



# Mid-Atlantic Regional Agronomist Quarterly Newsletter

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To subscribe or unsubscribe, please send your request to the editor at [rtaylor@udel.edu](mailto: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 coverpage.

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## **Corn Yield Response to Tillage and Rotation on Poorly Drained Soils**

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Studies in Ohio and other Corn Belt states have shown that increasing the amount of tillage from no-tillage to chisel to moldboard plow decreases the yield difference between continuous corn and corn rotated with soybean on poorly drained soils. No-till cropping systems are more likely to succeed on poorly drained soils if corn follows soybean rather than corn. On well-drained soils, crop rotation with soybeans had less effect on corn response to tillage.

The influence of crop rotation on corn response to tillage and soil type has been well documented in long-term OSU-OARDC studies conducted on poorly drained Hoytville silty clay soils in NW Ohio. This research has consistently shown that yield differences between no-till and tilled ground were greatly reduced where corn followed soybean.

Dr. Warren Dick and Dr. Randall Reeder have maintained two long-term rotation experiments at the OSU -OARDC Northwest Agricultural Research Station in Wood County. Dr. Dick's plots have been planted in continuous corn or a corn soybean rotation for 44 years while Dr. Reeder's plots have been cropped in different cropping sequences for 23 years. The primary objective of this research has been to study cropping sequences and tillage effects on crop production on tile drained Hoytville silty clay soil. Much of Northwest Ohio's corn is produced on this soil or soils with similar characteristics.

For these multi-year crop rotation studies, yields for corn after soybean, averaged across tillage, were 10 to 13% greater than yields after corn. However, the magnitude of the rotation effect was strongly influenced by tillage. In no-till systems, corn following soybean yielded 19 to 22% more than corn following corn. When tillage was used, the yield advantage was far less pronounced with yields for corn after soybean averaging 1% less to 7% more than those after corn.

Purdue University agronomists have also maintained long-term rotation tillage trials near West Lafayette, Indiana. In studies conducted since 1975 on a dark prairie silty clay loam soil, the average yield "drag" for continuous corn versus corn following soybean during the past ten years (1997-2006) was 3, 5, and 18% percent for moldboard plow, chisel plow, and no-till systems respectively.

For additional information on the NW Ohio rotation-tillage studies described above and recently established research comparing more diverse cropping sequences and tillage, consult

Extension Fact sheet AGF506 “Managing Tillage and Crop Rotations in Northwest Ohio” online at <http://agcrops.osu.edu/>

## **Key Steps for Managing the Risks of Continuous Corn**

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Given the potential for greater economic returns, many grain farmers are planning to increase their corn acreage in 2007. Although much of this additional corn will be produced in fields following soybean or wheat, some will be produced in fields following corn. Continuous corn is not recommended by most agronomists. In Ohio, corn grown following soybeans typically yields about 10% more than continuous corn. Benefits to growing corn in rotation with soybean include less disease and insect buildup, less crop residue, and less nitrogen fertilizer use. Growers who intend to plant second year corn should consider management practices that will minimize potential yield losses. The following are some key steps for managing risks of corn following corn.

1. Plant corn on the most fertile, well drained soils to reduce stress and maximize yield potential. Avoid droughty soils as well as poorly drained soil conditions. Studies across the Corn Belt have shown that the yield differential between continuous corn and corn grown in rotation with soybeans is greatest when yield potential is low. This yield advantage to growing corn following soybean is especially pronounced when drought occurs during the growing season. In a study conducted in Minnesota, the yield advantage to an annual rotation of corn and soybean compared with monoculture was frequently greater than 25% in low yielding environments.
2. Plant Bt rootworm resistant corn hybrids or apply soil insecticides in areas where western corn rootworm problems have occurred. Bt corn requires a 20% refuge planted to non-Bt corn to prevent resistance development. Corn rootworm problems on refuge acres may be managed with soil-applied insecticides, or high rate formulations of seed treatments.
3. Adjust nitrogen rates. Optimum nitrogen rates for corn after corn are generally higher than those for corn after soybean and the additional nitrogen required ranges from 30 to 50 lbs nitrogen/ A.
4. Select hybrids that have demonstrated high yield potential across diverse environments and stress conditions. Only hybrids with above average ratings for drought tolerance, stalk strength, and emergence under stress conditions (low temperatures and cold, wet soils) should be considered. Select corn hybrids with resistance to gray leaf spot, northern corn leaf blight, anthracnose and gibberella stalk rots, and diplodia ear rot. The severity of these disease problems is much greater in reduced tillage systems where

residues are present. In the past, the use of foliar fungicides has not been considered economical for disease control in field corn regardless of the rotation followed. Strobilurin fungicides have received much attention recently but university data on their efficacy is limited.

5. Develop strategies for dealing with increased crop residues. Use stalk choppers and knife rolls on combine heads, spread trash uniformly during harvest, consider strip tillage, avoid no-till where practical, avoid no-till planting on top of old rows, use row cleaners and seed firmers, and plant hybrids with good disease resistance, emergence, and seedling vigor.

Studies in Ohio and Indiana have shown that increasing the amount of tillage from no-till to chisel to moldboard plow decreases the yield difference between continuous corn and corn rotated with soybean, especially on poor drained soils. No-till cropping systems are more likely to succeed on poorly drained soils if corn follows soybean rather than corn. The influence of crop rotation on corn response to tillage and soil type has been well documented in long-term OSU-OARDC studies. On poorly drained Hoytville silty clay soils in NW Ohio, where corn followed soybean, yield differences between no-till and tilled ground were greatly reduced. Crop rotation with soybeans had much less effect on corn response to tillage on well-drained Wooster silt loam soils in NE Ohio.

## **Production Practices for Continuous Corn**

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What a difference a year makes!! One year ago, corn prices were well below \$3.00 per bushel. Now, corn prices are \$4.00 and over. With this rapid turn around in corn prices has come the decision by many farmers to increase corn acreage for 2007. Estimates are calling for US corn acreage to exceed 2006 production by 10-15% with many forecasting more than 90 million acres to be planted this spring.

