Pest & Crop

July 19, 2002 - No. 18

In This Issue

Insects, Mites, and Nematodes

Stressed Corn, Pollination, and Rootworm Beetles
– (*John Obermeyer, Rich Edwards, and Larry Bledsoe*) –

- Large numbers of rootworm beetles being reported in corn
- Stressed corn and spotty pollination are making treatment decisions difficult
- Length of silks and amount of pollen yet to fall is the key to fertilization

Several calls have been received this week concerning the large numbers of western corn rootworm beetles in cornfields. Many plants within these fields are being discovered with damaged roots from larval damage. This combined with present dry conditions and soil that was compacted this spring is resulting in severely stressed plants. Treatment decisions have been very difficult as the beetles flock to the actively pollinating plants occurring in spots within a field.

Western corn rootworm feeding on pollen on a leaf.

When fields are pollinating evenly, control may be necessary if the silks are clipped off to within 1\2 inch or less of the tip of the ear before 50% pollination is completed. Don't judge the need for treatment on beetle numbers … SILK DAMAGE ONLY. Producers have noted the beetles all over the plants, not necessarily feeding on the silks. Many beetles are in the corn whorls before tassels emerge, they are doing some insignificant but "showy" leaf feeding. As the tassels emerge, beetles may be seen feeding on the anthers and pollen. Pollen is their favorite food. Just as back in 1988, tremendous beetle numbers are being reported, but silks have very little damage. Plants under drought stress will often have the pollen shed and silking out of synchrony. Controlling beetles will only protect the silks yet viable to receive pollen, make certain that over half of the pollen hasn't already been shed.

Consider:

- Pollen is the rootworm beetles favorite food
- More than enough pollen is shed to fertilize ears and feed beetles
- Silks a 1/2 inch or longer can successfully receive pollen
- Silks can receive the pollen anywhere, not just the tip

The tough, but realistic, question is if the field is worth another $15.00 investment (7-8 bushels of corn)? For recommended control materials refer to Extension Publication E-219-W, *Corn Insect Control Recommendations* - 2002 (Revised 1/2002). Download a copy at, <http://www.entm.purdue.edu/entomology/ext/targets/e-series/fieldcro.htm>.

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Soybeans and the "S" Word (spider mites) - (*John Obermeyer, Rich Edwards, and Larry Bledsoe*) –

- Spider mites may or may not be the cause of discolored soybean plants
- Rain indirectly helps slow or control spider mites
- Consider many factors, especially future weather forecasts, before treating spider mites

Soybean fields have been stressed throughout this season, with the present hot and dry conditions, do we dare add another … spider mites! So far no reports of obvious spider mite damage has been received. However, groups looking for soybean aphids at the Diagnostic Training Center have quickly noticed that spider mites have begun to colonize plants. Spider mite presence is not cause for alarm, Future management decisions should be based on awareness of their movement into fields and the weather's affect on them.

Before considering a control, it is very important that spider mites are identified as the source of plant yellow/bronzing. Shake some discolored soybean leaves over a white piece of paper. Watch for small dark specks moving about on the paper. Also look for minute webbing on the undersides of the discolored leaves. Once spider mites have been positively identified in the damaged areas of the field, it is essential that the whole field be scouted to determine the range of infestation. Sample in at least five different areas of the field and determine whether the spider mites are present or not by using the "shake" method.

Moisture stressed plants actually provide a better nutritional feast for spider mites thus they thrive and quickly colonize areas or whole fields. The best spider mite control is to eliminate plant stress, this easier said than done. Rain indirectly controls spider mites. Pounding rains can physically beat spider mites off the plants where they meet their doom by drowning or to ground dwelling predators. More importantly, rains increase humidity that slows the spider mite reproduction and favors pathogenic fungi. Several days of relative humidity above 70% may induce an epizootic wiping out the spider mite population. On the other hand, warm temperatures and low humidity returning after rain may only delay the spider mite infestation. Above all else, significant rain helps the soybean crop to grow and provides less of a "protein broth" for the spider mites.

Reduction of crop yield is directly related to duration and intensity of the mite attack. The most severe damage occurs when the infestation starts in the early stages of plant growth and builds throughout the season (extended drought). However, a heavy infestation at seed set (dry period) can still cause economic damage. Before applying controls carefully consider that, depending when damage is noted, multiple insecticide applications may be necessary. This is because surviving spider mites are able to repopulate a field faster than can the natural predators that are often prevalent in infested fields. If leaf discoloration is apparent, spider mites are positively identified as the culprit, and hot, dry conditions are expected to persist, it is recommended that a control be considered.

