disc assembly. Also, check to see that the bearing hubcap is in place. Replace the hubcap if it is lost or damaged.

Adequate down pressure is most important. You may think that we're skipping to Step 2 before we finish our discussion on cutting the residue. You're partly right, we are – sort of. Keep in mind that you much approach these steps in order; but, practices and adjustments within each step may overlap. To adequately cut the residue, we must penetrate the soil to the proper depth (Step 2). Why? This is because we want the coulters and/or disk openers acting like a pair of scissors. The below illustration may help. Note that the coulter is running at the proper depth and the contact angle between the coulter and the soil is about 45^{O}. At this angle, the cutting is scissor-like and residue will be cut. Think about the way a pair of scissors cuts. When open too wide, it doesn't work. Nor would the scissor work well if you disassembled the tool and tried to press the two cutting edges together at the wrong angle. Keep in mind that the size of the coulter will affect this angle; bigger is usually better.



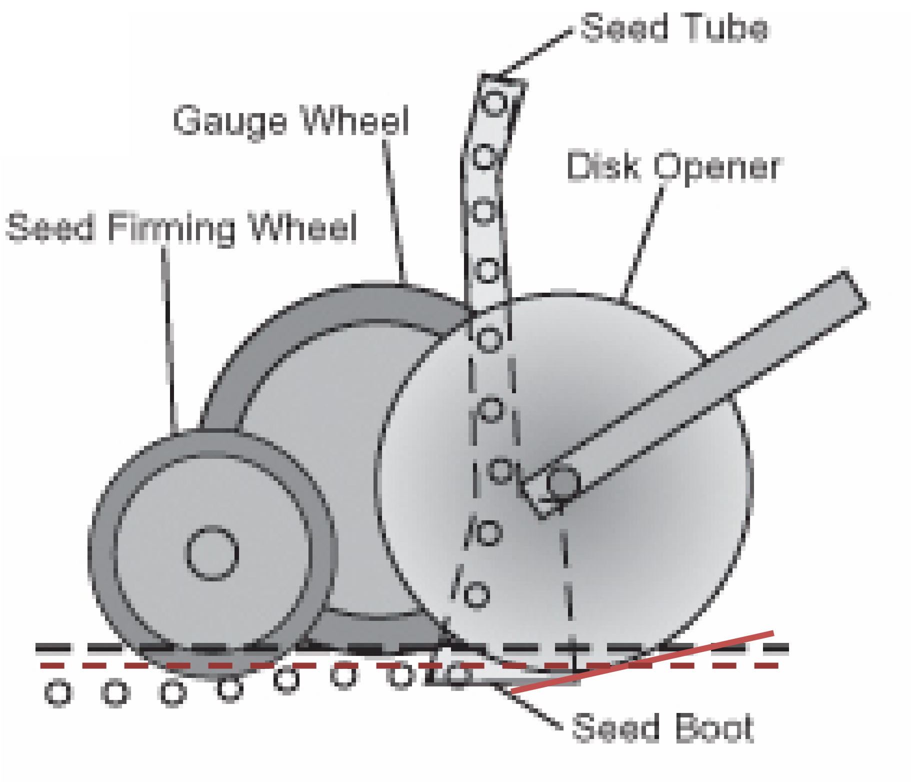
Step 2: Penetrate the Soil to the Proper Seeding Depth

The primary differences between conventional planter/drill systems and those designed for conservation tillage systems are down pressure and weight. Since openers and soil engaging devices must deliver more down pressure to penetrate firmer no-till soils and cut the residue, conservation planter/drill systems include heavy-duty down-pressure devices, are built heavier, and have the ability to carry much more weight than conventional tillage systems.

Individual planting units should be equipped with heavy down-pressure springs. In some conditions, the amount of down-pressure required to penetrate the soil will require 500 pounds per planting unit. Usually down-pressure springs are adjustable and multiple springs can be added if insufficient pressure is achieved. Only after adequate down-pressure is achieved are we ready to add weight to the planter/drill. **Adding weight by itself will not ensure penetration to the proper seeding depth.** Add sufficient weight to the planter to ensure penetration of the coulters and seed furrow openers into untilled soil, and to keep the seed-metering drive wheels on the ground.