Agronomists are similar to real estate agents regarding their mantra. In real estate, it is location, location, location. For agronomists, it is rotation, rotation, rotation. This has a good basis. Considerable research has been done comparing continuous corn with rotation corn. In nearly all cases, continuous corn has produced 10-20% less than corn grown in rotation with soybean when all other production variables were equal. And, continuous corn under no-till, the practice most likely to be used in the Mid-Atlantic region, has been shown by researchers at Purdue University to produce over 15% less than corn that is produced no-till but in rotation with soybean.

However, it is difficult to ignore \$4.00 corn and what appears to be a favorable demand in the future driven primarily by ethanol. Reality is there will be considerable corn after corn

planted this spring. In order to minimize the yield drag that likely will be realized with no-till continuous corn, I suggest that you consider these key production factors.

- Field Selection
  - Since dry years have been shown to limit yield for continuous corn more than wet or normal rainfall years do, avoid fields that have low water-holding capacity unless you have irrigation.
  - Avoid fields that drain poorly or have numerous low spots that remain wet long into the spring. These situations will make it difficult to get good seedling emergence. Poor emergence leads to poor plant population limiting your yield potential.
  
- Stand Establishment
  - Have your planter field ready before you go to the field. Winter is shop-time. Use it to replace those worn bushings, bearings and disk openers, jagged seed delivery tubes, linkages that are loose, and the other mechanical problems that exist.
  - Corn germinates when the soil temperature is 50<sup>0</sup> F. With more acres to plant, the temptation will be to start planting a little earlier than normal. If you plan to start early, make sure that your soil temperature has been at 50<sup>0</sup> F for 2 or 3 days and the forecast for the next week is a warming trend rather than for cold weather. Remember, the extra residue from last year's corn is going to keep the soil temperature colder longer than fields that were either tilled or are being planted after soybean.
  - Do not plant when soil conditions are too wet. You know when it is right. When it is too wet, you increase the risk of creating side-wall compaction with your disk openers. This type compaction will make it more difficult for the germinating seedling's roots to penetrate into the soil below the V-opening and put it at greater risk if the weather after planting is dry. In addition, if conditions are too wet when you plant, you increase the risk of having some seed pinned in a piece of corn stalk that was not cut when the disks traveled over it. Pinned seed will not have good seed-soil contact and have more difficulty germinating.
  
- Disease Risk
  - Disease risk will be greater because you are planting into last year's residue that has harbored disease inoculum over the winter. If you had grey leaf spot, leaf blights, or stalk and ear rot problems last year, you need to be wary of their infestation potential for this year particularly if you are planting into a field where disease pressure was moderate to severe.
  
- Insect Risk
  - Continuous corn neither increases nor decreases the potential for European corn borer (ECB) infestation. Excellent protection from ECB is available using Bt hybrids. Make sure that you plant your 20% non-Bt refuge areas as recommended to avoid developing corn borer resistance to this technology.

- The potential for corn rootworm infestation is increased in continuous corn. To avoid these root-pruning pests, either choose a hybrid that has a Bt event for rootworm protection or use one of the chemical forms of protection that come as either an in the furrow or t-band at-planting application or as a seed treatment.
- Hybrid Selection.
  - For corn after corn, select hybrids with good:
    - Disease resistance/tolerance
    - Seedling vigor
    - Root ratings
    - Stalk strength
    - Tolerance to stress
  - Choose hybrids that have good stability.
    - A stable hybrid is a hybrid that will do well over a wide spectrum of conditions. To determine the stability of a hybrid, get as much information about its performance from the different yield and performance tests conducted in your region as possible. A hybrid that consistently does well over a large number of locations in a region is likely to do well on your farm.
- Harvesting More Acres
  - You've got more acres to harvest which is going to make the harvest season longer. This also means you will transport more corn, dry more corn, and have more corn to store. Some of the corn will likely remain in the field longer than you would like. This will increase the potential for lodging and mechanical harvest losses.
  - Be able to start harvest earlier by selecting 1 or 2 hybrids that are earlier maturing. These hybrids don't need to be planted to your continuous corn fields but they should be part of your planting plans.
  - To minimize losses, harvest fields that had disease or insect problems during the season first, if they are ready.
  - Harvest those fields that cause problems when they get too much rain early if you can. You never know about the weather.

## **Corn Nitrogen, Phosphorus, and Potassium Uptake**

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Nitrogen (N), phosphorus (P), and potassium (K) are nutrients essential for corn growth and development. Nitrogen is a principle component of amino acids, the building blocks for proteins. Proteins are present in the plant as enzymes that are responsible for metabolic reactions in the plant. Corn responds dramatically to nitrogen fertilizer additions when deficient.

Phosphorus is immobile in soils, meaning that roots must thoroughly explore soil in order to obtain adequate amounts of this element. In the plant, P links the chain the of DNA and RNA components that make up the plant's genetic code. Phosphorus is a vital component of ATP, the energy unit of plants. The energy from photosynthesis is stored in the form of ATP. Some specific growth factors that have been associated with phosphorus are: stimulated root development, increased stalk and stem strength, improved flower formation and seed production, more uniform and earlier crop maturity, increased nitrogen N-fixing capacity of legumes, improvements in crop quality, and increased resistance to plant diseases.

Plants take up K as the potassium ion ( $K^+$ ). Potassium within plants is not synthesized into compounds and tends to remain in ionic forms in cells and plant tissues. The main function of K in plant is in the translocation of sugars within the plant and maintaining proper electrolyte balance, just as in humans. Potassium is also essential for the development of chlorophyll, however it is not part of its molecular structure.

