Pest & Crop

Purdue Cooperative Extension Service

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In This Issue

Insects, Mites, And Nematodes

Seedcorn Maggot Potential in Hastily Planted Fields

- *(Christian Krupke, John Obermeyer and Larry Bledsoe)*

• Seedcorn maggot are attracted to fields with abundant vegetation and/or animal manure.
• Weed control goes a long way in preventing infestations.
• Most corn seed is already protected by seed-applied insecticides
• Evaluate fields to determine level of damage and need for replanting.

Planting activity was at breakneck speed before the rain this week. Some planting occurred in fields that had less than ideal seedbeds, meaning little to no weed control had been applied. Corn and soybean seeds planted in high crop residue, weedy growth, and/or where animal manure was applied are most often subject to attack by seedcorn maggot. You are familiar with the many drawbacks of planting into weedy fields, but seedcorn maggot is a potentially serious pest that is often forgotten.

Seedcorn maggot adults are small, extremely common flies (look like a minature housefly) that are attracted to all types of decaying matter in which to lay their eggs. Soils planted too wet are often improperly sealed, allowing for flies to climb down into the furrow and deposit eggs next to germinating seed. Soon the yellowish-white maggots, up to 1/4 inch long, burrow into the seeds or underground portion of plants and feed; and they feed on a wide variety of plant material. The damage they cause can serve as an entry point for a range of other pests as well, including fungal and bacterial pathogens. All of this happens beneath the surface, so the damage is usually first observed weeks later as skips in the row where plants do not emerge, or if they emerge, die back. The problem will be worsened by cold-wet soils during the germination period.

Maggot damaged soybean

The good news is that these insects are very easily controlled with both soil and seed-applied insecticides. Therefore, when planting this early, it is a prudent management strategy to use Cruiser or Poncho treated seed (again, usually present on the vast majority of corn seed sold in Indiana) if a soil insecticide has not been used. Soybean seed, on the other hand, is typically *not* treated with an insecticide and would be prone to damage if planted into weedy fields. Be vigilant if you have seed of either type that was unprotected and planted under these conditions.

Alfalfa Weevil Management Not So Clear After Freeze Damage - *(Christian Krupke, John Obermeyer and Larry Bledsoe)*

Varying degrees of freeze damage occurred to the alfalfa crop a couple weeks ago, the worst being complete kill of the top-growth. Unfortunately, as discussed in a previous *Pest&Crop*, most of the weevil larvae were not frozen, merely dormant and lying in wait for the new growth. In other words, the weevils are likely still there although they may be difficult to detect unless one is carefully inspecting in the crown area.

The management guidelines listed below should be used to determine when alfalfa weevil should be controlled in southern Indiana. Of course, depending on the degree of freeze and weevil damage to any given field, some modification will be required. Because spring growth is so critical for restoring carbohydrate reserves to the taproot, there may be justification in treating for weevil damage before the threshold is reached.

