Purdue Cooperative Extension Service

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In This Issue

Insects, Mites, And Nematodes

Seedcorn Maggot Potential for Planted Soybean - (*John Obermeyer and Larry Bledsoe*)

- Seedcorn maggot are attracted to fields with abundant vegetation and/or animal manure.
- Winter annual weed control goes a long way in preventing infestations.
- Most corn seed is already protected by seed-applied insecticides, soybean is not.
- Evaluate fields to determine level of damage and need for replanting.

Planting activity was at breakneck speed before the rain this past week. Some soybean 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 on damaged soybean seed

seedcorn maggot. You are familiar with the many drawbacks of planting into weedy fields, such as black cutworm, but seedcorn maggot is a potentially serious pest that is often forgotten.

Seedcorn maggot pupa on damaged seedling, damage is done!

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, attracting flies to climb down into the furrow and deposit eggs in decaying weeds next to the seed. Soon the yellowish-white maggots, up to 1/4 inch long, burrow into the seeds or underground portion of plants and feed. 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 soil surface, so the damage is usually first observed as skips in the row where plants do not emerge, or if they emerge, die back. The problem will be worsened by cool-wet soils during the germination period. Sound familiar!

Low rates of Cruiser or Poncho is present on the vast majority of corn seed sold in Indiana and is very effective on seedcorn maggot. Soybean seed, on the other hand, is typically *not* treated with an insecticide and would be prone to damage if planted into weedy/manured fields. Should replanting be necessary, insecticide on the soybean seed (i.e., Cruiser or Gaucho) is probably not necessary, as the seedcorn maggot will probably have already pupated and soon to emerge as an adult fly.

Consider Corn Borer-Bt for Late-Planted Corn in Southern Indiana – (*John Obermeyer*)

Should wet conditions persist for southern Indiana producers, and switching of corn maturities becomes necessary, one might obtain varieties with Bt for corn borer if available. Because corn planted in a week or two will be very late to pollinate compared to most neighboring fields, second-generation corn borer moths (European and/or Southwestern) will be attracted to these fields for egg-laying. In addition corn earworm and fall armyworm will find these late-planted fields to their liking. If producers have an option in seed selection, they may consider using Bt for corn borer in their late planted or replanted acres. This “built-in” protection may protect yield and reduce harvest losses from these later-season insects.

Thanks to the Black Cutworm Pheromone Trap Cooperators! – (*John Obermeyer*)

This is the last week of the “Black Cutworm Adult Pheromone Trap Report” for this year. As addressed last week, this year’s moth counts have been lower than normal, and this past week hasn’t been any different. This doesn’t take away from the dedication these volunteers have shown in daily checking messy traps, plucking out captured moths, and reporting counts for the benefit of all of Indiana. Please look over the list of 37 cooperators, should you know them, please thank them. It really is valuable information.

As one trap cooperator pointed out to me while reporting their catch today, “Just this week I got an alert from a certain company that black cutworms had been caught and that we needed to be vigilant in scouting and spraying their insecticide. This just burns me up when I know for a fact that we have had very low counts. Yes, moths had been caught. Yes, we should scout our fields. No, we should not be spraying insecticide unless there is a real threat. How can these marketers sleep at night!? It just bothers me that they prey on fear and ignorance instead of education and making sound decisions based on something, anything other than nothing but ignorance.”

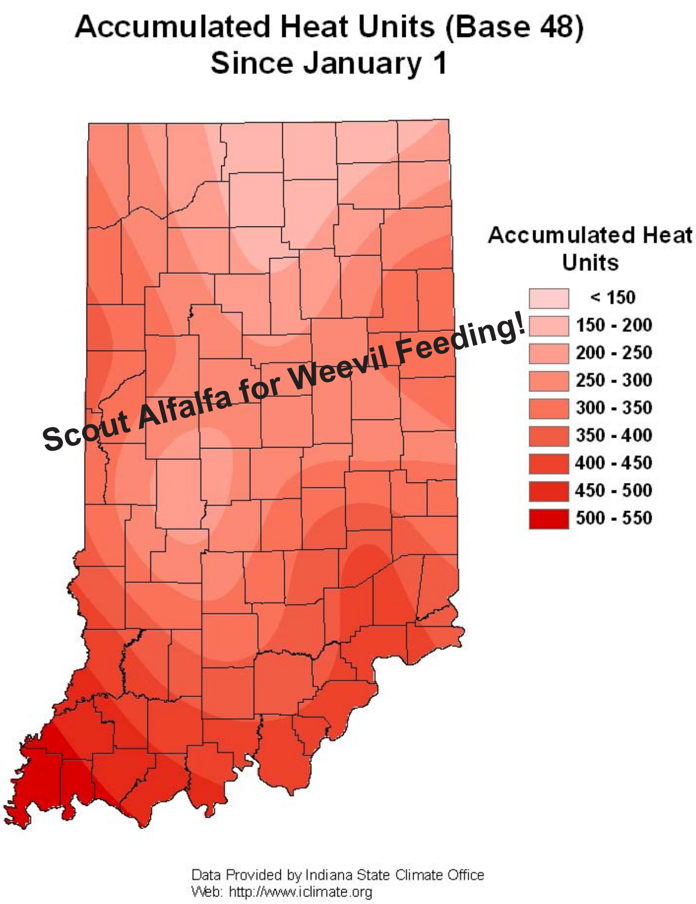
I can’t say it any better. Happy scouting!

Armyworm, Certainly Worth Monitoring High-Risk Fields – (*John Obermeyer*)

The first generation armyworm moth flight has apparently peaked, as numbers are declining. Though our captures have paled in comparison to Kentucky’s, certainly the threat exists, especially in southern and northeastern counties. The next two weeks will determine whether the moths were successful in mating and egg-laying on preferred grassy crops. Too, the larvae are prone to fungal diseases in wet weather, certainly present in southern counties.