In 2005 and 2006, a total of five experiments were conducted to evaluate the impact of plant population and relative maturity on nutrient uptake in corn grain and stover. Trials were conducted at the Virginia Crop Improvement farm near Mt. Holly, VA (Coastal Plain region) and at Kentland Farm, near Blacksburg, VA (Mountain and Valley region). The Blacksburg site was non-irrigated while trials were conducted under both irrigated and non-irrigated conditions at Mt. Holly. Main plots were seeding rate (20,000, 25,000, 30,000, and 35,000 seeds per acre) and subplots were corn hybrid relative maturity [early – Pioneer<sup>®</sup> Brand '34B97' (108 day RM); medium – Pioneer<sup>®</sup> Brand '33M54' (114 day RM); and late – Pioneer<sup>®</sup> Brand '31G66' (118 day RM)]. Total fertilizer rates for each experimental location are presented below.

Experiment	Planting Date	Total N applied	Total P <sub>2</sub> O <sub>5</sub> applied	Total K <sub>2</sub> O applied	Grain Harvest
	---date---	-----lb/ac-----	-----lb/ac-----	-----lb/ac-----	---date---
MT Holly Irrigated	04/19/2005	235	79	75	09/20/2005
MT Holly Non-irrigated	04/13/2005	170	59	60	09/19/2005
Blacksburg	05/09/2005	150	79	60	10/05/2005
MT Holly Irrigated	04/28/2006	223	73	70	09/20/2006
MT Holly Non-irrigated	04/26/2006	158	63	90	09/22/2006

Aboveground plant material was hand harvested from each plot at physiological maturity. Biomass yield (lb per acre) was calculated as the product of individual plant weight and measured plant population. Stem and leaf tissue and grain were ground and total carbon and N concentration for each sample was determined. Nitrogen, P, and K uptake values for grain and forage (stem and leaf) were calculated as the product of biomass yield of the respective plant component and nutrient concentration (%) within each component.

The medium maturity hybrid generally had the highest grain N uptake and the lowest stover N uptake. Phosphorus uptake was similar for all hybrids, but the Medium maturity hybrid had more K in the stover. At maturity, the grain contained approximately 65 % of the N, 61% of the P, and 15% of the K in the plant. This has implications on management of soil fertility as most of the stover residue is returned to the field and after decomposition, these nutrients become partially available for future crops. Grain is removed as are the nutrients contained within it. Fertilizer inputs of these nutrients must match or exceed these removals if soil fertility levels are to be maintained. Soil testing on a regular basis indicates if soil fertility levels of P and K are being maintained, depleted, or increased. Fertilizer applications should be adjusted based on maintaining adequate levels for high yields. Nitrogen is mobile in soil and can not be tracked with soil testing. Nitrogen application rates must be determined on a field and season specific basis according to yield potentials. Efficient crop production requires high yields, understanding nutrient uptake amounts, monitoring soil fertility levels and judicious fertilizer use.

Seeding rate	RM	N uptake		P uptake		K uptake	
		grain	leaf+stem	grain	leaf+stem	grain	leaf+stem
---seeds/ac---		-----lb ac-1-----					
20000	EARLY	122	81	26	24	27	179
20000	MEDIUM	129	67	27	20	30	196
20000	LATE	123	82	29	20	32	184
25000	EARLY	130	76	30	22	32	202
25000	MEDIUM	136	66	29	20	32	202
25000	LATE	132	71	32	18	34	195
30000	EARLY	150	72	34	21	37	210
30000	MEDIUM	182	85	41	22	45	260
30000	LATE	159	88	38	21	41	208
35000	EARLY	137	77	31	19	33	203
35000	MEDIUM	121	58	28	18	35	204
35000	LATE	129	66	33	18	40	196
Mean		137	74	31	20	35	203

# Targets for Silage Storage and Feeding

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## 1) Filling silos

- goal: make the system anaerobic as fast as possible and keep it that way
- the faster a silo is filled and quicker it is sealed the higher the nutrient recovery will be
- never leave chopped forage in a wagon or pile overnight; if you chop it you must pack it immediately
- clean out wagons (bird droppings, moldy forage, etc.) and silos

## 2) Bunks and piles:

- shape drive over piles with a narrow feeding face and longer storage length (no ovals or circle shapes)
- pack in 6 inch layers; larger layers do not pack well
- target silage densities of 14 to 16 lb of DM/cubic ft.
- use heavy tractors
- extra packing for more than an hour or so at the end is not beneficial
- cover with plastic and tires immediately after filling; delayed sealing leads to nutrient losses
- consider plastic on the side walls in bunks to minimize water damage
- overlap plastic at any seam by at least 4 to 6 ft
- maximize weight on plastic to keep air from penetrating into the silage mass- patch holes, etc.; tires and plastic are not any good if they are not managed properly
- white plastic with UV protection is better than black because it reflects heat
- thicker plastic is better: 8 mil is better than 6 mil, 6 mil is better than 4 mil
- new gravel bags for holding plastic down are a good alternative to tires

## 3) Bagging silage

- use tunnel extension on older baggers for tighter packing
- use stretch marks on bags to determine proper packing
- the top of the bag should be flush with the tunnel
- over packing destroys the integrity of the plastic and allows for more bleeding of air through the plastic
- be sure teeth on bagger are sharp; this will improve packing
- adjust brake tension based on moisture

- use tractor with adequate horse power
- feed forage evenly into bagger to avoid clumping
- pack tightly (12 lb of DM per cubic ft)
- if you start a bag, finish it as quickly as possible
- seal the end of the bag immediately
- use a vent cap to vent silo gasses for 2-3 days; if the bag continues to gas vent for a few minutes each day and reseal
- check and patch holes on a regular basis; clean area with alcohol on bags when patching (they have beeswax on them to help them slide)
- keep brush and grass down by bags

#### 4) Upright silos

- fix doors, cracks, etc.
- after filling, even out forage on top and put on silo cap immediately (if not feeding out right away)
- watch moisture levels: too wet leads to seepage and clostridial fermentations; too dry leads to poor packing and heat damaged forage

#### 5) Feed out management

- bunks and piles: remove 6-8 inches/d in hot weather to keep ahead of spoiling; remove more if silage is dry, chopped too long, or packed poorly; less may be removed in cold weather
- bag silos: remove at least 1 ft/d; see above
- where plastic is used, keep tires on plastic to minimize air infiltrating between the plastic and silage; remove only enough plastic to expose enough silage for a day's feeding
- manage face of bunkers/piles to minimize infiltration of air into the mass
- knock down only enough silage for the immediate feeding
- separate spoiled silage and discard

### **A Quick Note on Wide Swathing Alfalfa for Making Silage**

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There are several keys to obtaining a great alfalfa crop for making silage. First, stage of maturity sets the overall quality of the harvested plant. Next, how the plant is managed when harvested can maintain or change forage quality. Lastly, how the forage is managed in the silo during filling, storage and feed out can also either maintain or change forage quality. This article will briefly focus on issues during harvest and wilting that can affect forage quality.