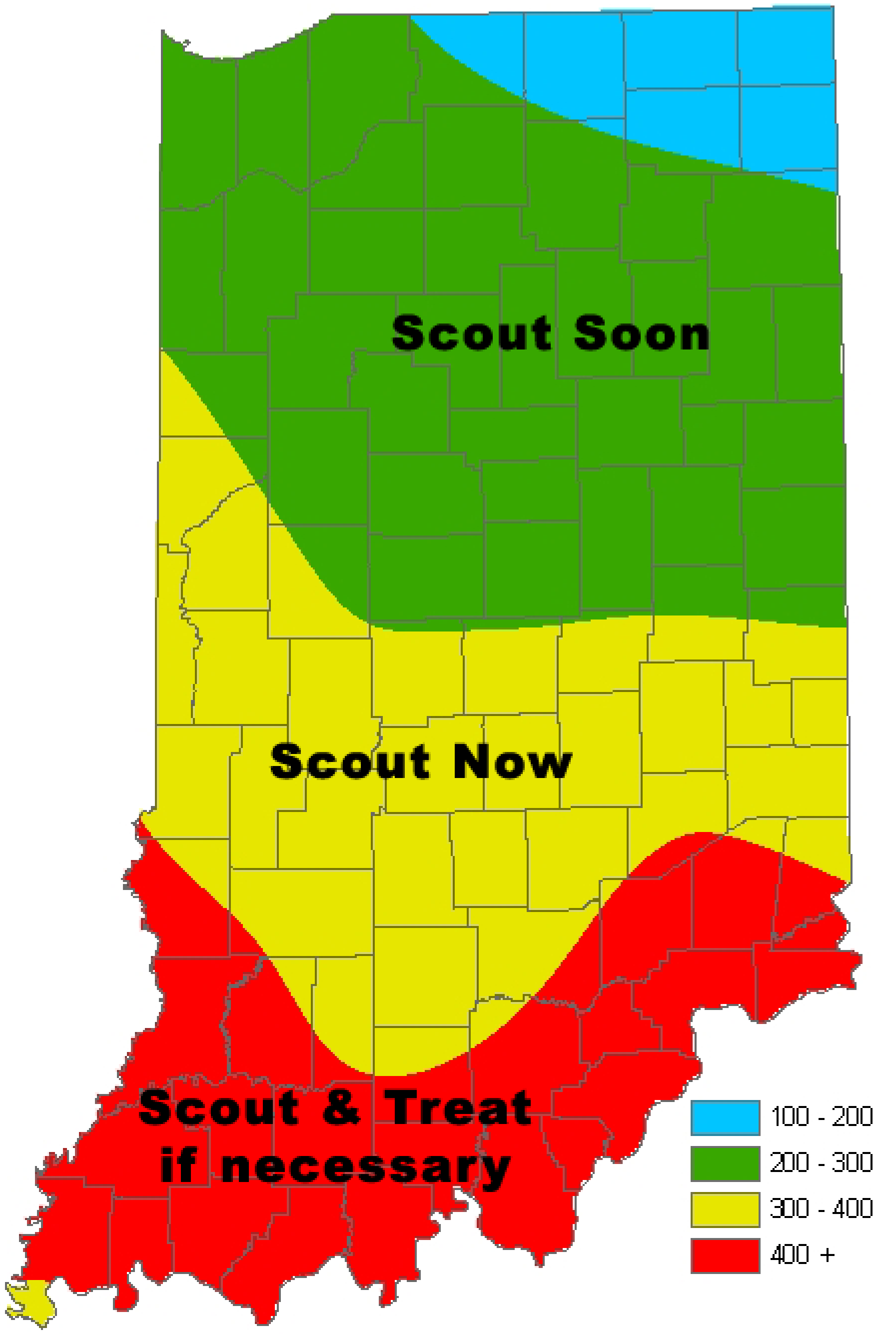
Larva nestled within damaged tip

Alfalfa Weevil Management Guidelines, 2007		
Southern Indiana		
Heat units	% Tip feeding	Advisory
200		Begin sampling. South facing sandy soils should be monitored earlier.
300	25	Re-evaluate in 7-10 days using the appropriate HU or treat immediately with a residual insecticide if 3 or more larvae are noted per stem and % tip feeding is above 50%.
400	50	Treat immediately with a residual insecticide.
500	75	Treat immediately.
600	75+	If cutting delayed more than 5 days, treat immediately.
750		If harvested or harvesting shortly, return to the field in 4 -5 days after cutting and spray if 1) there is no regrowth and weevil larvae are present OR 2) feeding damage is apparent on 50% of the stubble and weevil larvae are present.

Insecticides For Alfalfa Weevil Larval Control		
Insecticide	**Formulation and Amount per Acre**	**Harvest or Pasture Restriction**
carbofuran (Furadan)[1,2]	1/2 pt. 4F 1 pt. 4F 2 pt. 4F	7 days 14 days 28 days
chlorpyrifos (Lorsban)[1,2]	1 pt 4E 2 pt. 4E	14 days 21 days
cyfluthrin (Baythroid 2)[1,2]	1.6 - 2.8 fl oz. EC	7 days
gamma-cyhalothrin (Proaxis)[1,2]	2.6 - 3.8 fl oz. EC	1 day-forage 7 days-hay
lambda-cyhalothrin (Warrior)[1,2]	2.6 - 3.8 fl oz. CS	1 day-forage 7 days-hay
permethrin (Ambush)[1,2] (Pounce)[1,2]	12.8 oz. 2EC 8 oz. 3.2EC	14 days 14 days
zeta-cypermethrin (Mustang Max)[1,2]	2.2 – 4.0 fl oz. EW	3 days

1 Restricted use pesticide.
2 Highly toxic to bees.

Accumulated Heat Units Base 48 From January 1 (For Alfalfa Weevil Growth & Development)



Data provided by Indiana State Climate Office
Web: http://www.iclimate.org

Black Cutworm Adult Pheromone Trap Report Week 1 = 4/12/07 - 4/18/07 Week 2 = 4/19/07 - 4/25/07							
County	Cooperator	BCW Trapped		County	Cooperator	BCW Trapped	
		Wk 1	Wk 2			Wk 1	Wk 2
Adams	Roe/Mercer Landmark	3	7	Miami	Sweeten/Advanced Ag Solutions	0	0
Allen	Gynn/Southwind Farms	0	2	Newton	Ritter/Purdue CES	0	0
Benton	Babcock/Ceres Solutions	0	0	Newton	Babcock/Ceres Solutions	1	0
Benton	Babcock/Ceres Solutions	0	0	Porter	Hutson/Purdue CES	0	
Clay	Bower/Ceres Solutions, Brazil	0	1	Putnam	Nicholson/Nicholson Consulting	0	0
Clay	Bower/Ceres Solutions, Clay City	0	5	Randolph	Boyer/DPAC	1	0
Clinton	Foster/Purdue Entomology	4	5	Rush	Doerstler/Pioneer Hi-Bred	2	5
Daviess	Venard/Venard Agri-Consulting	6	1	Shelby	Gabbard/Purdue CES	1	0
Elkhart	Kauffman/Crop Tech	3	2	Starke	Wickert/Wickert Agronomy Services	0	0
Fulton	Jenkins/Fulton-Marshall Co-op	0	3	Sullivan	Bower/Ceres Solutions, Sullivan W	0	7
Gibson	Hirsch/Hirsch Family Farms			Sullivan	Bower/Ceres Solutions, Sullivan E	0	14*
Hamilton	Beamer/Beck's Hybrids	5	13	Sullivan	Bower/Ceres Solutions, New Lebanon	0	1
Jennings	Biehle/SEPAC	1	0	Tippecanoe	Krupke/Purdue Entomology	1	1
Knox	Bower/Ceres Solutions, Freelandville	0	1	Tippecanoe	Obermeyer/Purdue Entomology	3	9
Knox	Bower/Ceres Solutions, Fritchton	0	3	Tipton	Johnson/Pioneer Hi-Bred	0	0
Knox	Bower/Ceres Solutions, Oaktown	0	2	Warren	Mroczkiewicz/Syngenta	2	0
Lake	Kleine/Kleine Farms	0	3	White	Reynolds/ConAgra Snack Foods	0	7
Marshall	Barry/Fulton-Marshall Co-op	0	5	Whitley	Walker/NEPAC	1	3
Marshall	Misch/Pioneer Hi-Bred	2	0				