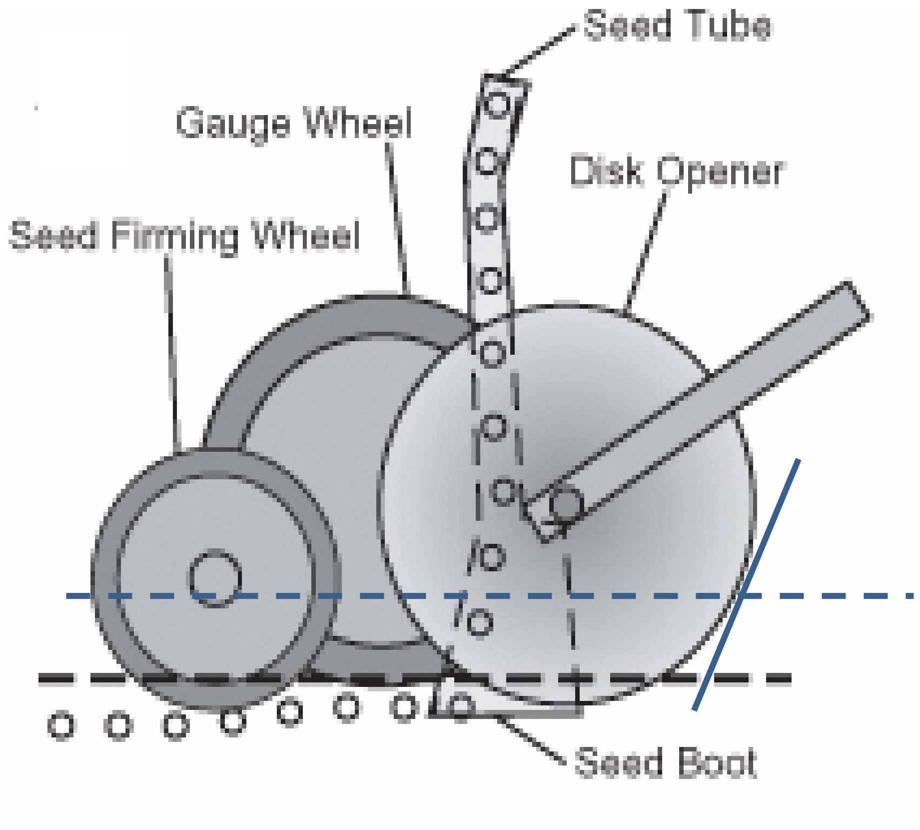
Let's do some weight calculations. We have a 15-row 15-inch planter. We've achieved at least 400 pounds of down-pressure per row unit with two heavy duty down-pressure springs not quite set for maximum down-pressure. So, 15 units x 400 lbs/unit = 6,000 pounds. Does the planter weigh enough, or do we need to add weight? Now, consider a 15-foot drill with 24 7.5-inch spaced units. With this number of units, we need at least 9,600 pounds (24 x 400) to make the drill work correctly.

Here are a couple of common scenarios. Let's assume that we don't have adequate down pressure. The scenario would look something like this (the dashed red line is the soil surface): First, we would not cut the residue because the angle of cut is wrong. We would however be pushing the residue into the seed furrow. Residue in the seed furrow prevents good soil-to-seed contact (Step 3). In addition to the seed drying out due to the residue in the seed furrow, we have a shallow planted seed.



Soybean seed depth should be between ¾ to 1¼ inches. If topsoil moisture is lacking, use the deeper placement, but never plant deeper than 1½ inches. If topsoil is adequate shallower seed placement may speed up emergence, but probably won't make much difference under warm soil conditions. Just make sure that the seed is in contact with moist soil. Placement depth is controlled by the gauge wheels (but only if we can penetrate the soil with adequate down-pressure and weight). Ideally, these should be adjacent to the disk opener. If controlled by the seed firming/closing wheel, then uniformity of seed depth could be erratic.

Now, let's consider too deep of a placement from improper adjustment (figure with blue lines). Not only will this delay and possibly prevent emergence, we will not likely cut the residue. Instead, we will be pushing it. Notice the angle created by running the planter too deep (and I've seen planters/drills run deeper than what is illustrated). There is no scissors action. Pushing the residue causes planters, and especially drills to drag up piles of residue.



Another thing to keep in mind is different soil types within a field. If the planter/drill moves out of heavier soil into a lighter soil or if the planter moves from compacted land to that which is not compacted, the planter will tend to sink and begin dragging up residue. The same principle applies; we begin cutting too deep and pushing the residue. Never set the planter on the field edges where the soil is more likely to be compacted or in an unrepresentative soil. Wide gauge wheels usually helps with this. Wide gauge wheels, drill units that do not run side-by-side and high clearance will go a long ways towards reducing residue dragging when in a field with highly-variable soil types.

Although not necessary, coulters can be added in front of the planter openers to ensure residue cutting. Like double-disk openers, the cutting angle must be correct. For adequate coulter penetration, weight may have to be added to the carrier. Some planter/drills use a weight transfer linkage to transfer some of the tractor weight to the coulters to ensure penetration. Because coulters are usually mounted several feet in front of the seed opening/placement device (in the case of coulter caddies even further), many use wide-fluted coulters. A pivoting hitch or a steering mechanism will keep the seed openers tracking in the coulter slots.

Step 3: Insure Good Soil-to-Seed Contact

Good soil-to-seed contact cannot be achieved unless the first two steps are performed correctly. If the first two steps were carried out correctly, the last step will be much easier.

Press Wheels and Depth Control. There are two methods for seed-depth control on most no-till planter/drill systems: 1) setting the depth from a gauge wheel adjacent to the seed furrow device or 2) adjusting press wheel pressure behind the seed furrow openers. The disadvantage of any system using the press wheel for depth control is its distance from the seed opener. As the distance increases there is a greater possibility that irregular terrain will influence both depth control and the press wheel's ability to provide good soil-to- seed contact. Therefore, depth control from an adjacent gage wheel is preferred. In either case, keep adequate pressure on the gauge or press wheel to force the openers into the soil to the proper depth. A harrow behind a drill ensures seed coverage and redistributes residue for effective conservation measures.