If a control is warranted, two pesticides are recommended for use. These include dimethoate (Dimethoate 400 and 4 EC) and chlorpyrifos (Lorsban 4E). Proper placement of these pesticides is the key to successful control results. Nozzle pressures of 40 psi and 30-40 gallons of water per acre for ground application helps distribute the pesticide throughout the foliage. If using aerial application, the control material should be applied in 3-5 gallons of finished spray per acre. Normally, aerial applications are not as efficacious as ground applications due to limited surface-area coverage. So where possible, use ground application. Also, research has shown that mite controls work best in the early morning or evening hours. This is primarily due to more stable weather conditions, less convection currents and evaporation, resulting in better targeting of the pesticide.

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Black Light Trap Catch Report
(Ron Blackwell)

County/Cooperator	7/2/02 - 7/8/02							7/9/02 - 7/15/02						
	VC	BCW	ECB	SWCB	CEW	FAW	AW	VC	BCW	ECB	SWCB	CEW	FAW	AW
Dubois/SIPAC	0	2	0	0	0	0	21	1	0	0	0	0	0	10
Jennings/SEPAC	1	0	3	0	0	0	25	0	0	1	0	0	0	23
Knox/SWPAC	1	1	1	2	0	0	0	10	8	15	10	0	2	0
LaPorte/Pinney Ag Center	7	6	2	0	0	0	15	5	9	0	0	0	0	15
Lawrence/Feldun Ag Center	0	3	0	0	0	0	10	0	3	0	0	0	0	38
Randolph/Davis Ag Center	0	9	2	0	0	0	148	12	8	0	0	0	0	166
Vermillion/Hutson	0	1	0	0	0	0	0	0	1	0	0	0	0	0
Whitley/NEPAC	4	8	3	0	0	0	95	6	11	2	0	0	0	192

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

Plant Diseases

Soybean Sudden Death Syndrome – (*Gregory Shaner*) –

- The time is approaching for SDS to appear

Sudden death syndrome (SDS) was widespread in Indiana during 1998 and 2000, and common across central Indiana last year. A soilborne fungus, *Fusarium solani* f. sp. *glycines*, causes SDS, so soybean fields where the disease occurred in recent years are at risk this year.

It is difficult to predict whether SDS will in fact be a widespread problem this year. One factor that works against an epidemic is the late planting of most of the Indiana's soybean crop. In the outbreaks of the past few years, severe SDS was associated with early planting. However, the unusually cool spring this year may have counteracted that generality to some extent.

SDS normally first appears in late July to early August. Heavy rain during early reproductive stages of soybeans seems to be critical for development of foliar symptoms of SDS. Leaf tissue between the major veins turns yellow, then brown. Soon, the leaflets die, shrivel, and often drop off, leaving the petioles (leaf stalks) attached. Brown stem rot may cause similar foliar symptoms, but the leaflets tend to remain attached to the petioles. To help distinguish between these diseases, split the lower stem and taproot. Plants with SDS will have a dark cortex, but white pith. With brown stem rot, the pith is often dark, but the cortex is normal.

A soybean specimen was received this week in the Plant and Pest Diagnostic Laboratory, from southern Indiana. It had lower stem symptoms suggestive of both SDS and brown stem rot. None of these plants showed interveinal necrosis on upper leaves, but the plants were only in the V6 to V7 stage of growth. Now is the time to start scouting fields for SDS and brown stem rot.

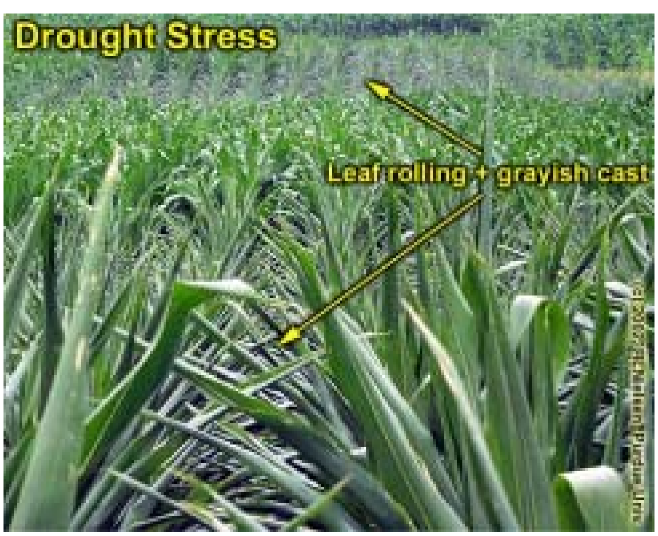
Agronomy Tips

Corn Suffering From Various Forms of WTMDS Syndrome - (*Bob Nielsen*) -

Back in mid-June, I discussed the fact that some of Indiana's corn crop was suffering from more than its fair share of Too Much Danged Stress (**Some Corn Afflicted With TMDS Syndrome**, *P&C Newsletter*, 6/14/02). In late June, I tried to reinforce the notion that a number of stresses are to blame this year and that every situation likely results from a different set or combination of stresses (**Too Much Dang Stress – Recap**, *P&C Newsletter*, 6/28/02). Last week, I discussed the importance of the timing of stress relative to crop growth stage plus the existence of other complicating stresses in determining whether or not subsequent crop stunting occurs (**Timing of Crop Stress is Critical!**, *P&C Newsletter*, 7/12/02).