* Not intensive

Black Light Trap Catch Report - (*John Obermeyer*)														
	4/16/07 - 4/23/07													
County/Cooperator	VC	BCW	ECB	SWCB	CEW	FAW	AW	VC	BCW	ECB	SWCB	CEW	FAW	AW
Dubois/SIPAC Ag Center														
Jennings/SEPAC Ag Center	0	0	0	0	0	0	0							
Knox/SWPAC Ag Center														
LaPorte/Pinney Ag Center	0	0	0	0	0	0	0							
Lawrence/Feldun Ag Center	0	0	0	0	0	0	21							
Randolph/Davis Ag Center	0	0	0	0	0	0	1							
Tippecanoe/TPAC Ag Center	0	0	0	0	0	0	2							
Whitley/NEPAC Ag Center	0	0	0	0	0	0	29							

VC = Variegated Cutworm, BCW = Black Cutworm, ECB = European Corn Borer, SWCB = Southwestern Corn Borer, CEW = Corn Earworm, FAW = Fall Armyworm, AW = Armyworm

Plant Diseases

Soybean Rust - *(Gregory Shaner)*

Will soybean rust reach Indiana this summer?

Although soybean planting has not gotten underway yet in Indiana, I have been getting questions about our risk for soybean rust this summer. We found soybean rust in a few counties in Indiana last October, in some late-maturing fields, but this has no effect on our risk this year. Killing frosts eradicated these infections, including any that might have occurred on kudzu in Indiana. Each year, the rust must migrate anew into the Midwest from overwintering sites in the South.

The news from the southern US is good. Cold weather a couple of weeks ago eradicated infections on kudzu in many sites in Florida, Georgia, and Alabama. Earlier this year, rust had been reported from 31 sites in the South, as far west as Mobile, Alabama. As of now, there are only 8 counties with rust, all in Florida and south Georgia. Recent weather has been warm and dry in the southeastern US, which is not conducive for rust development. Texas and Oklahoma have been wetter, but there are no reports of rust from there. In February, rust was found on volunteer soybean plants in south Texas. The field was subsequently tilled and planted to corn, which eliminated that source of rust.

Many soybean sentinel plots have been planted in southern states. Planting of sentinel plots is just getting started in Indiana. The sentinel plot system allows us to monitor the movement and development of rust during the growing season.

It is impossible to predict at this time whether rust will reach Indiana this summer. Our risk is probably low until such time as rust moves into Mississippi and Louisiana. The rust in Florida, Georgia, and Alabama must work its way westward into the Mississippi Delta before it is in a position to be carried into Indiana by winds that move up the Mississippi and Ohio River Valleys.

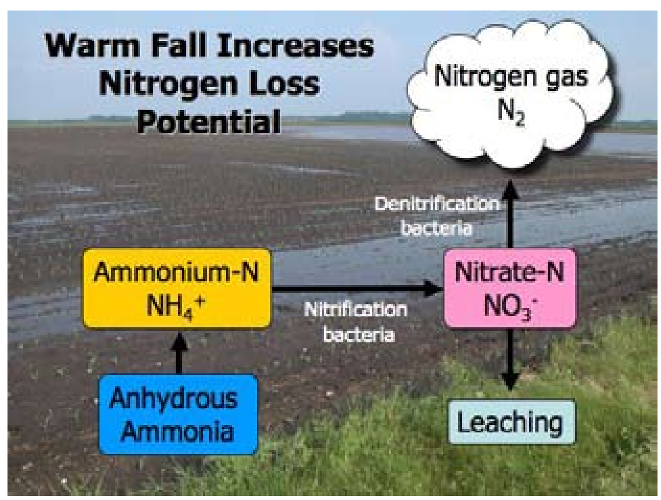
For those who use the Internet, up-to-date information about the status of rust can be found on the USDA PIPE Website, available at <http://www.usda.gov/soybeanrust/>. At the bottom of the homepage, under "Spotlights", click on the text to the right of the US map (USDA Public Soybean Rust Web Site). This will bring up a US map that shows where rust is (counties marked in red) and where people are scouting for rust, but have not found any (counties marked in green). From there, users can choose specific states for more detailed information. Alternatively, users can go directly to the site <http://www.sbrusa.net>.

