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Agronomy News

May 23, 2013 Volume 4, Issue 2

In this issue

Root Development in Young Corn

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Successful emergence (fast & uniform) does not guarantee successful stand establishment in corn. The next crucial phase is the establishment of a vigorous nodal root system. Success is largely dependent on the initial development of nodal roots from roughly V2 (two leaves with visible leaf collars) to V6.

Corn is a grass and has a fibrous type root system, as compared to soybeans or alfalfa that have tap root systems. Stunting or restriction of the nodal root system during their initial development (e.g., from dry soil, wet soil, cold soil, insect damage, herbicide damage, sidewall compaction, tillage compaction) can easily stunt the entire plant's development. In fact, when you are attempting to diagnose the cause of stunted corn early in the season, the first place to begin searching for the culprit is below ground.

To better understand rooting development and problems associated with root restrictions, it is important to recognize that root development in corn occurs in two phases. The first phase is the development of the seminal or seed root system. The second phase is the development of the nodal or crown root system.

Corny Trivia: Sometimes you may hear the seminal root system referred to as the primary root system and the nodal root system as the secondary root system. This classification was described by Cannon (1949) and certainly makes chronological sense but always confuses me from the standpoint of importance to the plant.

The Seminal (Seed) Root System

Seminal (seed) roots originate from the scutellar node located within the seed embryo and are composed of the radicle and lateral seminal roots. Even though the seminal roots technically are nodal roots, they are traditionally discussed separately from the nodal roots that develop later from the crown area of the seedling.

The radicle root emerges first from near the tip end of the kernel (Fig. 1) and initially elongate in that direction. The lateral seminal roots emerge later from behind the coleoptile (Fig. 2) and initially elongate in the opposite direction of the radicle root. However, soon both sets of seminal roots begin to elongate downward in response to gravity (Fig. 3).

The seminal root system helps sustain seedling development by virtue of water uptake from the soil, but a young corn seedling depends primarily on the energy reserves of the kernel's starchy

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Fig. 1. Radicle root and coleoptile of pre-VE seedling.

Fig. 2. Lateral seminal roots, coleoptile, and radicle root of pre-VE seedling.

Fig. 3. Seminal root system of VE seedling, but no evidence yet of nodal root system.

endosperm for nourishment until the nodal root system develops later. Once a seedling has emerged (growth stage VE), the rate of new growth of the seminal root systems slows down dramatically as the nodal root system begins to develop from nodes above the mesocotyl.

Even though the seminal root system contributes little to the season-long maintenance of the corn plant, early damage to the radicle or lateral seminal roots can stunt initial seedling development and delay emergence. Such damage will not necessarily cause immediate death of the seedling as long as the kernel itself and mesocotyl remain healthy, but may result in delayed emergence (Fig's 12 - 16) or the seedling leafing out underground. As more and more nodal roots become established over time, damage to the seminal root system will have less and less impact on seedling survival.

Examples of seminal root damage include imbibitional chilling injury (Nielsen, 2012), post-germination injury from lethal or sub-lethal cold temperatures (Nielsen, 2012), and “salt” injury from excessive rates of starter fertilizer placed too close to the kernel. Symptoms of such root damage include retarded root elongation, brown tissue discoloration, prolific root branching, and outright death of root tissue. If the radicle root is damaged severely during its emergence from the kernel, the entire radicle root may die. Once the radicle has elongated a half-inch or so, damage to the root tip will not necessarily kill the entire root, but rather axillary root meristems may initiate extensive root branching in response to damage to the apical meristem.

The Nodal Root System

Nodal roots develop sequentially from individual nodes above the mesocotyl, beginning with the lowermost node in the area of the young seedling known as the "crown". Once a seedling has reached the V1 stage of development, one can usually identify the first set of nodal roots beginning to elongate from the lowermost node. By the V2 stage of development, the first set of nodal roots are clearly visible and the second set of nodal roots may be starting to elongate from the second node of the seedling. Each set or "whorl" of nodal roots begins to elongate from their respective nodes at about the same timing that each leaf collar emerges from the true whorl of the seedling.