Consider scouting grass forages, wheat, and corn no-tilled into grass cover crops. Initially the larvae are only about 0.5 inch long and their marginal leaf feeding appears insignificant. Then what seems overnight, they grow, and their damage dramatically worsens. Let us know what you are finding, 765-494-4563, obe@purdue.edu.

Young armyworm larvae in corn seedling whorl



Nematode Updates 2008 - Corn Nematodes - (*Jamal Faghihi and Virginia Ferris*).

We had warmer soil temperatures early in the spring followed by cool and wet weather. This is a perfect recipe for Needle nematode damage. Early warmth has made most of the plant parasitic nematodes, including needle nematode, to become active and ready to invade the young corn seedling. These nematodes will invade the corn root system as soon as corn germinates. Young corn seedlings are vulnerable to the tiny nematodes as they aggregate around roots and with the aid of hollow needle-type mouth parts suck the juice out of the corn root. So, if these conditions persist, we anticipate encountering problems from needle nematode on corn. Nematode activity usually starts when soil temperatures reach 50°F. If you have noticed patches of stunted young corn seedlings in sandy soil, needle nematode might be the problem. In this case, you may wish to send the entire root system with adjacent soil to the Nematology Laboratory, address below, at Purdue University for analysis, to rule out the nematodes. Samples must be kept cool and prevented from drying.

Last year we experienced a possible emergence of another corn nematode called Lance nematode. We received several samples with unusually high numbers of Lance nematodes. These nematodes behave differently from the needle nematode. While Needle nematodes feed only from outside of the roots, Lance nematode is capable of either feeding from outside of the roots or from the inside after entering the roots. These nematodes are shorter than needle nematode but they are large relative to other plant parasitic nematodes that parasitize corn. They are tube-like, and less than 1/16th of inch long. The Lance nematodes are not visible on the root system and they have to be extracted by means of special laboratory procedures. While Needle nematodes disappear when the soil temperature becomes too hot, Lance nematode continues to feed throughout the growing season. Early symptoms, e.g., patches of stunted corn, are similar for both nematodes but corn usually recovers from Needle nematode damage. However, corn suffering from Lance nematode infestation continues to show signs of damage. Often, we are not capable of recovering Needle nematodes when the soil temperature reaches above 85 F, but we are capable of recovering Lance nematodes even though the soil temperatures might be high.

The sampling procedures for both nematodes are similar. However, samples for the Needle nematode must be taken before soil temperatures become too hot, usually 6 weeks after planting. Soil samples must be taken from a depth of 4-6 inches, as close as possible from the infected plants. Early in the season, it is essential to enclose the entire root system with surrounding soil of the infected plant. A more detailed sampling procedure can be found on the following website: <http://www.entm.purdue.edu/nematology/samples.html>.

Last year we cautioned you to be on the lookout for a new corn nematode called Corn Cyst Nematode. So far, the only report of the presence of this nematode in the Midwest has been in Tennessee. But, we need to be vigilant and continue to look at the corn root systems for presence of cyst nematodes on the roots. These nematodes look similar to the Soybean Cyst Nematode, a nematode that we are accustomed to seeing on soybean roots but never on the corn root.

If you have any questions about corn nematode or any other kind of plant parasitic nematodes, you can contact Jamal Faghihi at 765-494-5901 or send an email to jamal@purdue.edu. Soil samples for nematode analysis can be sent to: Nematology laboratory, Purdue University, Department of Entomology, Smith Hall, 901 W. State Street, West Lafayette, IN 47907-2089. The cost for nematode analysis for each sample remains at $10/sample.

Black Cutworm Adult Pheromone Trap Report
Week 1 = 5/1/08 - 5/7/08 Week 2 = 5/8/08 - 5/14/08

County	Cooperator	BCW Trapped Wk 1	BCW Trapped Wk 2	County	Cooperator	BCW Trapped Wk 1	BCW Trapped Wk 2
Adams	Roe/Mercer Landmark	2	2	Lake	Kleine/Kleine Farms	2	
Allen	Gynn/Southwind Farms	3	0	Marshall	Barry/Fulton-Marshall Co-op	9	6
Clay	Bower/Ceres Solutions, Brazil	0	2	Marshall	Misch/Pioneer	3	0
Clay	Bower/Ceres Solutions, Clay City	4	5	Miami	Sweeten/Advanced Ag Solutions	0	1
Clinton	Foster/Purdue Entomology	0	2	Newton	Ritter/Purdue CES	5	0
Daviess	Venard/Venard Agri-Consulting	1	0	Putnam	Nicholson/Nicholson Consulting	1	2
Elkhart	Willard/Crop Tech Consulting	0		Randolph	Boyer/DPAC	0	
Fayette	Schelle/Fayette County			Rush	Doerstler/Pioneer Hi-Bred	2	0
Fulton	Jenkins/Fulton-Marshall Coop	1	0	Starke	Wickert/Wickert Agronomy Services	0	
Gibson	Hirsch/Hirsch Family Farms	4		Sullivan	Bower/Ceres Solutions, Farmersburg	0	0
Green	Byarley/Pioneer-Worthington			Sullivan	Bower/Ceres Solutions, New Lebanon		3
Hamilton	Beamer/Beck's Hybrids	0		Sullivan	Bower/Ceres Solutions, Sullivan E		1
Jay	Shrack/RanDel	5	5	Sullivan	Bower/Ceres Solutions, Sullivan W		2
Jennings	Biehle/SEPAC	1	0	Tippecanoe	Obermeyer/Purdue Entomology	6	6
Knox	Hoke/SWPAC	0	0	Tipton	Johnson/Pioneer Hi-Bred	1	
Knox	Bower/Ceres Solutions, Fritchton	3	2	Warren	Mroczkiewicz/Syngenta	2	2
Knox	Bower/Ceres Solutions, Oaktown	6	2	White	Reynolds/ConAgra Snack Foods	0	
Knox	Bower/Ceres Solutions, Vincennes U			Whitley	Walker/NEPAC	0	2
Knox	Bower/Ceres Solutions, Westphalia	5	2				

Black Light Trap Catch Report - (*John Obermeyer*)