Purdue also maintains a toll-free soybean rust hotline, which I update regularly during the growing season. The phone number is 866-458-RUST (7878).

Agronomy Tips

Warm Fall Increases Nitrogen Loss Potential - *(Jim Camberato and Brad Joern)*

Farmers that applied anhydrous ammonia in the fall for corn in northern Indiana are wondering how much nitrogen (N) might be lost this spring as a result of the warm fall and winter weather. Warm temperatures allow ammonium (NH_4^+) derived from anhydrous to be converted to nitrate (NO_3^-). Then, excess soil moisture promotes NO_3^- leaching below the rootzone in most soils and NO_3^- conversion to nitrogen gas in poorly-drained soils. Although N loss to-date has probably been minimal, we are just entering the time period when loss typically occurs. This article explains the factors that affect N loss and management strategies to cope with N loss this spring.



Warm Wet Weather Increases Nitrogen Loss

To minimize N loss from fall-applied anhydrous it is suggested that soil temperatures be below 50 °F at application and a nitrification inhibitor, such as nitrapyrin (N-ServeJ), be included. This approach assumes the nitrification inhibitor will slow the conversion of NH_4^+ to NO_3^- and soil temperatures will fall to freezing prior to much NO_3^- being produced.

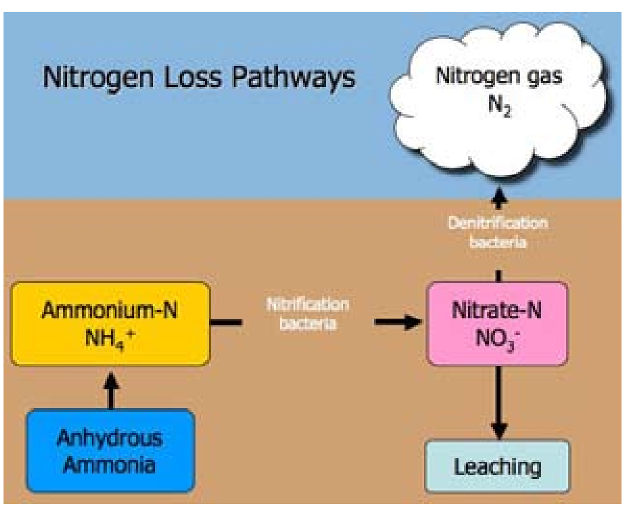
Although conversion of NH_4^+ to NO_3^- is slow at 50 °F, it does not stop until 32°F. Last fall, soil temperatures were warm after anhydrous application – staying in the mid to low 40's in November and December at 8" deep. Likely more than 45% of the N applied as anhydrous was NO_3^- by the first of January. Conversion of NH_4^+ to NO_3^- has resumed in March and April with soil warming.

If spring rainfall is heavy a lot of soil NO_3^- may be lost. Research conducted in southern Minnesota (Randall and Vetsch, 2005) found that 35% and 60% of the N from fall-applied ammonium fertilizers was lost when spring rainfall (April-June) was 13.8" and 15.0", but little N loss occurred with 11.1" of rain. Average rainfall for April-June in northern Indiana is 11.6" so minimal losses might be expected in an average year. However, a few excess inches over the next few months, especially if concentrated over a few days causing saturated soils, could result in substantial N loss. Long-term studies in West Lafayette have shown that NO_3^- loss through tile drains is typically greatest in May and June (Brouder et al., 2005). Denitrification losses would be expected at this time as well.

Nitrogen and Yield Loss can be Substantial with Fall-Applied Nitrogen

Using grain yield data from an 8-year field study conducted on a Crosby silt loam near Springfield Ohio (Stehouwer and Johnson, 1990) we calculated an average loss of 54 lb N/acre from a fall anhydrous application of 160 lb N/acre (34% of that added), equivalent to 12 bushels per acre less yield. In these studies N was applied as anhydrous ammonia after soils fell below 50 °F (between November 10th to 20th), so these losses occurred even though the anhydrous was applied within the suggested application window. Adding nitrapyrin to the fall anhydrous reduced N loss to less than 20 lb N/acre, but spring anhydrous was still more efficient and higher yielding (+6 bushels per acre).

Field-specific estimates of N loss are not possible at this time. However, the pre-sidedress soil nitrate test (PSNT) and the chlorophyll meter may be used to assess N availability during the growing season and provide a way to determine additional N needed.



Using the Pre-sidedress Soil Nitrate Test to Assess Nitrogen Needs

The NO_3-N content of the upper 1' deep of soil is one way to assess N supply for corn. Standard recommendations suggest sampling at the 4- to 6-leaf stage, but later in the season is more accurate. Unfortunately, representative sampling is time-consuming and expensive with banded fertilizer application (see Brouder & Mengel, 2003b).

Soil analysis for NO_3-N is relatively inexpensive. Results of the NO_3-N test are typically reported in parts per million (ppm) or milligrams per kilogram (mg/kg) which are equivalent in value. If more than 25 ppm NO_3-N is found in the sample then no additional N is recommended. At lower levels of NO_3-N, sidedress N rates can be reduced.