I think it is reasonable to note at this point in time that a fair number of Indiana's corn fields continue to suffer from the effects of early stresses that are now compounded by the enduring dry spell that grips some areas in the state. The technical term for the problem is acronymized as **WTMDS**, otherwise known as Way Too Much Danged Stress!

As more and more of the state's corn crop enters the critical pollination period, the potential yield effect of severe drought stress increases to maximums of about 4% per day during the two weeks prior to silking, 8% per day during silking, and 6% per day during the two weeks following silking. Recognize that these estimated yield losses are in response to SEVERE drought stress as characterized by leaf rolling from sunup to sundown plus a grayish cast to the leaves. Lesser yield loss would be expected, if any, from lesser degrees of soil moisture deficits.



The potential yield loss results from a combination of possible factors, take your pick: 1) delayed silk emergence plus shorter pollen shed duration resulting in asynchrony (poor timing) of pollen shed and silk availability, 2) silks not receptive to pollen grain germination as a result of silk desiccation, and 3) abortion of fertilized ovules during the first week or two after pollination. Pollen viability itself is commonly not an issue during drought stress unless temperatures surpass 100ºF for a number of consecutive days.

The drought stress that prevails in some areas of the state would likely not be severe by itself. The various and sundry early season stresses in some fields are greatly compounding the effects of drought stress on the corn crop. The range of outward symptoms of the current drought stress can be categorized by increasing levels of severity from A) minor leaf rolling during the heat of the day, B) leaf rolling many hours of the day, C) leaf rolling from sunup to sundown plus a grayish cast to the leaves, D) leaf death (bleached straw color leaves), or E) dead corn plants. Obviously, the latter symptom directly affects yield potential as it affects harvestable plant population.

A recap of the variety of stresses that occurred earlier in the season or, in some cases, continue to linger in their drought-enhanced effects on the corn crop include:

- Reduced and shallow root systems due to severe corn rootworm injury, especially in later-planted corn fields,
- Restricted and shallow root systems due to compaction from preplant tillage of "wetter than desirable" soils this spring,
- Restricted and shallow root systems due to planter furrow compaction from planting "on the wet side" this spring,
- Reduced and shallow root systems due to excessively wet and cold soils during initial nodal root formation for early-planted corn,
- Reduced and shallow root systems due to excessively dry or cloddy soils during initial nodal root formation for later-planted corn,
- Reduced root systems due to nematode injury on sandier soils back in May,
- Reduced root systems due to nitrogen deficiency in areas of fields where significant nitrogen loss had occurred earlier,
- Reduced root systems due to inhibition by low soil pH in areas of fields.

Examples of limited root systems.

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A Fast & Accurate Pregnancy Test for Corn - (*Bob Nielsen*) -

- Silk clipping can interfere with pollination success
- Silks normally detach from fertilized ovules within days of successful pollination and thus can be used as an early indicator of pollination progress and/or success

As corn rootworm beetles, Japanese beetles, and other obnoxious critters feast on corn pollen, they often unintentionally clip ear silks to an extent that pollen capture may be impeded. While you may be tempted to apply insecticides at the first sign of these insects, Purdue entomologists tell us that treatment is not necessary unless the silks are being continuously clipped back to less than 1/2 inch long before pollination is 50 percent complete. Silk length is easy to measure, but how do you determine how the progress of pollination?

Within 10 to 14 days after silking, you can easily estimate the success of pollination by inspecting ears for kernel blister development. At that point in time, the developing kernels will resemble white blisters on the cob. But by then, the insect damage has already occurred. Luckily for us, the corn plant has a quicker mechanism for indicating the current progress of pollination.

Silk Detachment From Fertilized Ovules.

Remember that each potential kernel (called an ovule) on the ear develops its own silk that elongates and eventually emerges from the tip of the ear shoot. The silks provide the pathway for the pollen to access the ovules.

Once a single pollen grain is "captured" by a silk, the pollen grain germinates and develops a pollen tube that contains the male genetic material. Given adequate moisture and temperature, the pollen tube grows down the length of the silk within 24 hours and fertilizes the ovule.

Within 2 to 3 days after an ovule has been successfully fertilized, the base of the silk will collapse and detach from the immature kernel. The kernel itself will usually not be recognizable to the naked eye at this stage.

Silks of unfertilized ovules remain attached, however, and will continue to lengthen and be receptive to pollen for up to 10 days after emergence from the ear shoot. Even if never fertilized, silks will remain attached to the ovules. Within days of full silk emergence, therefore, pollination progress may be estimated on individual ears by estimating percent silk detachment.