Regardless of the depth control, wide-flat press wheels are unacceptable for no-till since they will ride on the firm soil adjacent to the seed furrow and will not firm the seed into soil. On the other hand, a wide press wheel equipped with a rib that runs on each side of the seed furrow or a rib that runs directly over the furrow to press the seed works well. Another option is to use a pair of angled press wheels behind the opener to close the seed furrow at the same time. When using angled press wheels, make sure that pressure is not placed on the seed furrow to the point that a ribbon of soil moves the seed up. If available, adjust the angle such that the angle of the press wheels meets at the seed depth. Most planters are set for 1¾ inches for proper soil-to-corn seed contact. Therefore, they will have to be adjusted for soybean, cotton, or other more shallow planted crops. Press the seed, not the soil below the seed.

Sufficient weight must remain on the press wheels to ensure firming of the seed into the soil. Wet soil is easily compacted and care must be taken not to over pack the soil, making it difficult for seedling roots to penetrate the soil. In dry soil conditions, extra closing force may be needed. The key is to evaluate seed-to-soil contact, not the top of the seed-vee. As long as the contact is maintained, something as simple as a harrow that acts to close the top of the vee and pull light residue cover back over the vee may be all that is needed. This is a common practice on drills that use a narrow press wheel.

Cut the Residue, Penetrate the Soil, and Insure Soil-to-Seed Contact

These three principles will make you successful at no-tilling soybeans, or any crop for that matter. More detailed information can be found in the Virginia Cooperative Extension publication 442-457, "Planter/Drill Considerations for Conservation Tillage Systems." Contact your local county extension office to obtain a copy. Or you can view and obtain a copy on the web at http://www.ext.vt.edu/pubs/bse/442-457/442-457.htm.

Management of Drought Stressed Corn for Silage

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Harvesting Drought Stressed Corn

Many parts of the region are experiencing drought conditions. Here are some guidelines for dealing with this situation.

Drought stressed corn should be harvested at the same dry matter (DM) for normal corn: 32-35% DM. *Determining whole plant dry matter or moisture is critical because visual assessments can be very inaccurate! Many plants that look dry contain a significant amount of moisture in the stalk.* Use of a microwave oven or Koster Moisture Tester is recommended. Under hot dry conditions, plants may dry down at 1-2 points per day. Ensiling corn at less than 28-30% DM will result in excess nutrient runoff and extremely acidic silages. Harvesting corn too dry (greater than 40% DM) restricts fermentation, reduces the loss of nitrates, results in forage that is difficult to pack, and can result in excessive spoilage and poor bunk stability.

Chop forage at a theoretical setting of 3/8 to 3/4 inch if harvested at the optimum DM. If you have already missed the optimum dry matter for harvest and the plants are very dry, (more than 40% DM) consider, chopping your forage finer to improve packing (but remember you will have to balance the TMR for adequate effective fiber during feedout).

If the forage is not well eared, mechanical processing may not be needed. Process if the amount and maturity of the kernels warrants it.

As always, filling fast, packing tight and sealing immediately will help to ensure a good fermentation. Be sure to have adequate tractor weight on the pile as drier forages are more difficult to pack. Allow silage to ferment for at least 3-4 weeks (longer would be preferable) prior to feeding and gradually introduce new silage to animals.

Silage Additives for Drought Stressed Corn

- Homolactic acid bacteria (microbial inoculants): Severely drought stressed corn forage may contain lower numbers of naturally occurring lactic acid bacteria and may need some help during fermentation. If forage is in the normal range for DM, consider using a homolactic acid bacteria. Some strains of *Lactobacillus plantarum* may help with the reduction in nitrates.

- Heterolactic acid bacteria – *Lactobacillus buchneri*: Drought stressed corn silage often has high sugar content and can be highly prone to spoilage when exposed to air.

Lactobacillus buchneri is an organism that safely produces acetic acid, which reduces aerobic spoilage organisms and improves bunk life.

- <u>Buffered propionic acid-based preservatives</u>: Silage additives based on buffered propionic acid may be an acceptable additive for drought stressed forage especially if the DM% of the whole plant is high: greater than 38 - 40%. Addition of 2-4 lb./ton of such products per ton of wet forage can improve aerobic stability of the silage and reduce DM losses in the silo and during feedout. Higher application rates will increase the probability of effectiveness. Although this may seem costly, such preservation easily pays for itself by preventing drops in intake and milk production that would occur if cows were fed spoiled silage.

- <u>Water</u>: Water can be added to increase the moisture level of overly dry forage, but the amounts needed to have a substantial impact are large. For example to decrease the dry matter of forage at 50% to 45%, one would have to add 200 lb of water per ton of forage! In addition, added water can cause run off problems as it is not absorbed efficiently by the forage mass.