Using a Chlorophyll Meter to Assess Nitrogen Needs

An accurate assessment of corn N status can be obtained relatively easily using a chlorophyll meter (Minolta SPADJ) at the 8- to 10-leaf stage or later. The chlorophyll meter measures leaf greenness which is an indication of leaf chlorophyll and N content. Genetic, nutritional, and environmental factors affect leaf greenness so chlorophyll readings cannot be used directly, but need to be compared to a reference strip of highly fertilized corn (10-25% more than recommended) of the same variety grown in the same field. Nitrogen application with high clearance equipment, irrigation, or aerially is typically needed with late-season measurements. More details of using the chlorophyll meter can be obtained from Brouder & Mengel (2003a).

Greenness readings should be made across the field on the same leaf and leaf position, as nearly as possible. Prior to tassel the uppermost leaf showing a collar should be utilized. At tassel or later use the ear leaf. Measure greenness about half way between the leaf tip and base and half way between the edge and midrib. Do not read wet leaf tissue. Average readings on 30 or more plants per uniform field area and in the reference strip. Weekly readings beginning at V-8 through pollination is helpful in gaining confidence with this technique.

Greenness measurements are converted to an N sufficiency index (SI) by dividing the bulk field greenness reading by the reference greenness and multiplying by 100%.

For example: Assume the average bulk field reading is 45 and the average reference strip reading is 50. The SI calculation is 45 divided by 50, or 0.90, multiplied by 100%, to equal 90% SI.

Previous research has shown that sufficiency index ratings of 95% or less will benefit from additional fertilizer. If SI values are 90% to 95% then 30 to 40 pounds of N per acre is recommended. If SI values are less than 90% then 40 to 60 pounds of N/acre has been recommended in the past. Recent research has found that corn can respond to higher application rates and later in the season than previously thought. For example, Sawyer et al. (2006) at Iowa State University recommends 80 lb N/acre with SI values from 89% to 92% and 100 lb N/acre with SI values less than 89%.

Summary

Soil temperatures and rainfall in the next 4 to 8 weeks will determine the amount of N lost from fall-applied anhydrous. We will provide additional guidance on possible loss based on soil temperatures and rainfall as best we can during this time period. However, our guidance will be general because predicting N loss requires many field-specific assumptions. In your fields consider using the PSNT or chlorophyll meter readings during the growing season as a way to assess N availability and correct for N loss.

Related References

Brouder, Sylvie, Brenda Hoffman, Eileen Kladivko, Ron Turco, Andrea Bongen, and Jane Frankenberger. 2005. Interpreting Nitrate Concentration in Tile Drainage Water (AY-318-W). Purdue University Extension. [On-Line]. Available at <http://www.ces.purdue.edu/extmedia/AY/AY-318-W.pdf.> (URL verified 4/23/07).

Brouder, Sylvie M. and D.B. Mengel. 2003a. Determining Nitrogen Fertilizer Sidedress Application Needs in Corn Using a Chlorophyll Meter (AY-317-W). Purdue University Extension. [On-Line]. Available at <http://www.agry.purdue.edu/ext/pubs/AY-317-W.pdf.> (URL verified 4/23/07).

Brouder, Sylvie M. and D.B. Mengel. 2003b. The Presidedress Soil Nitrate Test for Improving N Management in Corn (AY-314-W). Purdue University Extension. [On-Line]. Available at <http://www.agry.purdue.edu/ext/pubs/AY-314-W.pdf.> (URL verified 4/23/07).

Randall, Gyles and Jeff Vetsch. 2005. Fate of N in Fall-Applied DAP, MAP, and Ammonium Sulfate Fertilizers. Univ. of Minnesota, Southern Research and Outreach Center. [On-Line]. Available at <http://sroc.cfans.umn.edu/research/soils/researchresults/2005/Fate%20of%20N%201205.pdf.> (URL verified 4/23/07).

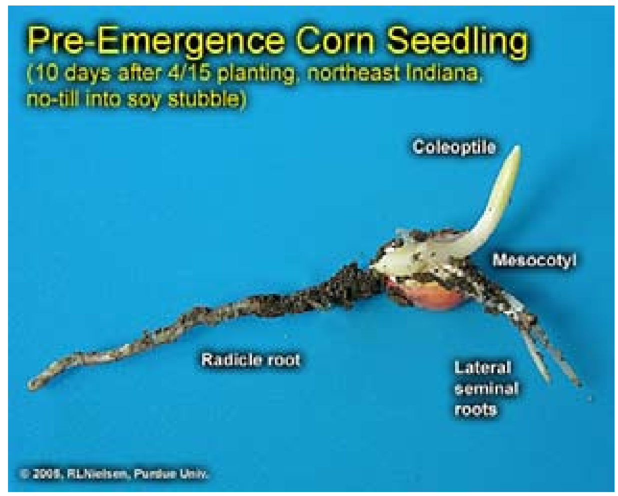
Sawyer, John, John Lundvall, Jennifer Hawkins, Dan Barker, Jean McGuire, and Micki Nelson. 2006. Sensing N Stress in Corn (PM-2026). Iowa State Univ. Extension. [On-Line]. Available at <http://www.extension.iastate.edu/publications/pm2026.pdf.> (URL verified 4/23/07).