The Ear Shake Technique.

For each ear, make a single lengthwise cut from the base of the ear shoot to the tip with a sharp knife, through the husk leaves to the cob. Slowly unwrap the husk leaves, taking care not to rip any silks from the ovules yourself. Then gently shake the ear. Silks of fertilized ovules will drop away, silks from unfertilized ovules will remain attached.

With practice, pollination progress can be easily determined by estimating the percentage of silks that fall away from the cob. Sampling several ears at random throughout a field will provide an indication of the progress of pollination for the whole field.

One Last Comment.

While the 'ear shake' technique will tell you how much of the ear has been fertilized, remember that pollination progress is also determined by pollen shed duration. Check the tassels in early to mid-morning hours to determine whether pollen shed is still occurring. If pollen shed is finished, it doesn't matter how badly those nasty insects are clipping silks. Unfertilized ovules will remain unfertilized ovules if there is no pollen left in the field. Spraying the bejeebers out of a field at that point is simply a costly form of revenge! For more information on the pollination process, see this week's accompanying articles on tassels and silks (*P&C* Newsletter, 7/19/02).

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Sex in the Corn Field: Tassel Emergence & Pollen Shed - (*Bob Nielsen*) -

- Corn produces both male and female flowers on the same plant
- The tassel contains the male flowers of the corn plant

Slowly and surely, the Indiana corn crop is moving into the critical flowering stages of pollen shed and silk emergence. While some early planted corn is already pollinating (9% as of 14 July according to USDA-NASS), much of the state's crop will pollinate during the next three weeks. Success or failure during this period of the corn plant's life will greatly influence the potential yield at harvest time.

As important as this process is to the determination of grain yield, it is surprising how little some folks know about the whole thing. Rather than leaving you to learn about such things "in the streets", I've developed this article and the accompanying one on silking that describe the ins and outs of sex in the corn field.

Remember that corn has both male flowers and female flowers on the same plant (a flowering habit called monoecious for you trivia fans.) Interestingly, both flowers are initially bisexual (aka 'perfect'), but during the course of development the female components (gynoecia) of the male flowers and the male components (stamens) of the female flowers abort, resulting in tassel (male) and ear (female) development.

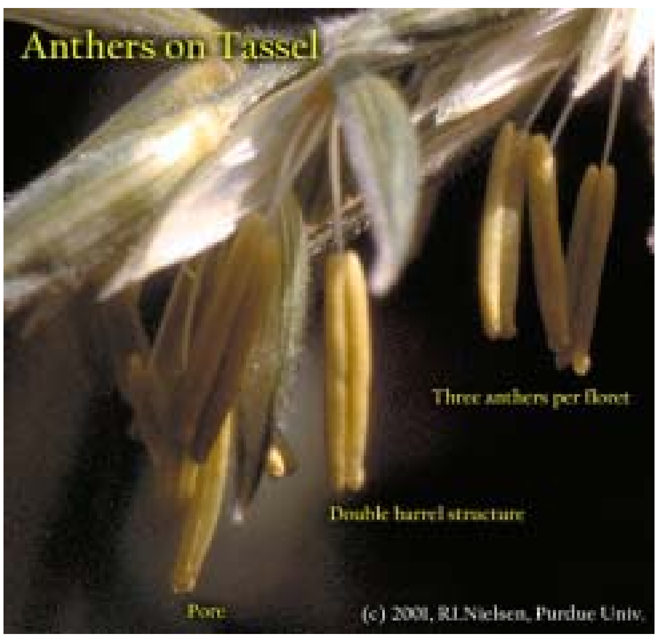
Technically, growth stage VT occurs when the last branch of the tassel emerges from the whorl (Ritchie et al., 1993). Portions of the tassel may be visible before the maximum leaf stage (final visible leaf collar) has occurred. Plant height is nearly at its maximum at growth stage VT. Pollen shed may begin before the tassel has completely emerged from the whorl.

The corn plant is most vulnerable to hail damage at growth stage VT since all of its leaves have emerged. Complete (100%) leaf loss at growth stage VT will usually result in complete (100%) yield loss by harvest. Even if pollination is successful, the ear shoots will usually die because few leaves remain to produce the necessary carbohydrates (by photosynthesis) to complete grain fill.

Between 500 to 1000 spikelets form on each tassel. Each spikelet contains two florets. Each floret contains three anthers. The anthers are those 'thingamajigs' that hang from the tassel during pollination. Under a magnifying lens, anthers look somewhat like the double barrel of a shotgun.