- <u>Sugars/molasses</u>: Drought stressed corn forage usually contains moderately high concentrations of fermentable sugars. Thus, the addition of molasses or other fermentable substrates is usually not warranted if the forage is harvested at the proper DM content.

- <u>Non protein nitrogen additives</u>: Non protein nitrogen (NPN) additives (urea and anhydrous ammonia) should not be used on very dry, drought stressed forages.

Nitrate Poisoning From Drought Stressed Forages

Many plants can accumulate nitrate under stressful conditions (excessive fertilization or water stress from rain after a drought). Sunflowers, corn, wheat, barley, rape, bromegrass, and sweet clover are some of the more common plants that can accumulate high levels of nitrates. High nitrates cause toxicity because once they are absorbed into the blood stream, they are converted to nitrites that binds to hemoglobin and reduces the oxygen carrying capacity of the blood. Acute poisoning can be observed within 6 hours of forage consumption and is characterized by dark-brown blood, labored breathing, tremors, and weakness. The following information is primarily aimed at the management of drought stressed corn silage but general concepts are valid for other forages as well.

- Do not graze or feed green chopped forages that have been drought stressed.

- Ensiling is the best method to manage forages with potentially high levels of nitrates.

- Wait at least 4 to 5 days before chopping drought stressed forage if it is heavily rained on.

- Although extremely high nitrate levels are rare, we recommend that you test your corn forage before chopping and after ensiling (before feeding).

Test for nitrates at chopping*:* If the levels of nitrates are extremely high (Table 1) you may want to raise your cutter bar during harvest and leave about 10-12 inches of stalk in the field (this is because nitrates tend to accumulate in the stalk of the plant). We realize this will further lower yields, but high yields with toxic levels of nitrates are undesirable.

When sending samples into the lab, you must obtain representative samples from the field. It is best if this material is chopped. (Do not send in large pieces of plants and stalks.) Labs like Cumberland Valley Analytical, UPS/FEDEX: 14515 Industry Drive, Hagerstown, MD 21742 Phone: 1-800-282-7522 can return results of a nitrate test back to you within a 24 h period.

Test for nitrates before feedout: Although ensiling will decrease nitrate levels by about 50 to 60% we would recommend that you test your drought stressed corn silage feed according to the guidelines (Table 1). If nitrate levels are high in feeds, check for nitrates and nitrites in water as these can also contribute to toxicity issues.

Table 1. Safe and toxic nitrate (NO_3) levels in feeds.

Nitrate ion, % dry matter basis	**Recommendations**
0 – 0.44	Safe to feed.
0.45 – 0.88	Usually safe to feed with balanced diet. Limit to 50% of DM intake in pregnant animals.
0.89 – 1.50	Limit intake to 20-25% of DM intake. Use caution. Do not feed to pregnant animals.
> 1.50	Toxic!

Silo Gas Caution

Use extreme caution around silos because nitrogen oxide gasses that are generated during the first few days of ensiling are lethal to animals and humans! These gasses tend to accumulate in low areas and are colorless to reddish-brown. Run the blower for 15 to 20 minutes before entering an upright silo and use caution around vents in silo bags. Use a respirator before entering a silo. In severe cases, the gasses will stain forages and other items. In some instances patches of yellowish silage may be observed. If these spots of silage have a very low pH (1 - 3) it is possible that nitric acid was formed.

Manage the Plastic on Your Silage Piles and Bunkers

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The primary purpose of covering silage with plastic and tires is to prevent air from interacting with the silage mass. Air allows for the growth of detrimental microbes that initiate a process leading to the destructing of nutrients and potential for increased loads of various toxins. Although bunker and pile silos are covered with "plastic and tires", often times their management is less than desirable. Several scenarios are common. First, inadequate amounts of tires are used and/or the amount of weight provided by the tires (because they are sidewalls only) is insufficient to keep air from penetrating under the plastic. Billowing plastic or plastic that "ripples" is a good sign of this. Next, plastic is often torn from natural causes, equipment or animals and not repaired. Another common problem is that plastic is often cut in advance, too far back from the leading edge of the feeding face. This exposes the surface of the silage to air for too many days before feeding. Lastly, sidewall plastic has been used to help prevent water seepage into the silage mass but often times the silage is damaged by pack tractors or there is potential that the plastic is damaged with small holes as it lies on the wall during filling (plastic can be scraped on the sharp edges of a concrete wall as the plastic moves during filling).