County/Cooperator	4/29/08 - 5/5/08							5/6/08 - 5/12/08						
	VC	BCW	ECB	SWCB	CEW	FAW	AW	VC	BCW	ECB	SWCB	CEW	FAW	AW
Dubois/SIPAC Ag Center	0	0	0	0	0	0	8	0	1	0	0	0	0	27
Jennings/SEPAC Ag Center	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Knox/SWPAC Ag Center	0	1	0	0	0	0	30	0	0	0	0	0	0	5
LaPorte/Pinney Ag Center	0	0	0	0	0	0	3	0	0	0	0	0	0	3
Lawrence/Feldun Ag Center	0	1	0	0	0	0	75	1	1	0	0	0	0	32
Randolph/Davis Ag Center	0	1	0	0	0	0	81							
Tippecanoe/TPAC Ag Center	0	1	0	0	0	0	30	0	0	0	0	0	0	14
Whitley/NEPAC Ag Center	0	1	0	0	0	0	234							

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

Weeds

Shattercane Interference and Nitrogen Accumulation in Roundup Ready Corn – (*Bill Johnson and Glenn Nice*)

Shattercane is an especially competitive weed because plant heights can reach 10 feet, which results in crop shading, and the weed is similar to corn in growth and nutritional needs. There are few published references on shattercane interference in corn. Beckett et. al., (1988) reported that shattercane interference in corn resulted in a 22% to 75% reduction in grain yield. They also determined that on a per plant basis, shattercane is more than twice as detrimental to corn yield as giant foxtail.

The goal of this article is to raise awareness of the effects of early-season weed competition on corn in weed management systems that are heavily reliant on a postemergence herbicide that will control relatively large weeds. The information presented in this specific article would apply to use of glyphosate in Roundup Ready corn, Liberty in Liberty Link corn, or Accent, Beacon, Steadfast, Option, or Equip in non-transgenic corn. All of these herbicides will control relatively large shattercane in corn unless the population is ALS resistant in which case the ALS herbicides will be less effective. Severe shattercane infestations in the eastern cornbelt are not as common as some other weeds such as foxtails, lambsquarters, and giant ragweed. However, our field surveys over the last three years have indicated that it is prevalent in almost every county sampled and Glenn, Tom and I receive a number of calls each year about shattercane management in corn. From a competitive standpoint, shattercane and johnsongrass would be similar in the amount of yield loss caused by interference in corn.

Prior to the introduction of Accent and Beacon about 20 years ago, shattercane was controlled in corn with preemergence herbicides and cultivation. Postemergence herbicides including Accent, Pursuit, Beacon, Steadfast, Option, Equip, Liberty, and glyphosate (Roundup/others) have been shown to be much more effective than soil-applied herbicides and cultivation for control of shattercane. The respective labels for most of these herbicides indicate that they can be applied to shattercane up to 12 inches tall. In production fields it is common to delay applications until plants are 12 to 18 inches tall. This delay in application timing is to ensure that most of the seedlings have emerged and there is adequate leaf area for spray coverage. The concern we have with applications to 12 to 18 inch tall plants is that even though effective control can be attained, yield loss had occurred due to weed interference and growers are unaware of it.

Nitrogen is a major economic input and is utilized in the plant to produce enzymes and proteins. Nitrogen has been shown to be a critical factor in weed competition. Research has shown that weeds reduce not only crop grain yield, but also the amount of macronutrients found in the corn plant. Yield reductions due to weed interference are increased by nitrogen deficiencies. However, corn-weed interactions are complex and additional stresses, such as drought have varying effects on yield losses.

We conducted field experiments to determine the impact of shattercane interference on corn grain yield and nitrogen uptake on a silt loam soil with 2.6% organic matter (Hans and Johnson 2002). A glyphosate-resistant corn variety was planted and atrazine was applied premergence and used to control all weeds except shattercane. In essence, this system is similar to conditions experienced in production fields when all weeds are controlled by soil applied herbicides and shattercane comes through the soil applied herbicides and requires postemergence treatments to clean up the escapes.

Shattercane emerged at the same time as corn and our treatments consisted of glyphosate applied to various plots when shattercane was either 3, 6, 9, 12, 15, or 18 inches tall (Table 1). After glyphosate applications to specific plots, those plots were hand-weeded weekly thereafter to maintain weed-free conditions after the early-season interference. Average shattercane density in this experiment was 18 plants per square foot. Corn tissue N content and yield is shown in Table 2.

Table 1. Shattercane removal height and corresponding dates and corn growth when glyphosate was applied in 1999 and 2000 at Columbia, MO.

	1999			2000		
	Date	DAP[a]	Corn Growth Stage[b]	Date	DAP[a]	Corn Growth Stage[b]
3	May 27	24	V3	May 15	28	V2
6	June 8	36	V6	May 24	37	V4
9	June 11	39	V7	May 29	42	V5
12	June 15	43	V8	June 2	46	V6
15	June 17	45	V8	June 6	50	V6
18	June 21	49	V9	June 8	52	V7

[a]Days after planting (DAP): May 3, 1999 and April 17, 2000.
[b]Corn growth stage is designated by the number of fully exposed leaf collars. V2=two fully exposed leaf collars, V3 = 3 fully exposed leaf collars, etc.