Regarding Seeding Depth & Rooting Depth: Some folks believe that planting corn deeper encourages deeper rooting and vice versa. This belief is mostly myth with a slight hint of truth mixed in. It certainly is true that the depth of the seminal root system is influenced by seeding depth. However, the nodal root system that develops from the crown of the plant is not influenced much at all by seeding depth. This is because the depth of the crown is fairly constant regardless of seeding depth. During emergence of the seedling, the mesocotyl elongates and elevates the coleoptile and crown towards the soil surface. As the coleoptile nears the soil surface, changes in the ratio of red to far red wavelengths of light causes a change in the supply of one or more growth hormones from the coleoptile to the mesocotyl tissue and mesocotyl elongation consequently comes to a halt (Vanderhoef & Briggs, 1978). Since the depth at which the emerging seedling senses the change in red to far red light is fairly constant, the resulting depth of the crown (base) of the coleoptile is nearly the same (1/2 to 3/4 inch) for seeding depths of one inch or greater.

Fig. 4. V1 corn seedling.

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Fig. 5. First set of nodal roots elongating from lowermost node of crown area of V1 corn seedling.

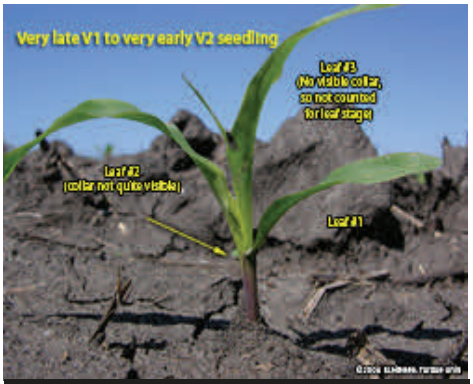

Fig. 6. Late V1 to early V2 corn seedling.

Elongation of the stalk tissue begins between leaf stages V4 and V5. Elongation of the internode above the fifth node usually elevates the sixth node above ground. Subsequent elongation of higher-numbered stalk internodes will result in higher and higher placement of the remaining stalk nodes. Sets of nodal roots that form at above ground stalk nodes are commonly referred to as “brace” roots, but function identically to those nodal roots that form below ground. If surface soil conditions are favorable (moist and not excessively hot), brace roots will successfully penetrate the soil, proliferate, and effectively scavenge the upper soil layers for water and nutrients.

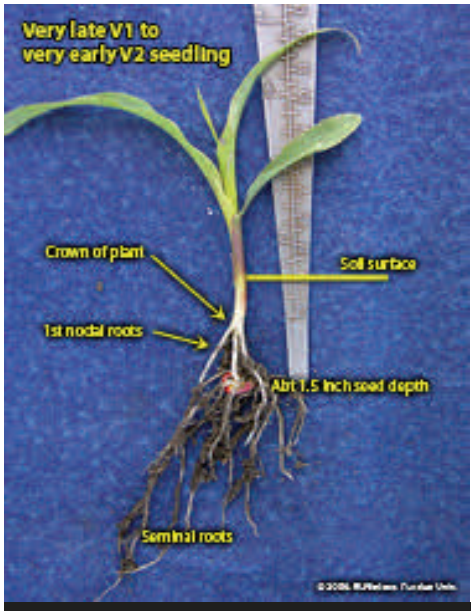

Fig. 7. Seminal and nodal roots of V2 V1 corn seedling.

Fig. 8. Root hairs on a V2 corn seedling.

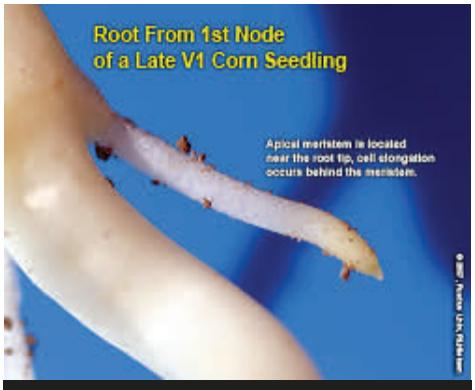

Fig. 9. Apical meristem of root.

Corny Trivia: Root hairs are lateral extensions of root epidermal cells, grow to a length of several millimeters, and number about 200 per sq. millimeter (Gardner et al., 1985). Their typical life span is only about 2 days at moderate temperatures and less so at higher temperatures (Gardner et al., 1985). Root hairs are visible even on the radicle root of a young seedling.

Collectively, the surface area represented by root hairs is very large and can account for a large share of nutrient and moisture uptake by the plant.

Corny Trivia: The primary meristem of a root is located near the root tip. Elongation of cells behind the meristem leads to elongation of the root.