Stehouwer, R.C. and J.W. Johnson. 1990. Urea and Anhydrous Ammonia Management for Conventional Tillage Corn Production. Journal of Production Agriculture 3:507-513.

Germination Events in Corn - *(R.L. (Bob) Nielsen)*

Germination is the renewal of enzymatic activity that results in cell division and elongation and, ultimately, embryo emergence through the seed coat. Germination is triggered by absorption of water through the seed coat. Corn kernels must absorb (imbibe) about 30% of their weight in water before germination begins. Less than optimum absorption of water (perhaps due to a rapidly drying seed zone) may slow or stop germination. Repeated wetting/drying cycles can decrease seed viability.

By comparison, soybeans must imbibe about 50% of their weight in water. But since soybeans are approximately 2/3 the weight of corn kernels, the total amount of absorbed water required for germination is relatively similar.



The visual indicators of germination occur in a distinct sequence. The radicle root emerges first, near the tip end of the kernel, within two to three days in warm soils with adequate moisture. In cooler or drier soils, the radicle root may not emerge until one to two weeks after planting.

The coleoptile (commonly called the "spike") emerges next from the embryo side of the kernel within one to many days of the appearance of the radicle, depending on soil temperature. The coleoptile initially negotiates its way toward the dent end of the kernel by virtue of the elongation of the mesocotyl. The coleoptile is a rigid piece of plant tissue that completely encloses the four to five embryonic leaves (plumule) that formed during grain development of the seed production year. The plumule leaves slowly enlarge and eventually cause the coleoptile to split open as it nears the soil surface.

The lateral seminal roots emerge last, near the dent end of the kernel. Even though these and the radicle root are technically nodal roots, they do not comprise what is typically referred to as the permanent nodal root system. The first set of so-called "permanent" roots begins elongating at approximately the V1 leaf stage (1 leaf with visible leaf collar) and is clearly visible by V2.

Troubleshooting Considerations

When temperatures are optimum, these three parts of the seedling may emerge from the kernel on nearly the same day. Excessively cool soils may delay the appearance of the coleoptile and lateral seminal roots for more than a week after the radicle root emerges. It is not uncommon in cold planting seasons to dig up kernels two weeks after planting and find only short radicle roots and no visible coleoptiles.

When excessively cold and/or wet soils delay germination and/or emergence, the kernel and young seedling are subjected to lengthier exposure to damaging factors such as soil-borne seed diseases, insect feeding and injury from pre-plant or pre-emergent herbicides and carryover herbicides from a previous crop

Related References

Hardman, L.L. and J.L. Gunsolus. 1998. Corn Growth and Development & Management Information for Replant Decisions. Univ. of Minnesota Ext. Service Pub. No. FO-05700. [On-Line]. Available at <http://www.extension.umn.edu/distribution/cropsystems/DC5700.html.> (URL verified 4/23/07).

Nielsen, RL (Bob). 2007a. The Emergence Process in Corn. Corny News Network, Purdue Univ. [On-Line]. Available at <http://www.kingcorn.org/news/timeless/Emergence.html.> (URL verified 4/23/07).

Nielsen, RL (Bob). 2007b. Requirements for Uniform Germination and Emergence of Corn. Corny News Network, Purdue Univ. [On-Line]. Available at <http://www.kingcorn.org/news/timeless/GermEmergReq.html.> (URL verified 4/23/07).

Ritchie, S.W., J.J. Hanway, and G.O. Benson. 1992. How a Corn Plant Develops (SP-48). Iowa State Univ. [On-Line]. Available at <http://www.extension.iastate.edu/pages/hancock/agriculture/corn/corn_develop/CornPlantStages.html.> (URL verified 4/23/07).

The Emergence Process in Corn - *(R.L. (Bob) Nielsen)*

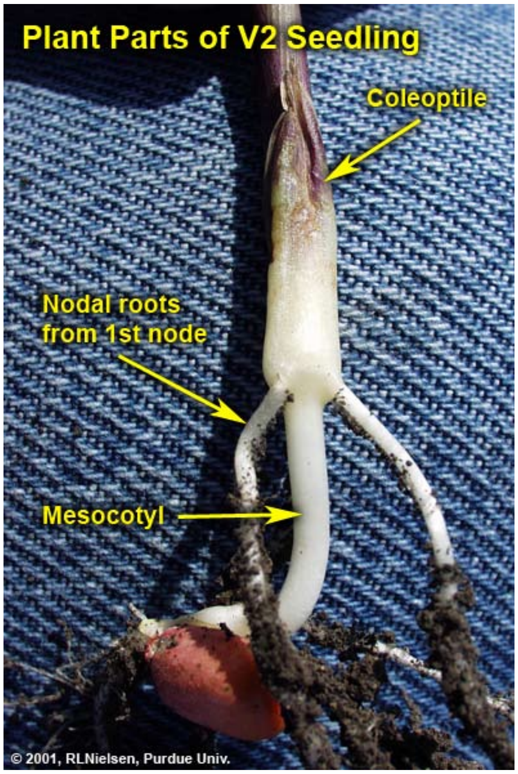
Successful germination alone does not guarantee successful emergence of a corn crop. The coleoptile must reach the soil surface before its internal leaves emerge from the protective tissue of the coleoptile. Growth stage VE refers to emergence of the coleoptile or first leaves through the soil surface (Ritchie et al., 1992).