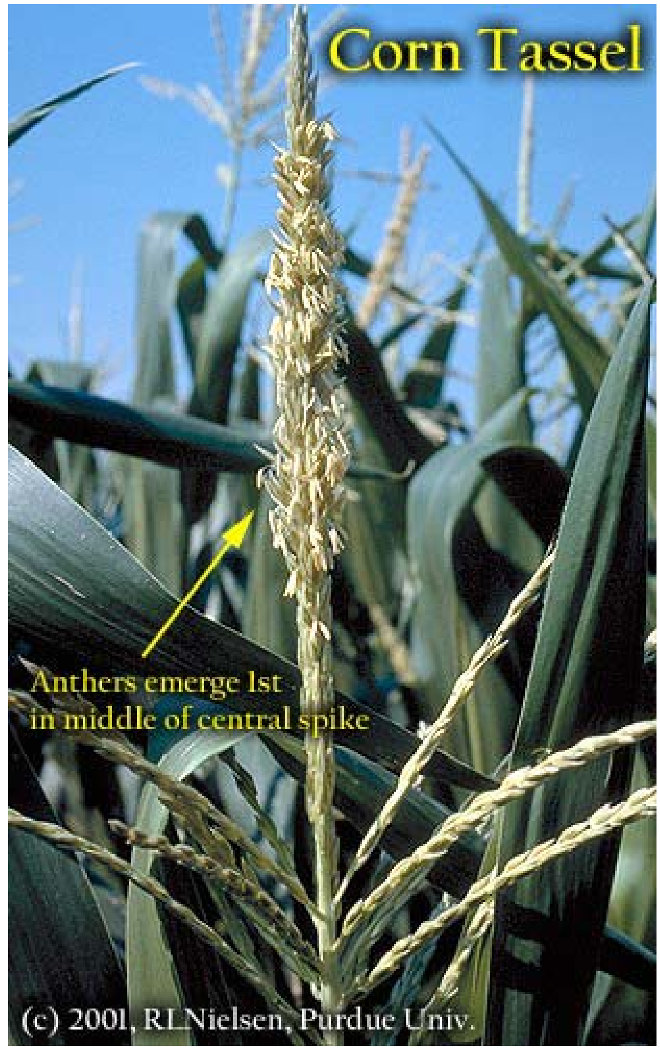
As these florets mature, anthers emerge from the glumes and pollen is dispersed through pores that open at the tips of the anthers. Pollen shed usually begins in

the mid-portion of the central tassel spike and then progresses upward, downward and outward over time. Anthers typically emerge from the upper flower first, while those from lower flower typically emerge later the same day or on following days. Spent anthers eventually drop from the tassel and are sometimes mistaken for the pollen itself when observed on the leaves or ground.



The yellow 'dust-like' pollen that falls from a tassel represents millions of individual, nearly microscopic, spherical, yellowish- or whitish translucent pollen grains. Each pollen grain contains the male genetic material necessary for fertilizing the ovary of one potential kernel.

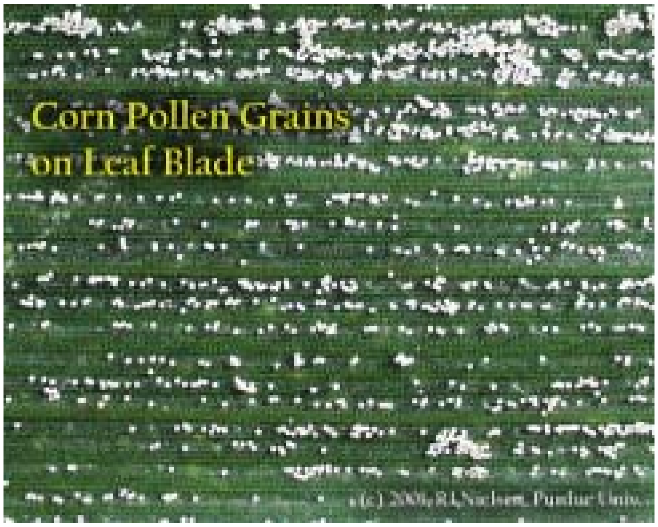
The outer membrane of a pollen grain is very thin. Once dispersed into the atmosphere, pollen grains remain viable for only a few minutes before they desiccate. Yet, with only a 15 mph wind, pollen grains can travel as far as Ω mile within those couple of minutes.



Therein lies the concern of the potential for pollen 'drift' from a transgenic corn field to an adjacent non-transgenic corn field and the risk of transgenic 'contamination' of grain intended for non-transgenic sale. The good news is that recent research suggests that the overwhelming majority of a corn field's pollen load is shed in the field itself.

All of the pollen from a single anther may be released in as little as three minutes. All the anthers on an individual tassel may take as long as seven days to finish shedding pollen, although the greatest volume of pollen is typically shed during the second and third day of anther emergence. Because of natural field variability in plant development, a whole field may take as long as 14 days to complete pollen shed.

Peak pollen shed usually occurs in mid-morning. Some research indicates that pollen shed decreases after temperatures surpass 86°F. A second 'flush' of pollen often occurs in late afternoon or evening as temperatures cool. Pollen shed may occur throughout most of the day under relatively cool, cloudy conditions.