Corn yields were quite different between years because of the drought that began in the latter half of the 1999 season and timely rainfall late in the 2000 season. Season-long shattercane interference resulted in an 85% yield loss in 1999 and a 43% yield loss in 2000 (Table 2). Yield reductions occurred when shattercane was allowed to remain with corn until 12 inches tall before herbicide treatment. In both years, late season corn biomass N content was highly

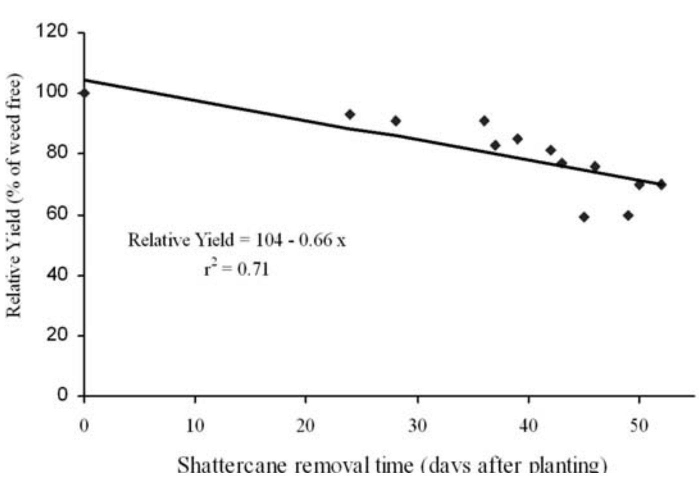
Table 2. Corn grain yield and biomass nitrogen at corn harvest in 1999 and 2000 at Columbia, MO.

Shattercane Removal Height (in)	1999 Corn Grain Yield (bu/A)	1999 Corn Tissue Nitrogen Content (lb N/A)	2000 Corn Grain Yield (bu/A)	2000 Corn Tissue Nitrogen Content (lb N/A)
Weed free	75	72	214	128
3	70	64	195	95
6	68	66	178	119
9	64	77	174	94
12	58	65	162	85
15	44	40	149	93
18	45	56	149	73
Weedy check	11	9	123	62
LSD (0.05)	15	24	48	35

correlated (r = 0.95 and 0.84, respectively) with corn yield. When shattercane was allowed to reach the maximum recommended height for nicosulfuron or primisulfuron application (12 inches), significant yield losses occurred and shattercane accumulated 10 and 20 lb N/A, while corn accumulated 10 and 16 lb N/A, respectively, in 1999 and 2000 (data not shown). This indicates that shattercane can accumulate significant amounts of N early in the season, similar to that reported for annual grasses in another article we posted earlier.

In addition, when shattercane reached 12 inches in height in these experiments, corn was at the V8 stage in 1999 and the V6 stage in 2000. The maximum recommended growth stage for most ALS corn herbicides that control grasses is V6. This is the stage in which the number of kernels/cob is determined. Herbicide stress at this stage can result in fewer kernels/cob, malformed ears and yield loss in certain hybrids.

Corn yields were converted to a percentage of the weed-free treatment in each year and are shown in Figure 1. This graphic shows the relative corn yield at each shattercane



removal timing in days after planting. This graphic shows that corn yield was reduced 0.66% per day for each day the herbicide application was delayed past the optimal stage which occurred about 20 to 30 days after planting. In terms of real numbers, in a field with a 200 bu/A yield potential, this equates to over 1 bu/A/day in yield loss if the optimal timing for removal is missed!

The take home message from this study is that if soil-applied herbicides are not used or they have little or no effect on reducing shattercane infestations, the herbicide used, shattercane should be controlled before it reaches 12 inches tall if the average density is 18 plants per square foot or greater to avoid yield losses. From a management standpoint there are a few soil applied herbicides which provide suppression of shattercane and could be effective in reducing early-season density and competitiveness. In the Weed Control Guide for Ohio and Indiana, we have listed the relative effectiveness of a number of soil applied herbicides for shattercane in the weed response table on page 37. Keep in mind that none of them will provide complete control and that use of the upper end of the labeled rate for a soil type will be required to provide any meaningful activity. Herbicides which contain a chloroacetamide (acetochlor, metolachlor, dimethenamid (Outlook), flufenacet (Define)) provide some suppression if the rate is near the upper end of the labeled use rate. In addition, for low cost shattercane suppression, Prowl would be economical to use in these situations, but keep in mind that Prowl cannot be incorporated or corn injury will occur. Balance Pro also provides some suppression and is a common tankmix partner with atrazine and atrazine premixes.

References:

Beckett, T. H., E.W. Stoller, and L. M. Wax. 1988. Interference of four annual weeds in corn (Zea mays). Weed Sci. 36:764-769.

Hans, S. R., and W. G. Johnson. 2002. Influence of shattercane (Sorghum bicolor L. Moench.) on corn (Zea mays L.) yield and nitrogen accumulation. Weed Technol. 16:787-791.

Delayed Preemergence and Early Postmergence Herbicides in Corn – (*Mark Loux with comments from Bill Johnson*)

This article originally appeared in the Ohio State CORN Newsletter. I have made a few edits to make this applicable to our situations here in Indiana.

We have observed quite a variety of weed control situations in cornfields across the state. A lot of corn was planted north of Indianapolis 2-3 weeks, and did not really receive adequate rainfall for herbicide activation until this past weekend. Wet weather in the extreme northern part of the state has resulted in situations where the corn was planted a week or more ago, but herbicides have not yet been applied. Wet weather south of Indianapolis has resulted in very little corn planted at all. Regardless of where your at, it's a good bet that weeds will have emerged in many fields before soil applied herbicides were activated or could be applied. The result of this can be that what was initially supposed to be a preemergence herbicide application must be adapted to an early postemergence situation. The good news here is that most preemergence corn herbicides can be applied to emerged corn, and some of them have enough foliar activity to control small, emerged weeds without the need to include postemergence herbicides. In addition, the majority of the corn planted in 2008 is resistant to glyphosate and/or glufosinate (Liberty/Ignite), and these can be combined with preemergence herbicides to control weeds emerged at the time of application.

An early postemergence application of foliar plus residual herbicides can be just as effective at preventing yield loss due to weed interference, compared with a program of consisting sequential applications of preemergence and postemergence herbicides. However, early postemergence treatments may not provide adequate "season-long" control of weeds that tend to emerge late, such as grasses, giant ragweed, and waterhemp. They also will not provide adequate control of weeds that are not well controlled by preemergence herbicides, such as shattercane, johnsongrass, and burcucumber. Fields treated early postemergence should be scouted later in the season to determine if an additional postemergence herbicide is needed. Some considerations for an early postemergence approach:

1) Most preemergence corn herbicides are also labeled for application to emerged corn. Notable exceptions are products containing isoxaflutole (Balance, Radius, Epic) or simazine. Corn herbicide descriptions in the current "Weed Control Guide for Ohio and Indiana" contain information on maximum size of corn for postemergence application of preemergence herbicides. A recent article on the Iowa State University Weed Science website <http://www.weeds.iastate.edu>, "Delayed PRE herbicide applications in corn", also indicates the maximum crop and weed sizes.