When alfalfa is mowed and lies in a windrow, the plant is still alive and respiring. Slow drying and prolonged wilts keeps the plants alive. During this time, sugars are used resulting in a decrease in energy content. Slow drying and prolonged wilts also increase the chance that the drying crop could be rained on which would prolong wilting time further and lead to even more nutrient losses. During wilting much of the moisture that is lost occurs via structures called “stomata” on the underside of the leaf. However, when the plant is shaded (e.g. on a cloudy day or material that is shaded inside a thick swath) the stomata close and drying is reduced.

One “hot topic” in making silage and hay the last few years is the concept of wide swathing. This is a simple concept: spread out the mowed alfalfa so that it will dry down quickly to minimize the time a crop lies in the field drying before chopping to make silage. This should accomplish two things, reduce nutrient losses from respiration and reduce the risk to weather damage. The research on wide swathing is quite complex because there are no standard definitions in place to describe a wide versus narrow swath. We will briefly describe some research that was conducted at the University of Delaware Newark farm last summer on wide swathing.

At first, second and third cutting, alfalfa was mowed with a John Deere 946 with a mower-impeller conditioner with a 13.5 ft cutter bar. All material was conditioned. Narrow swath ranged from about 4 to 5 ft across and was determined by the width between the tractor tires to avoid drive over. Wide swath alfalfa ranged from 8 to 9 ft wide (about 66% of cutter bar width). The dry matter (DM) of the swaths was monitored on a regular basis by taking representative samples and drying in a microwave oven. Forage was harvested when DM content of the windrows were about 43-45%. Five to six samples were harvested from different locations in the field for both narrow and wide swaths. Samples were harvested by hand from measured sections and chopped. Chopped forage was ensiled in vacuum sealed bags and allowed to ensile for about 60 days. The nutrient content of the silages was determined to assess quality.

Table 1 presents the drying time and DM% of alfalfa in narrow and wide swaths. On average wide swathed alfalfa spent about 22 hr less time in the field than narrow swathed alfalfa. If one was targeting a DM % of about 35%, chopping within a day would have been feasible at all cuttings. Of some concern was that alfalfa dried down very quickly in only 6 hr during third cutting.

Table 1. Drying time and DM% of alfalfa in narrow (4-5 ft) or wide (8-9 ft) swaths.

	<u>Drying Time, hours</u>		<u>% DM at Chopping</u>	
	Narrow	Wide	Narrow	Wide
Cutting 1	50	29	44	43
Cutting 2	54	28	44	46
Cutting 3	25	6	44	46

As expected the water soluble carbohydrate content of wide swath forage was 5.1% versus 3.7% for narrow swath forage at chopping. The pH and ammonia-N content of wide swathed silage was lower than narrow swathed but fermentation acids were similar between treatments. The ash content and neutral detergent fiber (NDF) digestion were similar between

treatments. However, the protein content was lower (20.2%) in wide versus narrow (21.6%) swathed silage and the NDF content tended to be higher in wide (49.5%) versus narrow (48.3%) swathed silage. We attribute this to leaf loss because of wheel traffic on the wide swath.

There is some controversy in the field relative to various aspects of wide swathing. The use of mergers, raking and tedding are still being researched. Some recommendations from New York (NY) suggest not to condition which will allow more moisture to leave from the stems through the leaves. However, other data from Wisconsin (WI) suggests that conditioning furthers the drying process even in wide swathed material. The jury is still out on these aspects of wide swathing.

Our preliminary conclusions show that wide swathing reduces drying time in the field and reduces the risk to damage from bad weather. However, we did not see an improvement in silage quality. This last finding is in contrast to other work from WI and NY. Wide swathing certainly makes sense during cool and moist conditions of first cutting. However, use caution if you plan to wide swath during later cuttings because wide swathed material may dry down too fast in hot weather relative to your ability to harvest it. We plan to continue our studies in this area during the summer of 2007.

## **2007 Pasture and Hay Weed Management Guide**

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University of Delaware Cooperative Extension has an updated Pasture and Hay Weed Management Guide in 2007. Many important updates have occurred since the 2006 version, and future updates will continue to assure that current information is included.

The guide is intended for use by anyone who manages forages for animal grazing and/or hay production. Information on cultural, mechanical, and chemical weed management practices is included at the front of the guide and is appropriate for the novice to the experienced manager. The section on chemical weed control is separated for legumes or grass forages. These sections can provide less experienced managers with important information on herbicides and weed management, but should be used in conjunction with recommendations from experienced university or industry representatives when making chemical weed management choices. University and industry representatives will also find these sections useful when selecting herbicide programs. The sections are primarily in table format to promote easy access to information. The sections provide information on: herbicide application timings; general restrictions and precautions; rotational crop and over-seeding restrictions; grazing, harvest, and slaughter restrictions; weed species susceptibility ratings; and comments for specific herbicide usage.

Printed copies of this guide are available at the New Castle, Kent, or Sussex County Cooperative Extension offices in Delaware. It is also available on the web at the Research &

Education Center (REC) website (<http://www.rec.udel.edu/>) under the publications heading. Either the entire guide, or a table of contents linked to individual sections, can be downloaded in .pdf format.

Corn and Soybean Weed Management guides (for Delaware and New Jersey) are also available at the same website, as well as various fact sheets, research reports, and recommendation sheets.