Weather conditions influence pollen shed. If the anthers are wet, the pores will not open and pollen will not be released. Thus, on an average Indiana summer morning following a heavy evening dew, pollen shed will not begin until the dew dries and the anther pores open. Similarly, pollen is not shed during rainy conditions. Cool, humid temperatures delay pollen shed, while hot, dry conditions hasten pollen shed.

Extreme heat stress (100°F or greater) can kill corn pollen, but fortunately the plant avoids significant pollen loss by virtue of two developmental characteristics. First of all, corn pollen does not mature or shed all at once. Pollen maturity and shed occur over several days and up to two weeks. Therefore, a day or two of extreme heat usually does not affect the entire pollen supply. More importantly, the majority of daily pollen shed occurs in the morning hours when air temperature is much more moderate.

Some Related References:

Ritchie, S.W., J.J. Hanway, and G.O. Benson. 1993. How a Corn Plant Develops. Iowa State Univ. Sp. Rpt. No. 48. On the Web at <http://maize.agron.iastate.edu/corngrows.html > (last verified 7/17/02).

Russell, W.A. and A.R. Hallauer. 1980. Corn. (a chapter in) Hybridization of Crop Plants. American Soc. of Agronomy-Crop Science Soc. of America. Madison, WI.

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Sex in the Corn Field: Silk Emergence - (*Bob Nielsen*) -

- Corn produces both male and female flowers on the same plant
- The ear contains the female flowers of the corn plant
- Severe soil moisture deficits can delay silk emergence and disrupt the synchrony of pollen shed and silk availability, resulting in poor kernel set

As important as the process of pollination is to the determination of grain yield in corn, it is surprising how little some folks know about the details of sex in the corn field. Rather than leaving you to learn about such things "in the streets," I've developed this article and the accompanying one on tassels and anthers that describe the ins and outs of this critical period of the corn plant's life cycle.

Remember that corn has both male flowers and female flowers on the same plant (a flowering habit called monoecious for you trivia fans.) Interestingly, both flowers are initially bisexual (aka 'perfect'), but during the course of development the female components (gynoecia) of the male flowers and the male components (stamens) of the female flowers abort, resulting in tassel (male) and ear (female) development.

The silks that emerge from the ear shoot are the functional stigmas of the female flowers of a corn plant. Every potential kernel (ovule) on an ear develops its own silk. Each silk must be pollinated in order for the ovule to be fertilized and develop into a kernel. Typically, up to 1000 ovules form per ear, even though we typically harvest only 400 to 600 actual kernels per ear.

Technically, growth stage R1 (Ritchie et. al., 1993) for a given ear is defined when even a single silk strand is visible from the tip of the husk. A field is defined as being at growth stage R1 when silks have emerged on at least 50% of the plants.

Silk Elongation and Emergence

Silks begin to elongate from the ovules about 10 days prior to silk emergence from the husk. Dissection of young developing ears prior to silk emergence from the husk will reveal silk elongation beginning first from the basal ovules of the cob, then proceeding up the ear over time.

In a similar acropetal fashion, silks from the basal (butt) portion of the ear typically emerge first from the husk, while the tip silks generally emerge last. Complete silk emergence from an ear generally occurs within four to eight days after the first silks appear.

As silks first emerge from husk, they lengthen as much as 1-1/2 inches per day for the first day or two, but gradually slow over the next several days. Silk elongation occurs by expansion of existing cells, so elongation rate slows as more and more cells reach maximum size.

Silk elongation stops about 10 days after silk emergence, regardless of whether pollination occurs, due to senescence of the silk tissue. Unusually long silks can be a diagnostic symptom that the ear was not successfully pollinated.

Silks remain receptive to pollen grain germination up to 10 days after silk emergence. After 10 days without being pollinated, silk receptivity decreases rapidly. Natural senescence of silk over time results in collapsed tissue that restricts continued growth of the pollen tube. Silk emergence usually occurs in close synchrony with pollen shed, so that duration of silk receptivity is normally not a concern. Failure of silks to emerge in the first place, however, does not bode well for successful pollination.

Pollination and Fertilization

For those of you serious about semantics, let's review two definitions relevant to sex in the corn field. Pollination is the act of transferring the pollen grains to the silks by wind or insects. Fertilization is the union of the male gametes from the pollen with the female gametes from the ovary. Technically, pollination usually occurs successfully (i.e., the pollen reaches the silks), but unsuccessful fertilization results in poor kernel set on the ears.

Pollen grain germination occurs within minutes after a pollen grain lands on a receptive (moist) silk. A pollen tube, containing the male genetic material, develops and grows inside the silk, and fertilizes the ovary within 24 hours. Pollen grains can land and germinate anywhere along the length of an exposed silk. Many pollen grains can germinate on a receptive silk, but typically only one will successfully fertilize the ovary.