As with all of corn growth and development, germination and emergence are dependent on temperature, especially soil temperature. Corn typically requires from 100 to 120 GDD (growing degree days) to emerge (Nielsen, 2007b; Nielsen, 2007c). Under warm soil conditions, the calendar time from planting to emergence can be as little as 5 to 7 days. Under cold soil conditions, emergence can easily take up to four weeks.

Elongation of the mesocotyl elevates the coleoptile towards the soil surface. The mesocotyl is the tubular, white, stemlike tissue connecting the seed and the base of the coleoptile. Technically, the mesocotyl is the first internode of the stem.

Useful Tip: Physiologically, mesocotyls have the capability to lengthen from at least a 6-inch planting depth. Realistically, corn can be planted at least three inches deep if necessary to reach adequate moisture.

As the coleoptile nears the soil surface, exposure of the mesocotyl to the red light portion of the solar radiation spectrum halts mesocotyl elongation. Continued expansion of the leaves inside the coleoptile ruptures the coleoptile tip, allowing the first true leaf to emerge above the soil surface. Since the depth at which the mesocotyl senses 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) at seeding depths of one-inch or greater.



Useful Tip: When corn is seeded very shallow (less than about 1/2 inch), the crown of the coleoptile will naturally be closer to the soil surface if not right at the surface. Subsequent development of the nodal root system can be restricted by exposure to high temperatures and dry surface soils.

Troubleshooting Considerations

Several factors can cause the coleoptile to split prematurely, allowing the leaves to emerge underground. Usually, more than one of the following factors are present when this problem occurs, making it difficult to place the blame on any one factor.

Exposure to light at deeper soil depths than usual due to cloddy seedbeds, dry seedbeds, sandy soils, or open slots in no-till.

Injury from certain herbicides, particularly under stressful environmental conditions. Symptoms include corkscrewed coleoptile, swollen mesocotyl and true leaves emerged from side of coleoptile.

Surface crusting, cloddy seedbeds, rocky seedbeds, planter furrow compaction, or otherwise dense surface soil that physically restrict mesocotyl elongation and coleoptile penetration. The pressure of the expanding leaves within the coleoptile eventually ruptures the side of the coleoptile. Symptoms include corkscrewed coleoptile, swollen mesocotyl and true leaves emerged from side of coleoptile. Note the similarity to those symptoms from herbicide injury.

Cold temperature injury, either from exposure to long periods of soil temperatures around 50F or from exposure to wide daily swings (25 to 30F) in soil temperatures. Symptoms include absence of emerged coleoptile, corkscrewed mesocotyl or coleoptile and true leaves emerged from side of coleoptile. Note the similarity to those symptoms from herbicide injury.

Useful Tip: The mesocotyl should remain firm, white and healthy through at least the 6-leaf stage, if not longer. If it is mushy, discolored, or damaged prior to this stage, then it is likely part of the crop problem being investigated.

Related References

Nielsen, RL (Bob). 2007a. Germination Events in Corn. Corny News Network, Purdue Univ. [On-Line]. Available at <http://www.kingcorn.org/news/timeless/GerminationEvents.html.> (URL verified 4/23/07).

Nielsen, RL (Bob). 2004. Corkscrewed Corn Seedlings. Corny News Network, Purdue Univ. [On-Line]. Available at <http://www.kingcorn.org/news/articles.04/Corkscrew-0501.html.> (URL verified 4/23/07).

Nielsen, RL (Bob). 2007b. Heat Unit Concepts Related to Corn Development. Corny News Network, Purdue Univ. [On-Line]. Available at <http://www.kingcorn.org/news/timeless/HeatUnits.html.> (URL verified 4/23/07).

Nielsen, RL (Bob). 2007c. Requirements for Uniform Germination and Emergence of Corn. Corny News Network, Purdue Univ. [On-Line]. Available at <http://www.kingcorn.org/news/timeless/GermEmergReq.html.> (URL verified 4/23/07).

Ritchie, S.W., J.J. Hanway, and G.O. Benson. 1992. How a Corn Plant Develops (SP-48). Iowa State Univ. [On-Line]. Available at <http://www.extension.iastate.edu/pages/hancock/agriculture/corn/corn_develop/CornPlantStages.html.> (URL verified 4/23/07).