A split stalk of an older plant will reveal a “woody” or "pithy" triangle of stalk tissue at the bottom of the corn stalk. This triangle is typically comprised of four stalk nodes, stacked sequentially with #1 at the bottom, whose associated internodes do not elongate. The first internode to elongate is the one above the fourth node, which elongates about 1/4 to 1/2 inch, above which is found the fifth node (usually still below or just at the soil surface). Consequently, five sets or whorls of nodal roots will usually be detectable below ground (one set for each of the below ground stalk nodes).

Corn seedlings transition from nutritional dependence on kernel reserves to nutritional dependence on the nodal roots around the V3 leaf stage. Damage or stress to the first few sets of developing nodal roots during the time period V1 to V5 can severely stunt or delay a corn plant’s development. Damage to the first few sets of nodal roots forces the young seedling to continue its dependence on kernel reserves longer than is optimum. If the kernel reserves are nearly exhausted, continued seedling development is easily stunted and seedling death is not uncommon. Typical stresses that can stunt initial nodal development include fertilizer salt injury, seedling diseases, herbicide injury, insect feeding damage, excessively wet or dry soils, soil compaction (tillage or planter).

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Starter Fertilizer Note: The success or not of this transition period that occurs around the V3 stage of development greatly influences whether the crop continues to develop strongly and uniformly. It is not uncommon for fields to develop rather uniformly up to about V3 (because of reliance upon kernel reserves) and then "fall apart" beyond the V3 stage if nodal root development has been compromised by "crappy" growing conditions and the transition from kernel reserves to nodal root support fails or is less than successful. It is at this stage that starter fertilizer plays a role in ensuring that the transition period occurs successfully. At about V3, one or more of the nodal roots will tap into a starter fertilizer band placed approximately 2 inches to the side and 2 inches below the seed (the proverbial 2x2 placement). Starter fertilizer placed in this position has the advantages over seed-placed starter fertilizer because a) its position relative to nodal root development is more advantageous and b) higher rates of nitrogen and/or potassium can be used without risk of injury to the seed during germination and emergence.

A somewhat uncommon, but dramatic, stunted root symptom is what is referred to as the “floppy corn” or “rootless corn” phenomenon (Nielsen, 2010b). This problem occurs most commonly as a result of the detrimental effects of excessively dry surface soil near the time of initial nodal root elongation in young (V2 to V4) corn plants. Young nodal roots that emerge from the crown area of the plant will die if their root tips (and associated meristematic areas) desiccate prior to successful root establishment in moist soil. The crown of a young corn plant is typically located only 3/4 inch or so below the soil surface and so is particularly vulnerable to dry upper soil conditions.

Fig. 10. Internode elongation between fourth and fifth nodes of a corn plant.

Fig. 12. Delayed emerger w/ healthy lateral seminal roots but damaged radicle root.

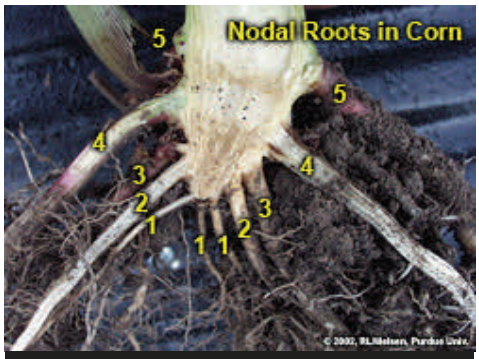

Fig. 11. Five identifiable sets or "whorls" of nodal roots in a split stalk section.

Fig. 13. Split coleoptile; precursor to leafing out underground.

Following is an example of a delayed emerger in a field where the "normal" emergers were already at late V1 to early V2. The radicle root was completely destroyed, though the lateral seminal roots were intact and healthy. The coleoptile on this seedling was split down the entire length of its side and would likely result in leafing out underground. The split coleoptile was likely due to the natural continued expansion of the enclosed leaves that would have otherwise emerged normally above ground.

Fig. 14. Dead radicle root on a delayed emerger seedling.

Following is another example of a delayed emerger in the same field where other seedlings were late V1 to early V2. The only visible damage to this delayed emerger was its radicle root whose apical meristem had been injured. The damage was less severe than the previous example and so the seedling was less severely stunted and managed to emerge above ground.

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Fig. 15. Delayed emerger with healthy lateral seminal roots and damaged, but alive, radicle root.