To use the plastic and tires effectively we suggest the following. First, silos should be sealed with plastic and good weights as soon as possible after filling. This eliminates air and allows fermentation to proceed. Use more weights at the edges and at any seams. For example, use of whole tires, gravel bags, lime, or dirt around the perimeter of piles works well. Gravel bags have worked well at the walls (Figure 1). Overlap the plastic by about 4 to 5 ft at any major seam. Some people have actually glued or taped these seams together as they are lying the tarp down to keep them in place during sealing. If you are using plastic on the side walls, protect the draped plastic from being damaged by the sharp edges of the concrete wall. Placing thin strips of old carpet or cutting a ribbed plastic drain pipe down the center and fitting it on top of the wall (Figure 2) are some practices that have been used. During feedout, try to minimize the time that the top layer of silage is exposed to air (especially in hot weather) by cutting back only enough plastic to expose 1 to 2 days worth of feeding. This needs to be balanced with safety. Silage on the top of bunkers and piles is less tightly packed and prone to "cave ins" so use common sense and caution when deciding how much plastic to cut. It is also extremely important that the plastic at the leading edge of the feeding face be securely weighted down. Think of this edge as another "seam". Use of heavier tires, split tires stacked 3 or 4 high (Figure 3) or gravel bags at this edge (Figure 4) will prevent air from penetrating under the plastic. We have found gravel bags work well since they can be rolled back prior to cutting the plastic. Start the heavier weights at this leading edge as soon as possible after opening the silo. Once a significant amount of air has been trapped under the plastic, placing heavier weights at that edge will trap some of that air under the plastic. Lastly, repair rips and holes in plastic as soon as possible. Assign someone to check for tears at least once to twice a week. The use of alcohol around the perimeter of the rip, to dry the plastic, and tape specifically for repairing bunker or bag plastic will work better than duct tape. Remember, the primary cause of hot, moldy silages and spoilage layers on the tops of silos is due to exposure to air. Thus, minimize this exposure by managing your plastic and weights effectively.

Figure 1. Gravel bags at the wall in a bunker silo.

Figure 2. Plastic drain pipe used to cover the top of the wall to prevent side wall plastic from being torn or punctured.

Figure 3. Split tires stacked at the feeding face to prevent air from penetrating under the plastic.

Figure 4. Gravel bags at the feeding face to prevent air from penetrating under the plastic.

Not All Nitrogen Sources Are Equal When It Comes To Stockpiling

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Stockpiling tall fescue for winter grazing is one the biggest advantages that cattle producers in the mid-Atlantic region have. Stockpiling can cut winter feed costs by one-third or more. Unfortunately, it is also one of our most underutilized resources. If you are not currently stockpiling tall fescue for winter grazing, you should sit down and really give it serious consideration. This is great time to be "proactive" and think about the alternatives for winter feeding and how they will impact your bottomline.

Recent research conducted on two farms located near Blackstone, and Amelia, VA compared the effectiveness of six different nitrogen sources for stockpiling tall fescue. The nitrogen sources used in this study were ammonium nitrate, ammonium sulfate, broiler litter, complete fertilizer (18-9-9), urea, and urea-ammonium nitrate (30% liquid). These fertilizers were applied in the third week of August at 0, 40, 80, and 120 lb of actual nitrogen per acre. The grass was allowed to grow until mid-December when it was harvested and weighed.

Results of this study indicates that ammonium nitrate was the most effective nitrogen source for stockpiling tall fescue (Figure 1). The least effective source was urea-ammonium nitrate. At the highest nitrogen rate there was almost a 950 lb difference in dry matter yield between these two sources. Urea produced an intermediate yield, but the yield response curve indicates that even if producers increased the amount of urea they were applying they could not achieve a yield equal to ammonium nitrate.

Broiler litter also produced an intermediate yield. However, organic nitrogen sources such as broiler litter offer additional advantages such as slow release nitrogen, organic matter, and additional nutrients like phosphorus. The ammonium sulfate and complete fertilizer (nitrogen in complete fertilizer was ammonium sulfate) produced respectable stockpile yields. A disadvantage of these nitrogen sources are their acid forming characteristics. It takes approximately two times as much lime per unit of nitrogen applied to neutralize the additional acidity.

Although ammonium nitrate was the best nitrogen source for stockpiling tall fescue, its future availability is uncertain. Global use of ammonium nitrate has decreased since 1985 and has been banned in some countries due to security concerns. In all likelihood the availability and increased price may limit the use of this nitrogen source in the future.