Silk Emergence Failure

Severe Drought Stress. The most common cause of incomplete silk emergence is severe drought stress. Silks have the greatest water content of any corn plant tissue and thus are most sensitive to moisture levels in the plant. Severe moisture deficits will slow silk elongation, causing a delay or failure of silks to emerge from the ear shoot. If the delay is long enough, pollen shed may be almost or completely finished before receptive silks are available; resulting in nearly blank or totally blank cobs. Severe drought stress accompanied by low relative humidity can also desiccate exposed silks and render them unviable to pollen germination.

The severity of drought stress required for significant silk emergence delay or desiccation can probably be characterized by severe leaf rolling that begins early in the morning and continues into the early evening hours. Such severe leaf rolling is often accompanied by a change in leaf color from "healthy" green to a grayish-tinged green that may eventually die and bleach to a straw color.

Silk Clipping by Insects. Although technically not defined as silk emergence failure, severe silk clipping by insects such as corn rootworm beetle or Japanese beetle nonetheless can interfere with the success of pollination by decreasing or eliminating viable or receptive exposed silk tissue. Fortunately, unless the beetle activity is nonstop for days, continued elongation of silks from the husk will expose undamaged and receptive silk tissue at the rate of about one inch or more per day.

Some Related References:

Ritchie, S.W., J.J. Hanway, and G.O. Benson. 1993. How a Corn Plant Develops. Iowa State Univ. Sp. Rpt. No. 48. On the Web at <http://maize.agron.iastate.edu/corngrows.html> (last verified 7/17/02).

Russell, W.A. and A.R. Hallauer. 1980. Corn. (a chapter in) Hybridization of Crop Plants. American Soc. of Agronomy-Crop Science Soc. of America. Madison, WI.

Don't forget, this and other timely information about corn can be viewed at the Chat 'n Chew Café on the World Wide Web at <http://www.kingcorn.org/cafe>. For other information about corn, take a look at the Corn Growers' Guidebook on the World Wide Web at <http://www.kingcorn.org/ >

Pest Management Tips

Integrated Pest Management
Purdue University

Predator Impacts on Soybean Aphid – (*Doug Landis, Entomology & Center for Integrated Plant Systems, Michigan State University*) -

Walking a soybean field this July is quite a different experience from 2001. While soybean aphids and predators were highly visible last year, populations of both appear to be lower in 2002. Understanding how predators respond to prey populations can help make sense of this situation.

Predators can impact soybean aphid populations in two important ways. First, when aphids initially migrate into a soybean field in the spring, predators already present there may encounter and eat them almost as fast as they arrive. This prevents potential colonies from ever forming. Biological control specialists recognize that such early season predation is a key factor determining if predators will or will not prevent an aphid outbreak. However, because the population of both aphids and predators at that time is very low, this process goes largely unnoticed by producers and is in fact quite difficult for entomologists to study.

Later in the season as aphid populations build to noticeable numbers, predators aggregate in these aphid hot spots. If enough prey are present, adult predators may lay eggs and their offspring will also feed on the colony. This process is much more visible and can result in very high populations of predators and subsequent declines in aphid populations. Many producers observed this process in 2001 when large numbers of the multicolored Asian lady beetle were very apparent in soybean fields.

Given the recent national news regarding forest fires in the western US, I like to use the following analogy. My mental model is to think of aphid colonies as little fires in a soybean field. Following aphid immigration there are hundreds of tiny fires in the field, some of which go out by themselves or are quickly extinguished by predators (my mental fire fighters). Other fires may be suppressed but left still smoldering (predators reduce but do not eliminate a colony) while some fires increase rapidly in size and intensity (i.e., were missed by predators). Over time, these bigger spot fires (developing colonies) attract more attention from the predators and are suppressed or extinguished. On the other hand, those formerly smoldering fires may now attract less predator attention and may subsequently increase in size and intensity.

In this way one can see that if the predators are abundant and quick to do their job early in the season, they may in fact prevent outbreak from ever occurring in a field. We have been researching this process in Michigan soybeans since 2001. Last year the aphids escaped early control and went on to form large populations in many fields. So far this year, it appears the firefighters (predators) are winning the overall battle in the fields we are studying.