Fig. 16. Closer view of damaged radicle root tip with numerous adventitious roots.

MD Grain Marketing Site Updated for 2013: Crop Budgets, Custom Rates and Lease Agreements

Shannon Dill, Extension Educator – AGNR

The University of Maryland Extension has updated www.extension.umd.edu/grainmarketing site with new input data for 2013 crop budgets. Also posted are the 2013 MD custom rate survey and a new lease agreement publication that outlines Maryland landlord/tenant laws and includes sample lease agreements.

Crop Budgets

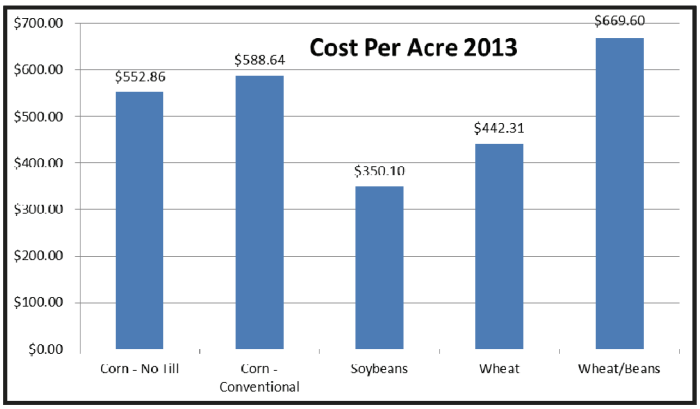
Cost of production is very important when making decisions related to your farm enterprise and grain marketing. Enterprise budgets provide valuable information regarding individual enterprises on the farm. This tool enables farm managers to make decisions regarding enterprises and plan for the coming production year. An enterprise budget uses farm revenue, variable cost, fixed cost and net income to provide a clear picture of the financial health of each farm enterprise.

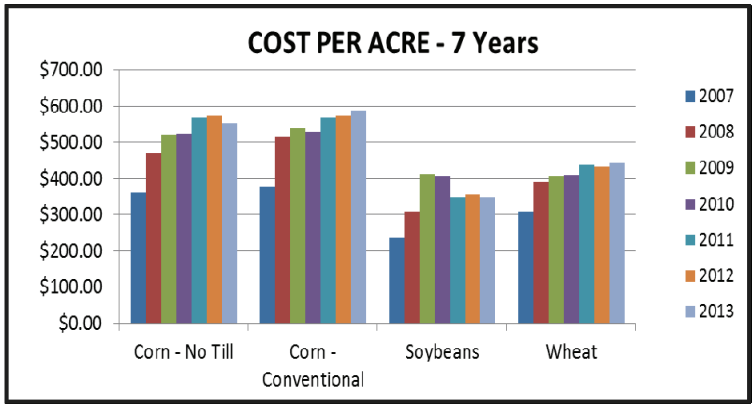
The 2013 Maryland enterprise budgets were developed using average yields and estimated input cost based upon producer and farm supplier data. The figures presented are averages and vary greatly from one farm and region to the other. It is therefore crucial to input actual farm data when completing enterprise budgets for your farm.

How to Use University Enterprise Budgets:

The enterprise budgets can be used as a baseline for your operation. Make changes to these budgets to include your production techniques, inputs and overall management.

The budgets are available electronically in PDF or Excel online at www.extension.umd.edu/grainmarketing. Use this document as a start or reference to create your crop budgets. If you have problems downloading any of these budgets contact information is located on the website.





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2013 Custom Rate Survey Now Available

Financial and economic considerations such as limited capital, untimely cash flow, insufficient labor, small acreage or other reasons require farmers to hire custom service for field operations. Custom work charges are determined by demand and supply and are negotiated between farmers and custom operators. The purpose of the publication is to provide information on custom work charges in Maryland and to provide data to assist in decision making regarding purchasing equipment.

Custom Work Charges

Custom work charges for Maryland are surveyed every other year in fall. The most recent mail survey was conducted in the fall of 2012 to determine custom work charges in Maryland for 2013. Data was collected from 70 custom operators and farmers and summarized for the state. Participants indicated the rates they charge for various field operations. The charges reported in this publication may serve as a guide in determining an acceptable rate for a particular job or farm practice. The charges can also be compared with costs and returns and may be used as a basis for working out more equitable charges for both the custom operator and customer. These are available online at www.extension.umd.edu/grainmarketing or contact your local Extension Office.