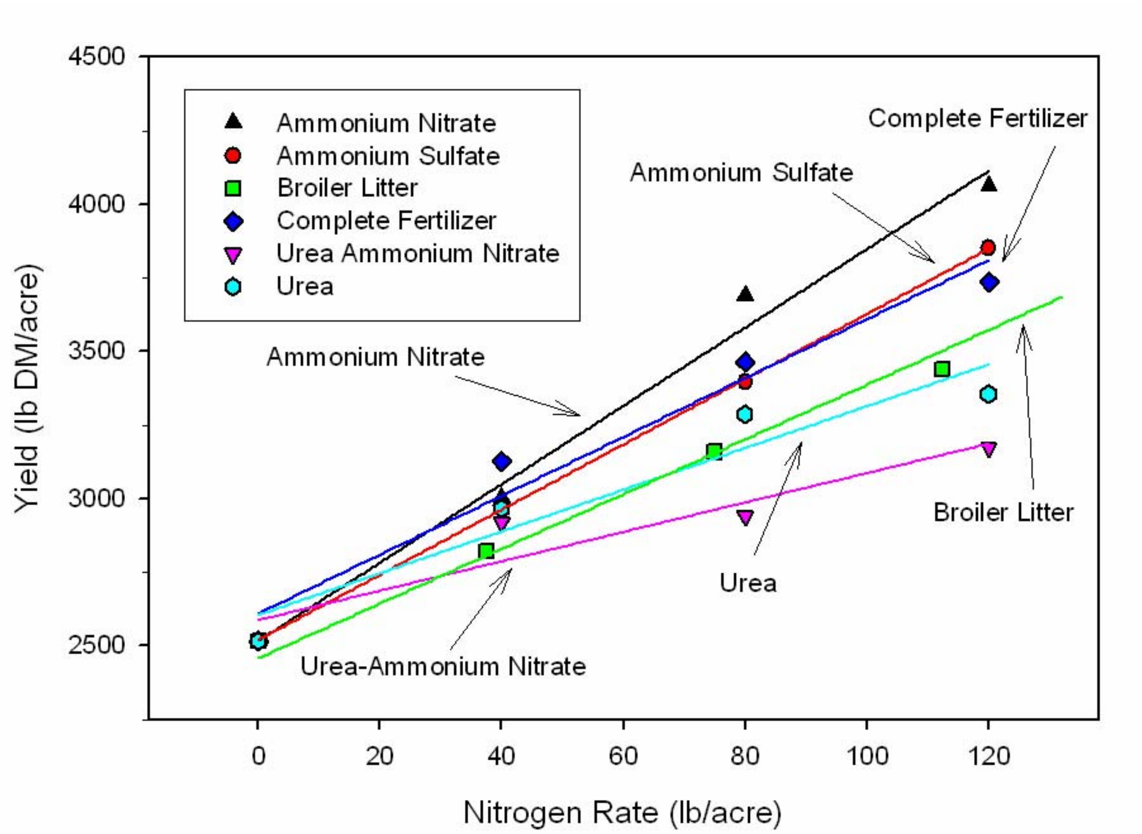

Figure 1. The effectiveness of six different nitrogen sources for stockpiling tall fescue for winter grazing.

Stockpiling for Winter Grazing in Drought Years

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Stockpiling tall fescue is one the cheapest and best ways to provide winter grazing for livestock in Virginia. In good years, tall fescue pastures top-dressed with 60-80 lb nitrogen/A in mid August can produce 1-2 ton/A hay equivalent. The question in drought years is does this recommendation work for dried up, overgrazed pastures. No pasture will respond to nitrogen until it rains. In addition, pastures that have been overgrazed have the least potential for fall growth. Applications of nitrogen for stockpiling should target pastures that have not been overgrazed or overgrazed the least.

The next question is when and how much nitrogen to apply. Ideally nitrogen for stockpiling should be applied in mid August at a rate of 60 to 80 lb/A. In a drought year there are several approaches to stockpiling. The first is to apply nitrogen in mid August at normal rates and then pray for rain. The second is to delay applications until rain looks like a sure thing. This option requires more planning since nitrogen needs to be applied prior to the impending rain. As the application date becomes later decrease the amount of nitrogen since the grass will have less time to grow before frost and cool temperatures set in. Research at the Southern Piedmont AREC has shown that a third option may exist. This option applies one-half of the nitrogen in August and one-half after it rains. If it doesn't rain then you don't make the second application.

Research at the Southern Piedmont AREC has shown that not all nitrogen sources are created equal when it comes to stockpiling. Three years of data found that the most effective nitrogen sources for stockpiling in late summer were ammonium nitrate and ammonium sulfate. Using urea or urea ammonium nitrate (30% solution) resulted in significantly lower yields. Organic nitrogen sources such as broiler can be used for stockpiling, but tends to yield lower because not all of the nitrogen is immediately available at application.

In drought years, winterfeed is often tight, so maximizing the utilization of stockpiled grass is essential. Strip grazing stockpiled fescue can increase grazing days by 30 to 40%. Allocate only enough pasture for 2-3 days of grazing. This is easily accomplished by using a forward temporary electric fence. No back fence is required since plants are dormant. During wet periods feed hay in a sacrifice area to avoid wasting stockpiled grass and damaging pasture sod.

Tips for Stockpiling Tall Fescue for Winter Grazing

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Stockpiling tall fescue can significantly reduce winter feed costs for cow-calf herds in the mid-Atlantic region. The following steps will help to optimize your stockpiling program.

Choose a strong tall fescue sod in a field that is well drained. To get the maximum yield response to nitrogen applications you will need a healthy stand of tall fescue. Choosing a field that is well-drained will help to ensure that the stockpile can be grazed with minimal pugging damage during the wet winter months.

Clip pastures that will be stockpiled to 3-4 inches prior to applying nitrogen. Clipping pastures removes old growth and increases the forage quality of the stockpiled grass.

Apply 60-80 lb of nitrogen per acre in mid to late August. Applying nitrogen too early can stimulate summer annual weed growth, while applying nitrogen too late decreases dry matter yield.

Allow growth to accumulate until mid-December before grazing. If limited grazing is available, feed hay during this accumulation period rather than the winter months.

Graze stockpiled pastures that contain legumes first. Legumes deteriorate at faster rate than grass and should be grazed first to minimize losses.

Strip graze tall fescue to maximize grazing days. Allocating only enough stockpiled grass for 2-3 days will increase grazing days per acre by 30%.