## **Managing “Sacrifice” Lots: Livestock Heavy Use Areas**

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### **Introduction**

A “sacrifice” lot is a designated livestock heavy use area, strategically located on the farm for the purpose of concentrating animals to feed, shelter, separate and care for them. Utilization of this sacrifice or heavy use area reduces labor, provides a safe and healthy husbandry environment and avoids livestock damage to other areas of the farm. A well designed and managed sacrifice lot will also reduce the negative environmental impacts of a confined and concentrated livestock operation. Animal segregation and confinement lots may be appropriately named as follows: feed lot, exercise lot, wintering lot, maternity lot, health or sick lot, loafing lot, breeding lot or turn-out lot. Specific animal breeds and sex may also determine the designation of a livestock management area, such as a calf lot, heifer lot, cow lot or bull lot.



### **Purpose and Description**

For pasture operations, the most common and necessary sacrifice lot typically is comprised of an area sufficient to provide the combined duty of feeding, exercising and wintering animals. Successful pasture operations have several pasture paddocks in rotation and incorporate a sacrifice lot to appropriately time grazing periods daily and seasonally as required. Sacrifice lots allow an operator to increase a farms animal carrying capacity and maximize grazing profits through controlled grazing. During periods of drought or dormancy a pasture may be severely damaged by animal traffic and grazing, therefore, the utilization of a sacrifice lot is imperative. When necessary, animals are confined to a sacrifice area to allow the successful establishment of new forage seeding, or maintain an adequate forage regrowth interval. Animal health management may require limiting lush pasturage, or holding livestock during applications of herbicides, insecticides and fertilizers to pastures. It may be desirable to also hold animals in a confinement lot to facilitate hay making to further maximize annual forage yield. Many farm managers utilize a sacrifice lot on a daily basis to gather livestock to feed pasture supplements necessary for a balanced ration, to water, to shelter, and to examine animal health and condition. By default feeding and



sheltering of livestock in a sacrifice lot will capture 40 to 100% of daily manure deposition, variable by seasonal duration of daily pasturing. This accumulated manure may be stored, and then timely spread according to pasture soil test requirements to better fulfill the farm nutrient management plan.

### **Sacrifice Lot Engineering**

A successful sacrifice lot is engineered, a carefully thought out and designed area which incorporates integral husbandry components. The area should be graded to drain free of standing water, and have a grass buffer perimeter sufficient to control offsite manure and soil loss. During the site leveling phase it may be required to buildup low areas, and install subsurface drainage and above ground swales. The lot should be centrally located to the barn and pasture paddocks, and should be sized according to the livestock species and number of animals, making sure to have adequate feed bunk space, and water access. It is important to consider during the lot design a sized and predetermined manure storage structure that coincides with the desired manure cleanout interval. Sacrifice lots are usually capped with soil, sand or stone dust to create level injury free livestock area. It is very important to keep refreshed capping materials in place over the underlying base materials to avoid hoof injury. Maintenance to a sacrifice lot requires the removal of manure and a portion of soiled capping product (spoil), followed by a replacement with fresh capping material and leveling. Often the lot spoil makes an excellent field leveler or patch product usually requiring only lime to correct pH prior to seeding. Frequent removal of manure and spoil insures a disease free and comfortable environment for livestock and handlers. Sand and stone dust materials are sterile and provide an excellent tool for eradicating contagious disease outbreaks in a herd. Also, plan to remove manure from around fed bunks and waterers every two weeks to control flies, internal parasites, and contagious diseases.

### **Sacrifice Lot Components**

The engineering components of a sacrifice lot need to be properly chosen and strategically integrated into a project for cost effectiveness and durability. Except for the installation of concrete most of the lot components are readily handled with a moderate sized loader and scraper blade equipped farm tractor; therefore, only the laying of concrete has a contracted labor cost included in the estimate. All of the following lot components will be evaluated and cost estimated for a 500 ft<sup>2</sup> application delivered to the farm with installation labor provided by the farm manager:

<b>Component</b>	<b>*Required Amount</b>	<b>*Estimated Cost</b>
Geotextile Fabric	500 square foot roll	\$ 350
1-2" Stone	6" depth-18-tons@\$15/ton	\$ 270
CR6 (Crush & Run)	6" depth-18-tons@\$14/ton	\$ 252
Pea Gravel	4" depth-5-tons@\$15/ton	\$ 150
Stone Dust	4" depth-8.5-tons@\$16/ton	\$ 136
Screened Sand	4" depth-7.5-tons@\$8/ton	\$ 60
<b>*per 500 ft<sup>2</sup></b>		

## **Cost Effective Engineering for Sacrifice Lots**

Certain areas of a lot may be best served by concrete, which typically includes the manure storage structure, permanent feed bunk areas and waterers. Installed concrete costs approximately \$3,800 per 500 ft<sup>2</sup> and requires critical site grading and preparation; the inclusion of a well packed 6-inch CR6 stone base with a uniform 4-inch concrete layer. CR6 is a blend of pulverized dust to 1.5 inch stone that packs readily into a dense base. Certain areas of the lot may be considered heavy traffic areas that require added base protection for durability, but are considered too large for concrete. Often referred to as an armored area, a geotextile engineered area consists of a level and packed soil covered with geotextile fabric that is stapled in place and overlapped 1-foot. A 6-inch layer of large 1-2 inch stone is placed on the geotextile fabric, followed by a 4-inch layer of pea gravel, and then capped with 4-inches of stone dust. The average cost to armor heavy traffic areas is \$900 per 500 ft<sup>2</sup>, which is about 1/4 of the cost of concrete. Areas in a lot that typically require armoring are entrances to barns, pasture turnout lanes, traffic areas around bale feeders, feed bunks, and concrete aprons. The geotextile engineered areas are very durable if the surface is regularly scrapped off and refreshed with the capping materials.