Crop Reports

Western

As May comes to an end, the weather in Garrett County feels more like April with night temperatures in the 30's and 40's. Some early planted corn has emerged but corn planting is only around 50% completed. Very little soybeans have been planted. A few farmers have harvested first cutting hay or small grains for silage on acres that will be planted to corn. Very little other hay has been harvested.

Central

Overcast skies and light misty rains throughout mid-May did little to slow down corn and soybean planting. Most full season corn is in the ground and full-season soybeans are moving full-steam ahead. The thermometer dipped below freezing on May 14th, but did not last long enough for damage to corn, beans, or fruit. It did hit the uncovered tomatoes and cucumbers with losses in the 25% range. Small grains in the boot stage and being harvested for silage is nearing completion. Barley silage in the dough stage will occur within days of this writing. First cutting of alfalfa and grass hay for silage is behind schedule so less than average forage quality can be expected. Harvest of dry hay has been nearly impossible so most orchardgrass is still standing. Pastures are in excellent to good condition but more sunshine is needed to increase the energy in the grass.

Northeast

Planting and crop progress are slower than normal. Corn planting is finishing up and emergence is looking good; we can finally see that the fields are planted. Soybean planting is well under way but behind the normal pace. The cool weather has favored pasture operations. Hay first cutting is "on again, off again" due to rain showers with yields about normal.

Southern

Lingering rain showers continue to hamper planting progress for soybeans and corn. Fortunately, most corn has been planted. Unfortunately, the wet conditions are causing some emergence issues, most notably on heavier soils that have crusted. Corn that is up is developing slowly. The first PSNT tests were collected on Monday. Most corn fields are showing some uneven color and size due to varying soil and moisture conditions. Another side-effect of the cooler and wetter conditions is trouble with burn-down programs with some weeds that were sprayed on the larger side of the control spectrum, being able to hold on to live another day. The same is true with early burn down programs of marestail in full-season bean fields. These fields will be problematic once the beans germinate. Wheat and barley continue to look good. Barley fields are beginning to turn. Slug damage continues to be an issue in corn. Rains have hampered hay harvest. Most fields are past prime cutting stage with producers looking for any window for harvest. Tobacco planting continues with good conditions for setting transplants.

Upper Eastern Shore

Barley looks good and is maturing properly. Most of the wheat looks good with the exception of a little bit of frost damage. Usually wheat yields very well when we have a cool grain fill period, which we seem to be having. Corn is growing better now that it has warmed up, with most of it being planted and emerged. There is some slug damage in

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some corn fields. Full season soybean planting is underway and the first beans planted are emerging fine. Hay harvest has been slow with all the rainfall, but is progressing with some good quality hay being made.

Lower Eastern Shore

Wheat and barley are progressing well. Most of the wheat is in the heading to milk stages of development. Powdery mildew can be found more in barley than in wheat that haven't received timely fungicide sprays. Septoria leaf spot has been found in wheat. There is no scab incident to report at this time. Most of the corn planting is getting complete however there are areas in Worcester and Somerset counties where planting it is still underway. For fields that were planted on time, corn is emerged and you can find corn 6-12 inches tall. Farmers are side dressing corn fields with UAN and anhydrous ammonia. Slug problems were wide spread in corn this year. Slug damage has become a bigger issue in conventional corn this year than in previously reported years. Soybean planting is continuing smoothly. The first cutting of alfalfa and other hay crops has completed with reports of excellent hay quality.

Timeline: This crop report is for the field observations from May 9 through May 23, 2013. Crop Report Regions: Western (Garrett, Allegany and Washington), Central (Carroll, Frederick, Howard, Montgomery), Northeast (Cecil, Harford, Baltimore), Southern (Anne Arundel, Prince George's, Calvert, Charles, St. Mary's), Upper Eastern Shore (Kent, Queen Anne's, Talbot, Caroline), Lower Eastern Shore (Dorchester, Wicomico, Worcester, Somerset).

Agriculture Weather Report

Adam Caskey, Meteorologist

It looks as though a more summer-like weather pattern will take shape over the last week of May and first week of June. Model guidance and ensembles are in fairly good agreement with the overall flow over the next few weeks, so my confidence is average to good in the long range outlook. Overall, the atmospheric flow that should develop will give Maryland an enhanced chance of above average and warmer temperatures through the first week of June.