Frost seed legumes on grazed areas. Closely grazed stockpile provides an excellent opportunity to establish legumes in grass dominated pastures. Broadcasting the seed as the pasture is being grazed can enhance soil-seed contact and increase overseeding success.

Fertilizing Pasture and Hay fields for Fall Production following Drought

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With much of the state still in the grip of drought, growers need to carefully consider factors that can affect their fall fertilization program as well as impact forages' winter survival. Where grazing is short, fall fertilization may be needed to help feed animals on pasture as late in the season as possible to reduce the need for the inadequate and now expensive hay crop. In addition, fall fertilization of certain forage crops can provide a stockpile of forage available for grazing in late fall and early winter.

Rainfall/soil moisture level is a major factor in determining when late summer/fall nitrogen (N) fertilizer can be applied without damaging the forage planting or causing an increase risk for nitrate toxicity in the available forage. Following a drought similar to that experienced in many areas of the state and region, N fertilization should be delayed until adequate rainfall has been received to recharge moisture levels in the topsoil to near field capacity level. This moisture level should be adequate to stimulate or allow renewed growth following the drought although for maximum growth potential continued rainfall as well as pasture/hay fertilization will we needed.

The actual N rate to apply should be geared to the amount of time between when rainfall refills the soil moisture holding capacity and the expected date of the first killing frost. If you begin receiving rainfall in time to fertilize in August or very early September, application of 50 to 75 lbs N/acre can help the pasture or hay field recover and produced enough growth for fall grazing/harvest. If adequate rainfall does not come until mid-to late-September, reduce the N rate to between 25 and 50 lbs N/acre. If rainfall begins in mid-October, a further reduction to 25 lbs N/acre or less is appropriate. Do not adjust the above N rates for the legume (clover) content of the pasture or hay field unless the accompanying legume is alfalfa. Red clover, white clover, alsike clover, and most other pasture legumes with the exception of alfalfa will have shut down the N-fixing association with the bacteria, Bradyrhizobia. Therefore, little to no N will be available for any companion grass.

Producers are often hesitant about applying potash (K) and phosphorus (P) during droughts. Although it might be wise to delay P and K applications until cooler weather arrives in early- to mid-Sept, soil test recommended levels of P and K should be applied by no later than the end of September. Potash in particular will be invaluable to the recovering forage grasses in preparation for winter survival. The phosphorus fertilizer will help plants reestablish a vigorous root system and activate recovery from the rhizomes. Next spring growers should watch the stands carefully and provide N at or just before spring green-up to encourage vigorous spring growth. If the stands appear very week, addition P and K and boron (l lb B/acre for most legumes and up to 2 lb B/acre for alfalfa) early in the season will help strengthen stands and improve yields.

Summer Annual Grasses and Johnsongrass: Forage Related Disorders

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Sorghum, sudangrass, sorghum-sudangrass hybrids, and naturally occurring Johnsongrass can be utilized for hay, silage, or grazing. Although these species are generally safe to use as forages, they can under certain circumstances contain toxic levels of nitrate and prussic acid (cyanide). Being aware of the factors that can result in accumulation of nitrates or the formation of prussic acid and using alternative forages during these periods will reduce chances of livestock losses.

Nitrate Toxicity

Nitrates can accumulate in summer annual grasses and Johsongrass at toxic levels (Table 1). This most often occurs when heavy nitrogen fertilization is followed by drought. Nitrates are taken up by the plant, but not utilized since plant growth is restricted by the drought. Any factor that slows plant growth in combination with heavy nitrogen fertilization can result in nitrate accumulation. Drought stressed plants should not be grazed until growth has resumed after rainfall (usually 4-5 days).

In cattle, nitrate is converted to nitrite in the rumen, and the nitrite is absorbed into the blood stream. Nitrite interferes with the bloods ability to carry oxygen. Symptoms of nitrate poisoning include trembling, staggering, rapid and labored breathing, rapid pulse, frequent urination followed by collapse, coma, and death. The onset of symptoms and death is rapid and usually occurs within one to two hours. In animals affected by nitrate poisoning, the blood will take on a brownish chocolate color, giving the with nonpigmented skin and mucus membranes a muddy brown color.

Nitrates are stable in hay and can cause poisoning months later. In some cases it may be advisable to wait to make hay until the drought is over and plant growth has resumed. In other cases, it may be advisable to raise the cutter bar 3-6 inches to decrease nitrates as a greater percentage of nitrates are stored in the lower stems of these plants. When high nitrate forage is harvested as silage, nitrates can be reduced by 40-60% during the ensiling process. It is very important to have all suspect forages tested before grazing or feeding. Testing is available at Virginia Tech and a number of private labs. Contact your local extension agent or veterinarian for more information.

Horses, monogastrics with a functional cecum, tend to be more tolerant of nitrates in forage tissue. Although no threshold levels have been officially established, forages are generally considered safe for horses if the nitrate concentration in the plant material is below 1.5 to 2.0%. An accurate nitrate test is needed to make this assessment. Local veterinarians should be consulted before feeding high nitrate forage materials to horses.