Fortunately, the largest portion of a sacrifice lot will only require minimal site grading and preparation before capping with stone dust or screened sand. Capping a packed soil base with 4-inches of stone dust will require 8.5 tons at \$16 per ton, costing \$136 per 500 ft<sup>2</sup>; whereas, 4-inches of screened sand will require 7.5 tons at \$8 per ton, costing \$60 per 500 ft<sup>2</sup>. Areas that require building up or leveling may require a stone base with 1-2-inch stone and/or CR6 before capping. A 6-inch CR6 base will require 18-tons at \$14/ton, costing \$252 per 500 ft<sup>2</sup>. A number of local quarry websites have current price quotes and online product calculators for estimating the project requirements and costs.

## **Green Engineered Sacrifice Lots**

If the sacrifice lot is large enough to support weed growth, then consider a green engineered lot that utilizes an annual cover crop planting system. There certainly are sound economic reasons for developing a lot management strategy which also maximizes pasturing potential. The answer is frequent and scheduled planting of annual forages in these areas. Light tillage prior to seasonal plantings may be all that is required for successful broadcast seeding with inexpensive equipment.

The following is an example of a green engineered annual pasture lot system:

- 1) In the fall on lightly tilled soil, broadcast 120 lbs/acre cereal rye variety Abruzzi + 30 lbs/acre of annual ryegrass variety Marshall. After, seeding lightly harrow and roll firmly. This area will quickly green and support moderate to heavy pasturing into the winter, and will be especially useful if rotational use of the lot is possible. Lime and nitrogen may be the only fertilizer nutrients required. Add lime as required by soil testing, and apply nitrogen if the crop appears deficient after emergence.

2) In early March, on the lightly tilled and repaired soil, sow the same seed mixture, or oats may be substituted for the cereal rye.

3) Then overseed the lot in Mid-May with a broadcast seeding of 30lbs/acre German foxtail millet, followed by light tillage and a firming of the soil. All of the above mentioned seeding might also be accomplished with a grain-drill followed by a roller-harrow or cultipacker. The adding of the annual legumes: lespedeza, vetch, clover and soybeans to the fall, early spring and summer seedings will increase biomass, improve nutrition and palatability, further reduce weed competition and potentially eliminate the need to fertilize with nitrogen.



**German foxtail millet in 30-days**

### **Annual Pasture Lot System Advantage**

The advantages of these annual forages for a green engineered sacrifice lot are multi-fold such as; providing highly palatable forage, aggressive competition with weeds, reducing erosion, capturing nutrients, and improving soil organic matter and tilth. The annual pasture lot system may lengthen the maintenance interval for some sacrifice lots, and certainly reduce unwanted environmental and animal health impacts. This system will certainly beautify the farm by reducing dust and mud and unwanted weeds. For details about developing an annual pasture lot system for your farm give your local Extension office a call.

## Annual Cover Crop Options for Delmarva

<b>Table 1. Suggested annual cover crop options for southern Delmarva and Eastern Maryland—contact your local Cooperative Extension office for information on your area.</b>			
<b>Crop Species</b>	<b>Best planting date</b>	<b>Seeding rate per acre</b>	<b>Seed cost per acre</b>
Austrian winter pea	March 1	75	\$39.00
Oats	March 1	80	\$22.56
Striate or Kobe lespedeza	March 5	35	\$28.00
Korean lespedeza	March 10	30	\$21.60
Forage soybeans	May 12	75	\$45.00
German foxtail millet	May 25	30	\$15.72
Pearl millet	May 25	35	\$22.40
Hairy vetch	September 1	25	\$31.25
Crimson clover	September 1	25	\$34.13
Annual ryegrass	September 15	30	\$26.10
Cereal rye	September 25	120	\$19.20

\*Seed cost is based upon industry price quotes per 50 lb unit in fall 2005.

### **Grass Tetany—A Look at its Causes, Symptoms, and Management**

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Grazing animals on pasture can be an integral part of an effective feeding regime for cattle and other livestock. Grazing reduces valuable labor time and cost for the farmer because no harvesting is needed and provides exercise for the animal; however, as with other feeding programs, it does not come without risk.

A concern when ruminants, especially cattle, that are allowed to graze on pasture is grass tetany (also called hypomagnesium tetany, lactation tetany, grass staggers, winter tetany, or wheat pasture poisoning). It generally becomes a problem when the diets of cattle are changed from winter stockpiles (silages) to rapidly growing, lush, spring grasses. Incidences of grass tetany are seasonal and more common when the weather is cool and rainy and soil test levels for the pastures indicate low magnesium (Mg), calcium (Ca), phosphorus (P), and high potash or

potassium (K) levels. Pastures prone to cause grass tetany include, but are not limited to, a wide variety of grasses such as perennial ryegrass, wheat, oats, and rye.

It is thought that grass tetany is caused by a deficiency of Mg in the blood; however, not all animals with hypomagnesaemia will develop grass tetany. Normal levels of Mg in the blood are about 2 mg/100 ml of plasma. In a hypomagnesemic animal, the level of Mg in the blood is reduced to 1 mg/100 ml and in animals with grass tetany the blood Mg often is below 1 mg/100 ml.

The decrease of Mg in the blood when cattle are grazed on pasture in part can be attributed to low concentrations of plant available Mg in the soil. In addition, it is likely that the soil will have low amounts of calcium and high levels of K and nitrogen (N). A “tetany ratio” can be used to calculate whether or not forage is at risk for causing grass tetany (ask your soil test laboratory to include in a soil test report the amount of Mg, K, and Ca in the soil on an equivalent weight basis. From the soil test results, divide the equivalents of K by the sum of the equivalents of Ca plus Mg. A value of 2.2 or greater classifies the pasture as being “tetany-prone”).

Cows in transition and up to 2 months post-calving are the most susceptible to grass tetany. This is due to their need for excess minerals because of those that are lost through milk production. Animals require Mg in their blood as it functions as a cofactor for important enzymes.

Cows require a constant supply of Mg in their diets. There is only a small amount of Mg that is stored in the body and its absorption is partially dependant on the concentration of P absorbed through the rumen. When cows graze pastures low in P, Mg absorption through the rumen is limited. Low levels of Ca in the blood may also cause a rapid decrease in the concentration of Mg in both cerebrospinal fluid and blood, increasing the risk of the development of grass tetany.