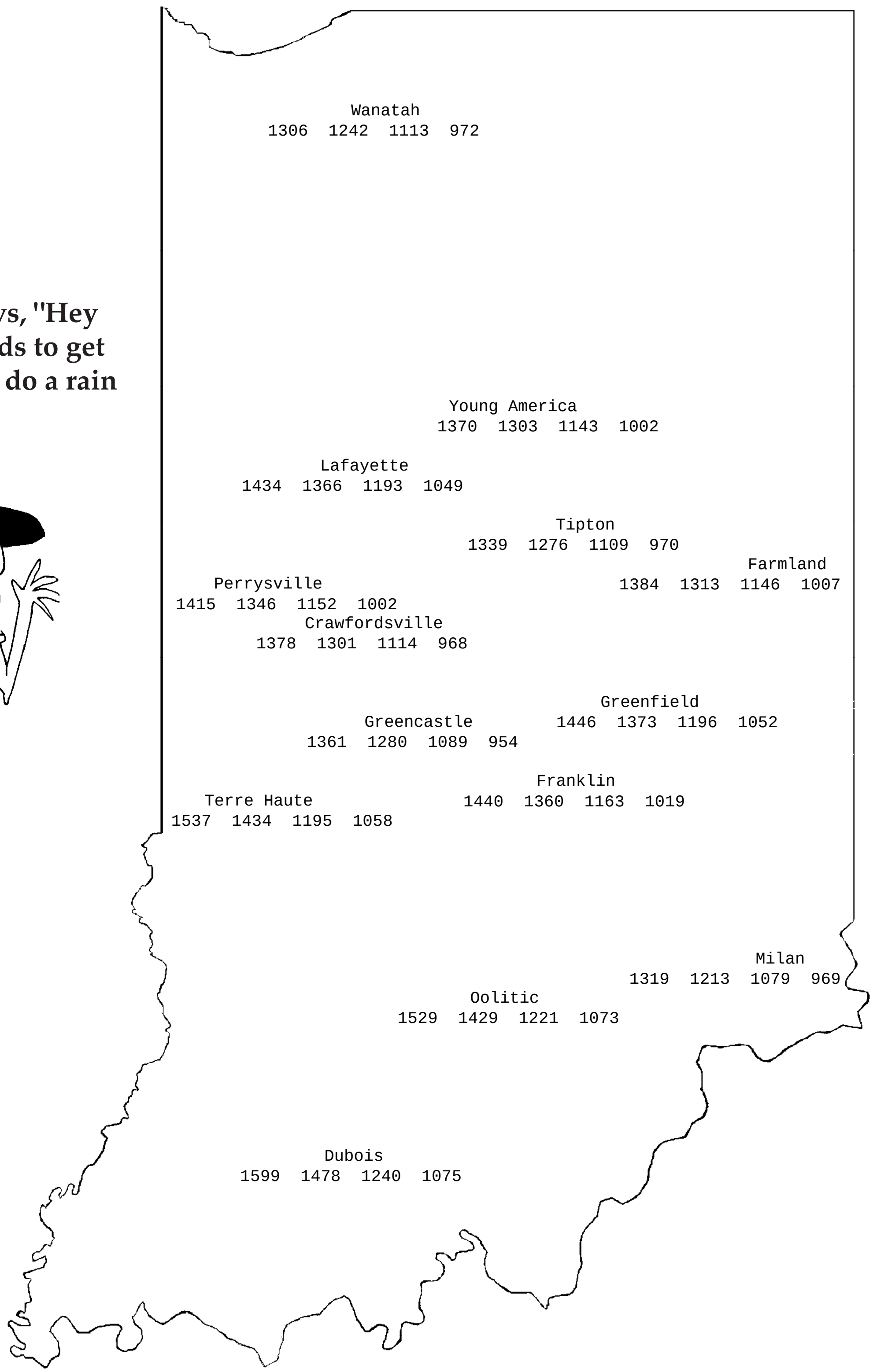
This article is being reprinted with permission from Michigan State University's *Field Crop Advisory Team Alert*, Volume 8, Number 13, July 11, 2002.

Weather Update

MAP KEY			
Location			
GDD(2)	GDD(10)	GDD(43)	GDD (75)

Temperature Accumulations from Jan. 1 to July 17, 2002

GDD(2) = Growing Degree Days from April 21 (2% of Indiana's corn planted), for corn growth and development
GDD(10) = Growing Degree Days from May 5 (10% of Indiana's corn planted), for corn growth and development
GDD(43) = Growing Degree Days from May 26 (43% of Indiana's corn planted), for corn growth and development
GDD(75) = Growing Degree Days from June 2 (75% of Indiana's corn planted), for corn growth and development



4" Bare Soil Temperatures 5/17/02

Location	Max.	Min.
Wanatah	95	77
Columbia City	94	70
Winamac	96	74
W Laf Agro	91	77
Tipton	86	76
Perrysville	85	75
Crawfordsville	75	70
Terre Haute	96	77
Vincennes	88	76
Oolitic	81	74
Dubois	93	74

Bug Scout says, "Hey everyone needs to get out there and do a rain dance!!!"

Pest&Crop
Extension Entomology Office
Department of Entomology
Purdue University
1158 Smith Hall
West Lafayette, IN 47907-1158

http://www.entm.purdue.edu/Entomology/ext/targets/newslett.htm