Nitrate testing is available from the following laboratories:

Toxicology Laboratory
College of Veterinary Medicine
Duck Pond Drive
Virginia Tech
Blacksburg, VA 24061-0442
(540) 231-7666
http://www.vth.vt.edu/

Cumberland Valley Analytical Services
Mail: PO Box 669, Maugansville, MD 21767
UPS: 14515 Industry Drive, Hagerstown, MD 21742
Phone: 800-282-7522 (800-CVAS-LAB) Fax: 301-790-1981
http://www.foragelab.com/

A&L Eastern Laboratories, Inc.
7621 Whitepine Road
Richmond, Virginia 23237
Email: office@al-labs-eastern.com
Phone: (804) 743-9401
Fax: (804) 271-6446
http://www.al-labs-eastern.com/

Table 1. Nitrate levels in forages[a].

Nitrate Concentration[b]		Forage Status	Comments
----%----	---ppm---		
0-0.25	0-2,500	SAFE	Generally considered safe.
0.25-0.5	2,500-5,000	CAUTION	Can be a problem for pregnant and young animals. Limit to ½ of ration. Do not feed with non-protein N. Check water for nitrates.
0.5-1.5	5,000-15,000	DANGER	Limit to ¼ of ration. Supplement with energy, minerals, and vitamin A.
Over 1.5	Over 15,000	TOXIC	Forage should not be fed. If forage must be fed, limit to less than 15% of ration.

[a]Adapted from Southern Forages, 1996.
[b]Nitrate concentration is expressed as NO_3. To convert these values to NO_3-N multiply by 0.23.

Prussic Acid Poisoning

A potential problem with sorghum, sudangrass, sorghum-sudangrass hybrids, and naturally occurring Johnsongrass is prussic acid or cyanide poisoning. Under normal conditions these forages contain little free cyanide. However, when freezing, drought stress, wilting, or mechanical injury damages plant tissue, an enzymatic reaction occurs and free cyanide is produced. If forage is ingested during this period, cyanide is readily absorbed into the bloodstream where it interferes with normal cellular respiration. Symptoms of cyanide poisoning are similar to nitrate poisoning and include labored breathing, excitement, gasping, convulsions, weakness, prostration and death. The onset of symptoms and death is very rapid, occurring in minutes to several hours. In contrast to nitrate poisoning, the blood of animals affected by cyanide poisoning is fully oxygenated and bright cherry red in color.

In most situations, *Sorghum* species (including Johnsongrass) pose little danger to grazing animals when properly managed. Young plants or regrowth after grazing contain higher concentrations of prussic acid and should not be grazed until plants have reached a height of 20-30 inches. Drought stressed plants should not be grazed until growth has resumed after rainfall (usually 4-5 days). Plants that have been frosted should not be grazed for 7-14 days or until the leaves are dead and dried out. Early frost may only affect certain portions of field, so additional frosts may result toxic forage in other areas of the field.

Cyanide does escape from plant tissue; therefore hay that has been properly cured is safe to feed. Properly ensiled forage is also safe to feed. When forage is being utilized as green chop, it is important to feed the green chop in a timely manner. If the green chop is allowed to wilt or heat, cyanide is released and the forage becomes toxic. If questionable forage must be grazed or utilized as green chop, feed dry hay along with the fresh plant material. Never turn hungry animals into questionable forage. The use of tester animals may be advisable before allowing the entire herd to graze potentially toxic forage.

Additional information about nitrate and prussic acid poisoning can be found in the following references:

Ball, D.M., C.S. Hoveland, and G.D. Lacefield. 2007. Southern forages, fourth edition. Phosphate and Potash Institute and the Foundation for Agronomic Research, Norcross, GA.

Collins, M. and D.B. Hannaway. 2003. Forage-related animal disorders. p. 415-442. In (R.F. Barnes et al. (eds.) Forages: An Introduction to Grassland Agriculture, sixth edition. Blackwell Publishing, Ames, IA.

Cheeke, P.R. 1998. Natural toxicants in feeds, forages, and poisonous plants, second edition. Interstate Publishers, inc., Danville, IL.

Notices and Upcoming Events

September 15, 2007,
Equine Pasture Walk, 9:30 to 2:30, Contact Richard Taylor at 302-831-1383

November 13-15, 2007
Mid-Atlantic Crop Management School to be held at the Princess Royale Hotel and Conference Center in Ocean City, Maryland. Contact Dr. Greg Binford (binfordg@udel.edu) with questions or to obtain a registration booklet (available sometime in late August).

January 7-12, 2008
Delaware Ag Week, Harrington, DE. Contact Ed Kee at 302-856-7303 or email: kee@udel.edu
Delaware—Maryland Hay and Pasture Day, Evening Program for Part-time Hay and Pasture Producers, Dairy Day, and Agronomy/Soybean Day

Newsletter Web Address

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

http://www.grains.cses.vt.edu/grains/Articles/articles.htm

or

www.mdcrops.umd.edu Click on Newsletter

Photographs for Newsletter Cover

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

www.scenicbuckscounty.com