2) Be sure to check labels or consult manufacturer representatives, local agronomists, etc for information on the use of adjuvants in postemergence applications. The addition of surfactant or crop oil concentrate will often be needed to ensure control of emerged weeds, but use of inappropriate adjuvants can increase the risk of crop injury. Control of emerged grasses with atrazine will require the addition of crop oil concentrate.

3) Most corn herbicides cannot be applied using 28% as the spray carrier after the corn has emerged. Degree and Degree Xtra are the exceptions to this rule. These products can be applied in 28% to corn up to 6 inches tall as long as air temperatures do not exceed 85 degrees

4) Fields should be treated before most annual weeds exceed 2 to 3 inches in height, to avoid yield loss due to early-season weed interference. When applying within a week or two after corn planting, we suggest using full rates of preemergence corn herbicides. It is possible to reduce rates somewhat when the early postemergence application stretches out to 3 weeks or more after planting, but we suggest reducing preemergence rates by no more than 33% even then. Where the plan is to definitely make another application of postemergence herbicides, lower rates can be used. However, keep in mind that the difference between full and half rates of atrazine premix products can be as little as $7 to $9 per acre, or a bushel to a bushel and a half of corn at current crop prices.

5) Treatments that contain atrazine will control many small, emerged broadleaf weeds. Among preemergence herbicides, Lexar/Lumax and mixtures of SureStart plus atrazine provide the broadest spectrum of broadleaf weed control, especially as weeds get larger. Emerged grass weeds tend to be more of an issue. Atrazine has activity on emerged grasses, and it is most effective when applied at high rates to very small (less than one inch) grasses. Products which contain rimsulfuron (Resolve) will provide some foliar and residual control of grass weeds and Resolve can be mixed with either the atrazine premixes or with glyphosate or glufosinate in Roundup Ready or Liberty Link corn, respectively. Larger grasses will require the addition of postemergence herbicides such as Option, Equip, Steadfast, Accent, glyphosate (Roundup Ready corn) or glufosinate (Liberty Link corn). Impact and Laudis also have some activity on emerged grasses and they also control many broadleaf weeds. However, we feel that they would fit best in situations were grass densities are low since they are not quite as effective as the previously mentioned grass herbicides. Impact and Laudis should be mixed with atrazine for most effective control.

Agronomy Tips

Late Planting/Replanting & Relative Hybrid Maturity - (*Bob Nielsen*)

- Planting delays continue.
- Consider switching to earlier maturity hybrids by early June.
- Check seed availability with seed dealers now.

Frequent rains of recent weeks delayed the start of corn planting throughout Indiana. Rains late last week and over the weekend will further delay the completion of planting, especially in the southern third of the state. Rainfall over the 7-day period ending 8 am EDST May 12 ranged from 2 to 4 inches throughout central, eastcentral, and southern Indiana (Fig. 1). Rainfall amounts elsewhere in the state ranged from one-half to 2 inches.

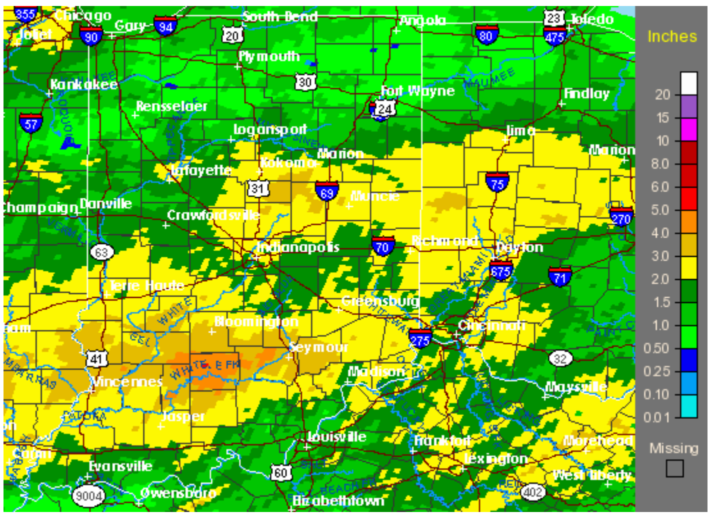


Fig. 1. Estimated 7-day precipitation throughout Indiana as of 8 am EDST on 12 May.
(*Source: National Weather Service*)

As of May 11, the Indiana office of USDA's National Ag. Statistics Service estimated that only 61 percent of the state's corn crop was planted compared to the most recent 5-year average of 72 percent (USDA-NASS, 2008). The good news is that this year's planting pace is not the slowest in recent memory. The two slowest planting years in the past five were 2002 and 2003 (Fig. 2). In contrast, the fastest planting year in the past five was 2004. The 2008 pace is between the slowest and fastest of the past five years and is interestingly not that much slower than that of last year.