Incidences of grass tetany can be characterized as acute, sub acute, or chronic. In acute cases, the animals are generally found dead. If the animal is discovered in time, signs and symptoms may include excitability, twitching, ear flicking, aggressiveness, abnormal gait, vocalization, convulsions, and frothing at the mouth. Their body temperature begins to rise and their heart beats louder and faster. Death generally occurs within 1 hour of the onset of symptoms. In sub acute cases, animals remain standing and signs develop over a period of a few days and include abnormal gait, excessive blinking, decreased feed intake, weight loss, and decreased milk production. The sub acute form, if not treated, can also result in death. Lastly, in the chronic form of grass tetany, animals may exhibit unthriftiness, weight loss, and decreased milk production.

The diagnosis of grass tetany is difficult because the cow usually dies before any determination can be made. Immediately before symptoms are seen, serum Mg levels will be low. As symptoms progress, serum Mg levels may rise to near normal levels. A better diagnostic method is the measurement of urinary Mg because the kidneys will begin storing Mg when serum levels are insufficient. Grass tetany is sometimes mistaken for ketosis or milk fever;

however, animals that are deficient in Ca will generally appear sluggish, whereas Mg deficient animals will exhibit excitability.

Treatment of grass tetany involves removal from the pasture and increasing blood serum levels of Mg. A treatment method that has been suggested by the USDA is a dose of 200 ml of a 50 % solution of magnesium sulfate, injected subcutaneously. Other treatments are available so consult with your veterinarian for the option suited to your operation. After serum Mg levels are increased, the animal should be continued on a diet high in Mg to prevent relapse.

Some factors may predispose cattle to developing grass tetany. As cows age, the level of Mg and other minerals that are absorbed through the rumen are decreased. In addition to age, researchers have determined that Angus and Angus crosses are more susceptible than other breeds because they are naturally poor absorbers of Mg. High producers are susceptible to hypomagnesaemia and grass tetany. Early spring calving often places the cow at risk since plants are less efficient at taking up Mg in early spring.

Grass tetany is easily preventable. Analysis of forage should be performed prior to grazing if there is a history of grass tetany in the animals or on the pasture. If possible, fertilizers that are high in N and K should be avoided. When cattle consume forage high in N, a substantial amount of ammonia is produced in the rumen. If there is a large amount of ammonia present, dietary Mg may be converted to the unfavorable, insoluble hydroxide form. This lowers the availability of Mg in the blood and tissues.

Fertilizers that may be applied to raise Mg levels of the soil include dolomitic or high Mg limestone which can contain 12-13 % of actual Mg. Dolomitic limestone is generally used when the soil pH is low. When a liming product is not desirable, a foliar application of Epsom salts ( $MgSO_4$ ) in a 3 to 6% solution to supply 10 to 20 lbs  $MgSO_4$  per acre is an option. If the K levels are not too high, Sul-Po-Mag ( $K_2SO_4 \cdot MgSO_4$ ) can be applied either as a dry fertilizer or as a foliar spray. If the soil has a high pH, pastures can be dusted with a mixture of fertilizer containing magnesium oxide ( $MgO$ ) although this has not been found to be very palatable.

Magnesium oxide also can be mixed with salt and fed directly to cattle *ad libitum*. The salt increases the palatability of  $MgO$  as well as increases the sodium level in the blood. A suggested mixture is 75 % salt to 25 %  $MgO$ . It has been shown that the balance of these two minerals may also help to increase the absorption of Mg through the rumen.

Perhaps the easiest method of prevention is simply not grazing lactating or high risk cows on grass tetany "hazard" pastures and reserving the land for other livestock such as steers or dry cows. Instead, legume hay or high-legume pastures would provide a safer alternative for these animals. Not only is it safer for the cow, but because legumes are more digestible than grasses, it is likely that lactating cows will produce more milk (6-10 lb) when grazed on a legume stand. Another incentive is that when managed correctly, a legume pasture will produce just as much forage as a grass stand.

The authors would like to acknowledge the following information sources:

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## **Why Shouldn't I let the Animals Graze that Close**

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Early in the spring before cool-season forages really take off, it is often tempting to place animals on pastures and let them graze as close as they want and in doing so you can reduce your need for hay/grain and allow the animals out of confinement. This practice is especially prevalent among those who are not set up for rotational grazing or don't have the time to spend moving animals from pasture to pasture. The potential for damage to your pasture with this practice depends on your stocking density (animal units per acre), pasture species, animal species, weather, fertility, and a number of other factors. I often see this practice used by the

small grazer who has limited land with which to work (Photo 1). Let's discuss a few of these factors with emphasis of their impact on pasture health.



Photo 1. An overstocked (2 horses per acre), continuously grazed pasture showing the impact of early grazing on stand density (Photo courtesy R. Taylor). In the upper left corner, note the winter hay fed site.

Stocking density or the number of grazing animal units per acre often is determined by outside circumstances such as acres of pasture available and number of animals on the farm instead of by forage availability and forage (pasture) growth rate. Early in the spring as grasses and legumes are coming out of the winter and using up the last of their stored energy (starch-sugar-carbohydrate) reserves to produce new leaves, the amount of leaf area available to intercept sunlight and fix carbon dioxide as sugars is very limited. Pasture plants left ungrazed quickly produce enough leaf area to become self-sustaining and capable of sustaining the rapid growth rate we traditionally think of for cool-season forages in late spring. If animals are allowed to graze this new growth before the pasture plants reach the self-sustaining point, the plants are forced to use any remaining stored food reserves to generate new leaves. When the food reserves eventually are completely used up, the plant, where possible, will cannibalize existing tissue (roots and other tissues) to support new growth. If close grazing persists, plants run out of energy or tissues to sacrifice and die or are weakened to the point that even if grazing is halted the plants are not able to compete with germinating weeds or other plants not favored by the grazing animal.