Wheat Stem and Head Injury in Southern Indiana
- *(Shawn Conley)*

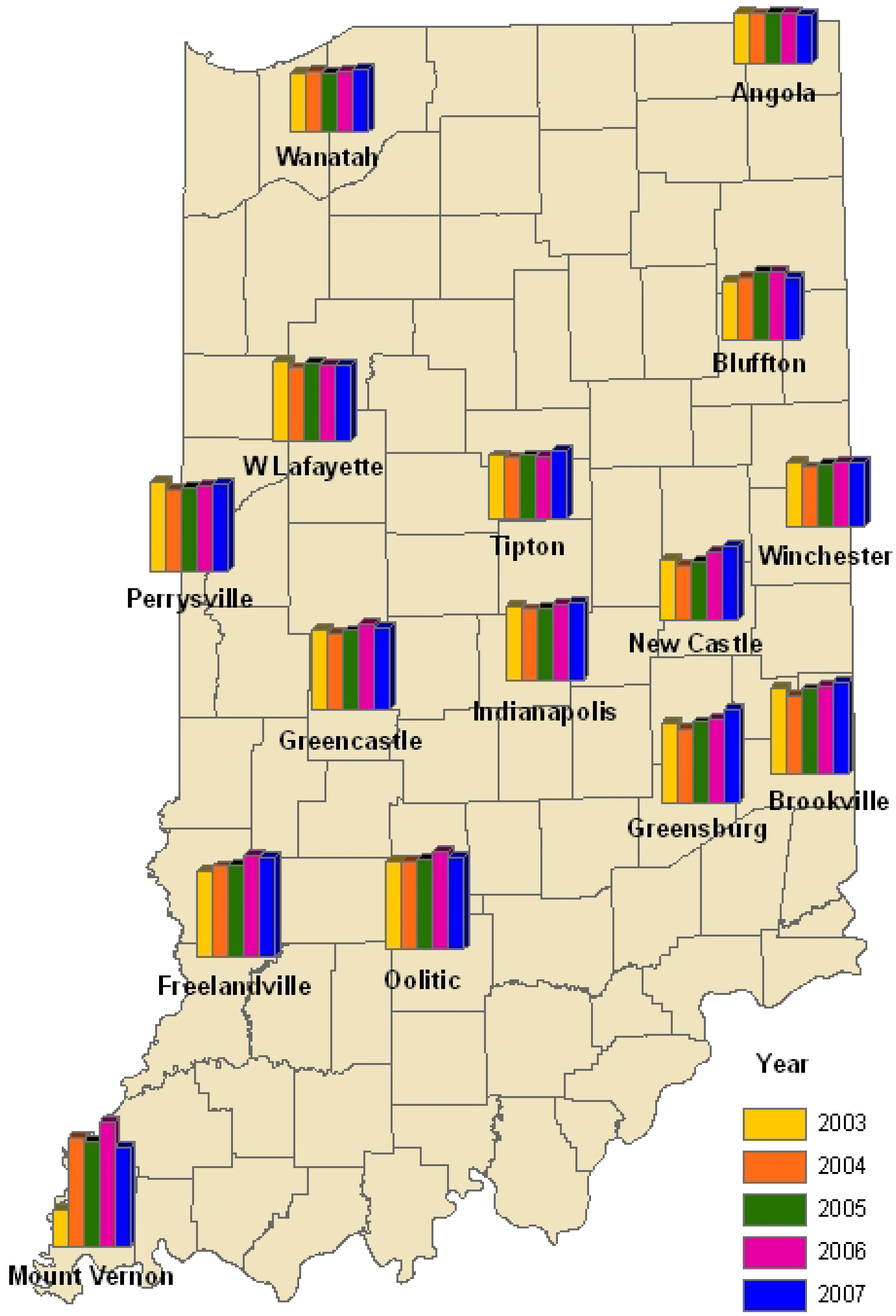
Stem necrosis (death) was visible in several fields I visited in southern Indiana on 4/20/07. There was substantial variability between fields, varieties, and across the landscape, so each field should be assessed individually. In some fields very few stems were injured, whereas in other fields the main stem, primary, secondary, and tertiary tillers were lost. I was also able to find head injury in several wheat fields (Image 1).

To assess stem injury, dig several wheat plants and identify the main stem on each plant (it will usually be the largest stem). Carefully peel away leaves to expose the lower most visible node. The stem below the node will appear normal, mottled and white (Image 2, 4), or begin to turn brown and flat (Image 4).

Those stems that are completely brown are most likely dead and with warm weather will quickly lodge (Image 3). The mottled stems may be a precursor to stem death or may just show symptoms of cell damage to the epidermis (outside cell wall). It is uncertain if this damage will lead to weakened stems and lodging once we approach harvest. Follow this same procedure for each tiller to assess overall freeze damage and yield loss. Unfortunately, I was unable to locate a yield loss equation to assist growers in making the decision to keep or destroy a wheat field. If you have crop insurance, follow their recommendations implicitly. If you do not have crop insurance, my best guess is as follows: Loss of the main stem ~10 to 15% yield loss, main stem + primary tiller ~15 to 25% yield loss, main stem + primary + secondary tiller ~25 to 50% yield loss, main stem + primary + secondary + tertiary tiller > 50% yield loss. Realize that loss of main stem and tillers will also lead to decreased test weight and delayed wheat maturity (~7 to 10 days). These factors should be taken into consideration when deciding whether to keep or destroy a wheat crop.

Temperature Update

Accumulated Growing Degree Days (86/50) From January 1



Data provided by Indiana State Climate Office
Web: http://www.iclimate.org