The planting delays are greatest in the southern third of Indiana, where USDA-NASS estimates only 34 percent completion as of May 11 in contrast with 61 and 74 percent completion in the northern and central areas of the state (USDA-NASS, 2008). With more rain in the current forecast for the coming week, many of those planters will likely not return to the fields before next week. Consequently, much of the remaining 39% of the state's corn crop will be planted

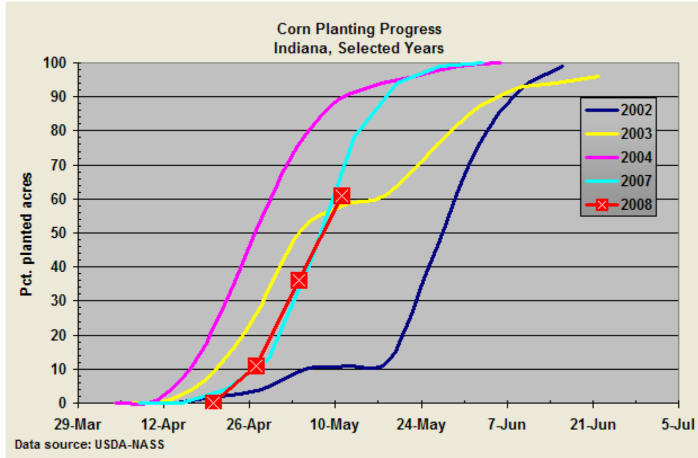


Fig. 2. Corn planting progress in Indiana for 2002 (slowest pace in past 5 years), 2003 (second slowest pace in past 5 years), 2004 (fastest pace in past 5 years, 2007, and to date (May 11) for 2008.
(*Source: USDA-NASS*)

later than desired. Additionally, a few early-planted fields may require replanting if plant populations are reduced due to soggy soils and/or disease.

Some of the locals who frequent the Chat'n Chew Café are beginning to question whether they should consider replacing their remaining full-season corn hybrids with shorter-season versions. They worry that full-season hybrids planted from here on out may not mature safely before the first killing fall frost. After all, hybrid maturity ratings are closely associated with the accumulation of Growing Degree Days (GDDs) after planting (Fig. 3) and there are only so many GDDs available in a given growing season prior to killing fall frosts.

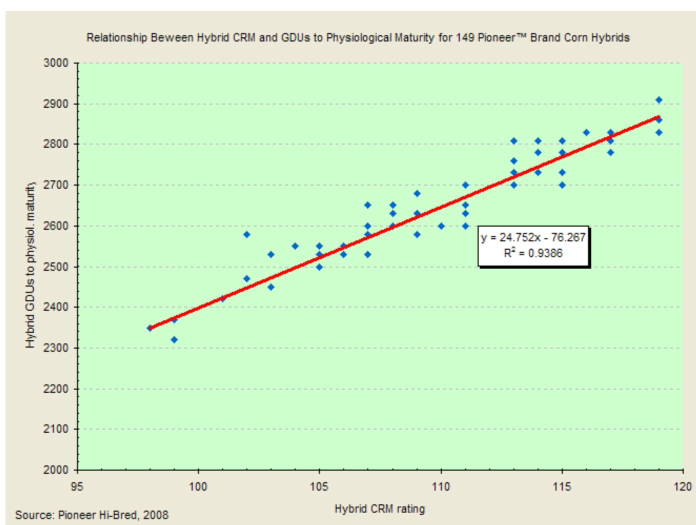


Fig. 3. Relationship between hybrid relative maturity (CRM) ratings and heat unit (GDU) accumulation from planting to physiological maturity. (*Source: Pioneer Hi-Bred, 2008*)

Fortunately, we know from previous research (Nielsen et. al., 2002) that corn hybrids adjust their GDD needs downward as planting is delayed. This means that late-planted hybrids mature in fewer than expected GDDs from planting. The number of GDDs required from planting to physiological maturity in corn decreases nearly 7 GDDs per day of delayed planting after May 1. For example, a hybrid planted June 1 will mature approximately 210 GDDs sooner than it would if planted May 1 (30 days times 7 GDDs per day of delayed planting).

The bottom line from this research is that a given hybrid maturity can be planted later than we once thought possible and still mature safely before a killing fall frost. Nevertheless, at some point on the calendar, growers eventually need to consider switching to earlier maturity hybrids to minimize the risk of frost damage in the fall.

The tables that follow summarize the delayed planting effect on hybrid GDD requirements and present the results in terms of "safe" hybrid maturities for a range of delayed planting dates (see Nielsen & Thomison, 2003, for more information). Both tables assume "normal" GDD accumulations for the remainder of the growing season and a fall frost date that is based on a 50% risk of frost occurring by a given date for individual crop reporting districts around the state (Indiana State Climate Office, <http://iclimate.org>).

Table 1 targets physiological maturity occurring the same week that a killing frost is expected to occur. Table 2 targets physiological maturity occurring the week before a killing frost is expected to occur. The "safe" hybrid maturities listed in Table 2, therefore, are a bit less risky relative to maturation and killing fall frosts.

The hybrid maturities listed in the tables are described in terms of "CRM" or comparative relative maturity ratings as defined by Pioneer Hi-Bred (2008). Pioneer publishes relative maturity data for hybrids in terms of both CRM ratings and GDDs from planting to physiological maturity. Such data can be used to define the relationship between CRM ratings and GDD requirements (Fig. 3). That relationship coupled with our previous research on the effects of delayed planting on GDD requirements allow me to estimate "safe" hybrid maturities for a range of planting dates (Tables 1 & 2).

DISCLAIMER: I am NOT suggesting that Pioneer hybrid maturity definitions are the industry standard. Nor am I promoting Pioneer hybrids. I work with Pioneer's hybrid maturity data because a) many farmers and consultants can relate to Pioneer hybrid maturity ratings and b) I cannot easily find similar on-line datasets for the complete hybrid lineup for any other major seed corn supplier.

BOTTOM LINE: The tables indicate that growers in the central and westcentral Indiana plus the entire southern third of Indiana could continue to plant full-season hybrid maturities through at least the end of May. That's good news for southern Indiana where planting delays are the greatest. Growers in the northern third of the state and eastcentral Indiana who routinely "push the limits" of adapted hybrid maturity may want to consider switching to something less than 110 day hybrids before the end of May. In addition to managing the risk of not maturing prior to a killing fall frost, the eventual agronomic decision to switch to earlier maturity hybrids with delayed planting should result in drier grain at harvest (approximately one-half percentage point of grain moisture difference per "day" difference in hybrid relative maturity) and thus lower grain drying costs and less risk of low test weight grain. At a minimum, growers facing further significant delays in planting corn may want to begin talking with their seed dealers about the possible availability of earlier maturity hybrids.