Pasture species is another key factor in how well the pasture can adapt to early close grazing. Pasture species that have many basal (low growing) leaves are generally less susceptible to close grazing. Kentucky bluegrass, the ryegrasses, the festuloliums, and to some degree tall fescue

have basal leaves that allow them to tolerate some close grazing. Kentucky bluegrass and the ryegrasses are the most tolerant of close grazing.

Horses are one of the closest grazing animals and can often keep pastures grazed right down to the soil level (Photo 2). Horses also graze almost continuously due to the small size of their stomach and the fact that fiber digestion takes place in the enlarged cecum that comes after the small intestines. In addition, we often overstock horses on pastures and this places additional stress on pastures. Whenever you graze early in the season, be sure to understand the grazing habits of your animals and avoid adding additional stress to pastures as they begin spring growth.



Photo 2. A pasture (April 5) grazed to within a  $\frac{1}{4}$  to  $\frac{1}{2}$  inch of the soil surface by horses (Photo courtesy R. Taylor).

Overgrazing early in the spring can have significant repercussions ranging from stand loss, low vigor (and thus lower yields) for the remainder of the season, weed encroachment, and susceptible plants subject to damage from other seasonal stresses (temperature, moisture, insects, diseases, and weeds). Favorable growing conditions are not enough to overcome the damage done to these pastures that eventually may need partial or complete renovation to restore them to optimal productivity.

What options do you have when you are not set up for rotational grazing? As expensive as it may be to keep animals in the barn or on a sacrifice lot where you will have to provide them with hay or other feed, this remains your best and often only option. You need to keep animals off pastures until adequate growth has occurred. An estimated normal height to start grazing in pastures dominated by each of the following grasses or legumes is given in Table 1. A rule-of-thumb suggests allowing pastures to obtain 2 inches of additional growth (above the suggested normal height) before the first grazing period for all forages. For example, Kentucky bluegrass,

many clovers, and bermudagrass should be about 4 inches high when you begin grazing but for the first spring grazing cycle you should allow them to reach 6 inches before starting.

Table 1. Suggested normal plant heights when making grazing decisions.		
Grass/legume species dominating the pasture	Height (inches) to begin grazing	Height (inches) to stop grazing
Orchardgrass, fescue, ryegrasses, festuloliums	6	3
Kentucky bluegrass, bermudagrass	4	2
White clover (common, small, intermediate)	8	3
Ladino clover (large or giant type)	4	2
Red clover	6	2
Big bluestem, little bluestem, switchgrass, Indiangrass	12	6
Eastern gamagrass	15	8

Another option available is to ensure the animals are well fed before they are let out onto the pasture. This works for ruminants but will not work as well if grazing horses. Horses with their small stomach tend to graze a large percentage of the time they are on pasture. To use this option with horses, you will need to limit the time they spend on the pasture to a few hours per day, lengthening the time as the grass approaches the suggested height for grazing. A second caution—if you have less than 2 to 3 acres available per horse, you are close to the point of overstocking the pasture and will need to be very careful not to over graze.

A third option partially discussed above is to limit the amount of time the animals are allowed to graze on a pasture in early spring. Depending on the growth rate of the pasture it can range from one or two hours per day to many hours per day. This is appropriate where a lack of interior fencing does not allow rotational grazing but the manager has time available to move animals between the barn or exercise/sacrifice lot and the pasture.



**Professional Position Available—New Castle County, DE Extension Agent**

**3066 Extension Agent III (Level 14) Cooperative Extension Service, New Castle County**

**DEADLINE:** June 30, 2007

This position is located in Newark, Delaware.

**REQUIREMENTS:** Bachelor’s degree, Master’s preferred, and four years of program field experience in agronomic crops or closely related field with background in crop science, soil science, weed science, entomology, plant pathology, or an appropriate related discipline.

Knowledge and experience with extension or adult education methods along with excellent human relation, organization, and written and oral communication skills. Demonstrated leadership ability coupled with public relation skills. Intermediate computer skills and familiarity with information delivery methods (electronic media, written media, web, etc.).

**SPECIAL REQUIREMENTS:** Must possess a valid motor vehicle operator's license and have access to private reliable means of transportation. Work may involve restricted use of pesticides or knowledge thereof. Ability to conduct research/extension field demonstration projects preferred.

**DUTIES:** Develop an agricultural education program which is based on local and regional needs. Evaluate crop production problems and issues and help develop improved management strategies which will require both short and long-term solutions. Assess needs and issues and deliver educational programs related to agricultural producers transitioning to alternative agricultural enterprises and issues related to the urban/rural or farm interface. Serve as a member of various USDA agricultural committees and state agencies in an advisory role. Be a resource to various local news media including newspaper, radio, and television. Serve as a resource to other Extension, University of Delaware, and Delaware State University personnel. Possess the ability to write grants to obtain funds to conduct applied extension/research demonstration projects.

**CONTACT:** Send letter of interest, curriculum vitae, names, addresses, and phone numbers of three references to Mr. Ed Kee, University of Delaware Carvel Research & Education Center, 16483 County Seat Highway, Georgetown, DE 19947 (302)856-7303, ext. 590. Kee@udel.edu.

<http://www.udel.edu/udjobs/current/p-3066.html>

## Notices and Upcoming Events

### January 7-12, 2008

**Delaware Ag Week**, Harrington, DE. Contact Ed Kee at 302-856-7303 or email: [kee@udel.edu](mailto:kee@udel.edu)

**Delaware—Maryland Hay and Pasture Day, Evening Program for Part-time Hay and Pasture Producers, Dairy Day, and Agronomy/Soybean Day**

### November 28-30, 2006

**Mid-Atlantic Crop Management School** to be held at the Princess Royale Hotel and Conference Center in Ocean City, Maryland. Contact Bob Kratochvil ([rkratoch@umd.edu](mailto:rkratoch@umd.edu)) or Richard Taylor ([rtaylor@udel.edu](mailto:rtaylor@udel.edu)) with questions or to obtain a registration booklet (available sometime in August).

## **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](http://www.mdcrops.umd.edu)

## **Photographs for Newsletter Cover**

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

[www.scenicbuckscounty.com](http://www.scenicbuckscounty.com)