With the warmer temperatures and increasingly intense sun, moisture can become a concern, but as of now, no part of Maryland is even considered abnormally dry according to the U.S. Drought Monitor. Also, according to the latest Crop Moisture Index from NOAA, only the western panhandle of Maryland is considered abnormally moist in the shallow soil profile. Should the anticipated weather pattern hold true through early June, I expect most of our moisture to come from sporadic afternoon thunderstorms, so there's equal chances of being above or below average for rainfall.

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Announcements

2013 Pesticide Container Recycling Program from MDA

Maryland Department of Agriculture's Pesticide Container Recycling Program will be accepting clean, empty containers from June 4 through September 27, during normal business hours. Containers will be collected from their current owners, for safe disposal and recycling.

Containers must be cleaned (triple-rinsed or pressure-rinsed) according to label directions.

Please remember to remove lids and label booklets from the containers prior to drop-off.

Call 410- 841-5710 for more details and drop-off instructions.

Collection dates and venues can be found at this link, http://mda.maryland.gov/plants-pests/Documents/recycle.pdf

Cover Crop Sign-up Begins June 24

Sign-up for MDA's 2013-2014 Cover Crop Program runs June 24 through July 15 at soil conservation district offices statewide. Don't miss this once a year opportunity to apply for attractive grants to help offset the cost of planting small grains on your fields this fall to conserve nutrients, reduce soil erosion and pro-tect water quality in the Chesapeake Bay and its tributaries. Maryland's revised nutrient management regula-tions require cover

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crops to be planted when organic nutrient sources are applied to fields in fall.

Approximately $20 million has been allocated for this year's program. Farmers may choose from two planting options. Traditional cover crops receive a base rate of $45/acre and up to $55/ acre in add-on incentives for using highly valued planting practices. Harvested cover crops qualify for $25/ acre with a bonus payment of $10/ acre if rye is used as the cover crop. There are no enrollment caps and cer-tain restrictions apply. Studies have shown that cover crops improve soil health, reduce weeds and pests and encourage bene-ficial insects. The Cover Crop Program is administered by the Maryland Agricultural Water Quality Cost-Share (MACS) Program and funded by the Chesapeake Bay Restoration Fund and the Chesapeake Bay 2010 Trust Fund. Applicants must be in good standing with MACS and in compliance with the Nutrient Management Program.

Upcoming Events

2013 Strawberry Twilight Meeting, Wednesday May 29th

The 2013 Strawberry Twilight Meeting will be held Wednesday, May 29, 2012 from 6:00-8:00 PM, rain or shine, at UMD – Wye Research and Education Center, Farm Operations Complex, 211 Farm Lane, Queenstown, MD.

You'll hear: University of Maryland and USDA small fruit experts discuss the current season's challenges and the impact that a new fruit pest may have on the industry. For additional program information, contact Mike Newell at 410-827-7388 or mnewell@umd.edu. If you need special assistance to attend this program, please contact Debby Dant at 410-827-8056 or ddant@umd.edu.

Pre-sidedress Soil Nitrate Test (PSNT) Training Session

The University of Maryland Extension (UME) Agricultural Nutrient Management Program will be providing free training workshops on the Pre- sidedress Soil Nitrate Test (PSNT). This program may be of interest to you if you grow corn for grain or silage and also use organic sources of nitrogen. The PSNT is an adaptive nitrogen management tool to help you determine if sidedress nitrogen will benefit your corn crop. You will learn why and how to use the PSNT procedure for determining the status of soil nitrate-nitrogen and how the results can guide your decision- making process (possibly saving you money on fertilizer nitrogen!).

Certified Nutrient Management Consultants or Certified Farm Operators will receive 2 hours of continuing education credits toward their nutrient management certification.

There will be two sessions:
May 31, 2013 at the WYE Research and Education Center in Queenstown, MD.

June 3, 2013 at the University of Maryland Extension Frederick office at
330 Montevue Lane in Frederick, MD.

Each session will be from 1:00 PM – 3:00 PM

Please contact Paul Shipley at 301-405-2563 or prs@umd.edu to register.

Did You Know

Wheat was first planted in the United States in 1777 as a hobby crop.

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If you would like to receive this newsletter via email please contact Rhonda Barnhart at rbarnhar@umd.edu. The subject line should be: Subscribe Agronomy News 2013.

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Agronomy News is published by University of Maryland Extension, Ag & Natural Resources Profitability Impact Team.

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