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Pioneer Hi-Bred. 2008. Pioneer® Brand Products. [On-line]. Available at <https://www.pioneer.com/growingpoint/product_info/catalog/PrdSelection.jsp> [URL accessed 5/11/08] [NOTE: The Pioneer GrowingPoint Web site requires a login; either as a current Pioneer customer or as a guest. After you've completed the Web site registration process you will be routed to the "Search Products & Traits" Web page. From here, select "Corn grain" from the "Product Line" dropdown menu and click "Enter".]

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Table 1. Approximate "safe" relative hybrid maturities for late planting dates in Indiana with the assumption that the hybrid will mature the week of the expected first fall frost date. The expected fall frost date is that based on a 50% risk of frost occurrence. The acronym "CRM" refers to Comparative Relative Maturity as defined by Pioneer Hi-Bred.

Approx. "safe" relative maturities for late planting dates in Indiana with assumption that the hybrid will mature the week of expected fall frost date.

Crop Rpt District	"Typical" CRM	Expected Fall Frost Date	Planting Date		
			17-May	24-May	31-May
			Approx. "Safe" Relative Maturity		
NW	109	6-Oct	112	110	108
NC	109	6-Oct	111	110	108
NE	109	6-Oct	109	108	106
WC	112	13-Oct	118+	118+	118
C	112	13-Oct	118+	118	116
EC	109	6-Oct	112	111	108
SW	116	20-Oct	118+	118+	118+
SC	113	13-Oct	118+	118+	118+
SE	113	13-Oct	118+	118+	118+
		50% fall frost risk date			

Table 2. Approximate "safe" relative hybrid maturities for late planting dates in Indiana with the assumption that the hybrid will mature one week before the expected first fall frost date. The expected fall frost date is that based on a 50% risk of frost occurrence. The acronym "CRM" refers to Comparative Relative Maturity as defined by Pioneer Hi-Bred.

Approx. "safe" relative maturities for late planting dates in Indiana with assumption that the hybrid will mature one week before expected fall frost date.

Crop Rpt District	"Typical" CRM	Expected Fall Frost Date	Planting Date		
			17-May	24-May	31-May
			Approx. "Safe" Relative Maturity		
NW	109	6-Oct	109	108	106
NC	109	6-Oct	109	107	105
NE	109	6-Oct	106	105	103
WC	112	13-Oct	118+	118	116
C	112	13-Oct	118	116	113
EC	109	6-Oct	109	108	106
SW	116	20-Oct	118+	118+	118+
SC	113	13-Oct	118+	118+	118+
SE	113	13-Oct	118+	118+	118+
		50% fall frost risk date			

Requirements for Uniform Germination and Emergence of Corn - (*Bob Nielsen*)

Rapid, uniform germination and emergence of corn help set the stage for maximum grain yield at the end of the season. Without such a successful start to the season, the crop is behind the proverbial "eight-ball" right from the beginning. The good news is that there are only four simple requirements for uniform germination and emergence of corn. The bad news is that one or more of the requirements are sometimes absent in one field or another.

Adequate and uniform soil moisture at the seed zone. Adequate soil moisture is most simply defined as not too dr y and not too wet. Most growers know what "adequate" looks and feels like. Uneven soil moisture in the seed zone can be caused by variable soil characteristics, tillage patterns, unusual weather conditions and uneven seeding depth. Uneven soil moisture throughout the seed zone is the primary cause of uneven emergence, the results of which can easily be yield losses of 8 to 10 percent. Remember that uneven seedbed soil moisture can be described as "adequate' versus "too wet" as well as "adequate" versus "too dry".

Useful Tip: When seedbed conditions are dry, make sure that your choice of seeding depth ensures uniformly adequate soil moisture for the germination of the seed. Even though a 1.5 to 2 inch seeding depth is a good choice for many conditions, don't hesitate to increase seeding depth to 2.5 to 3 inches if that is the depth where the uniform soil moisture is located. Planting shallower than 1.5 inches increases the risk of poor or uneven germination during subsequent drying of surface soils.

Fig. 1. Uneven corn emergence in 2006 due to uneven (too wet vs. "just right") seedbed soil moisture.

Adequate and uniform soil temperature at the seed zone. Corn will germinate and emerge slowly and unevenly when soil temperatures are less than 50°F. When soils warm to the mid-50's or warmer, emergence will occur in seven days or less if soil moisture is adequate. Thermal time from planting to emergence is approximately 117 growing degree days (GDDs) using the modified growing degree formula (Nielsen, 2007b) with air temperatures or about 127 GDDs based on soil temperatures.

Uneven soil temperature in the seed zone can be caused by variable soil texture, soil color, soil drainage, surface residue cover in reduced tillage systems and seeding depth control. Temperature variability during germination and emergence is most critical when average soil temperatures are hovering about the critical 50°F minimum threshold value.

Useful Tips: Dark-colored soils will typically warm more quickly than light-colored soils. If soils dry differently across the field, the drier areas will typically warm faster than the wet areas. Uneven residue cover (surface trash) in reduced tillage systems causes significantly lower soil temperatures under the heavier cover than under barer spots in the field. Uneven seeding depth exposes deeper planted seeds to slightly cooler seed zones than seeds placed shallower. Consider row-cleaning attachments for the planter to move aside the surface trash during planting and expose the seedbed to sunlight and its warming effects. Consider strip tillage practices in the future to better manage surface trash in a reduced tillage system.

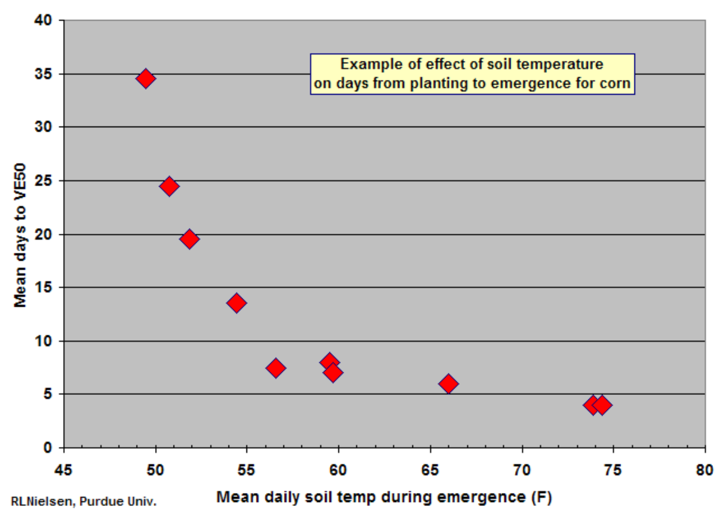

Fig. 2. Example of the effect of soil temperature on the timing of corn emergence.

Adequate and uniform seed-to-soil contact.In order for the kernel to absorb moisture quickly and uniformly, soil must be firmed completely around the kernel. Seed-to-trash contact results from "hair-pinning" of surface trash into the seed furrow during no-till planting when soil and/or trash are too wet for adequate coulter cutting action. Seed-to-clod contact results from planting into cloddy fields created by working soil too wet. Seed-to-rock contact is, needless to say, not good for proper germination either. Seed-to-air contact results from open planter furrows when no-till planting into excessively wet soils. Germination of kernels lying in open planter furrows is dependent on rainfall keeping the open furrow environment moist.

Useful Tips: Whippers, wipers, movers, fingers, and other similar trash management gadgets for the planter are most beneficial when you are challenged with rocky, cloddy, or trashy surface soil conditions. They help clear the way (literally) for the planter's double-disc openers to more easily do their job of creating an optimum seed furrow. Other planter attachments that help press the kernels into the seed furrow can improve seed-to-soil contact and seeding depth uniformity when seedbed conditions are otherwise challenging.

Surface Soil Free From Crust. Severe surface crusting or compaction will restrict emergence of the coleoptile and cause underground leafing or plant death. Severe sidewall compaction can also limit elongation of the mesocotyl and emergence of the coleoptile.

Useful Tip: Avoid excessive tillage prior to planting the crop, especially if significant rainfall is forecast prior to emergence of the crop. Avoid excessive downpressure on the closing wheels of the planter. Avoid planting "on the wet side" that often results in smeared sidewalls.

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Nitrogen Loss Likely in Southern Indiana – (*Jim Camberato*)

Nitrogen applied to sandy soils was at risk for loss from the soil in Southern Indiana this last week due to excessive rainfall. The form of nitrogen susceptible to loss was nitrate. About ¼ the nitrogen applied in 28% urea-ammonium nitrate (UAN) liquid fertilizer is nitrate when applied. The urea and ammonium forms are ¾ of the N content at application. However, urea is converted to ammonium within a couple days of application. And, soil microbes convert the ammonium to nitrate in only a couple of weeks at 60 ^{o}F. Unlike ammonium, nitrate is **not** attracted to the soil's cation exchange capacity (CEC) so it leaches downward with rainfall moving through the soil. Two inches of rain will move nitrate about a foot in most sandy soils. With enough rainfall the nitrate will be moved out of the potential crop rootzone.

Anhydrous ammonia is less susceptible to nitrogen loss than 28% UAN for two reasons. First, all of the nitrogen is in the ammonia form at application. Second, the ammonia in the injection zone kills the bacteria that convert ammonium to nitrate. It is thought that the bacteria repopulate the injection zone in 10-14 days after application so during this time the nitrogen remains in the ammonium form. While in the ammonium form and attracted to the soil CEC very little ammonium will leach from the soil.

Nitrogen loss from silt loam or heavier soils was not likely to be substantial despite the rainfall. In more poorly drained soil nitrate is still the form subject to loss, but not from leaching. The loss process in these soils is denitrification, whereby nitrate is converted to a nitrogen gas by soil bacteria under saturated conditions. The activity of these bacteria is highly temperature dependent. Since soils were cold when saturated, loss of nitrate from more poorly drained soils was likely minimal.

One way to assess nitrogen loss is to apply additional nitrogen (40 to 60 pounds of nitrogen per acre) to areas in representative fields, establishing reference strips for comparison with the bulk field. Chlorophyll meter readings at the 8-leaf stage or later comparing the nitrogen status of the reference strip and bulk field are a good indicator of whether or not the crop will benefit from additional nitrogen fertilizer. However, rescue applications at this time can only be made with high clearance equipment. Details on the use of chlorophyll meters can be obtained from: <http://www.agry.purdue.edu/ext/pubs/AY-317-W.pdf>.

Early Planted Corn Feeling "Under the Weather" - (Bob Nielsen)

The seemingly relentless cool, wet, and cloudy weather of recent weeks has not only delayed the completion of corn planting, but has also certainly not been favorable for rapid and vigorous stand establishment for fields of corn already planted. Germination and emergence have been slow relative to calendar time, as has subsequent leaf stage development, simply because heat unit accumulation per day has been less than normal.

A few fields have experienced chilling injury to kernels during the imbibition process. Imbibition occurs during the first 24 to 36 hours after planting. Symptoms of such imbibitional chilling injury include kernels that fail to germinate or arrested growth of the radicle root or coleoptile. Instances of chilling injury during the emergence process have also been reported, often causing deformed elongation of the mesocotyl (the so-called "corkscrew" symptom) and either delayed emergence or complete failure of emergence (i.e., leafing out underground).

Lower than desired plant populations may justify replanting consideration for some fields, but please base that decision as much as possible on facts and not emotion. Use my worksheet for replant decisions, available on the Web at <http://www.agry.purdue.edu/ext/pubs/AY-264-W.pdf>.

The appearance of plants in fields where emergence was reasonably successful can be best described as "crappy", primarily due to their yellowish-green color and general lack of vigor. Everyone knows the remedy for poor plant appearance and vigor is simply a return of sunshine and warmer temperatures. If there's good news about such early-season stress, it is that the primary potential effect on yield at this point in time is the effect on "effective" plant population (i.e., plants that will survive to produce a normal-sized ear). Stress that occurs prior to leaf stage V5 has no direct effect on ear size determination simply because the uppermost, harvestable, ear is not initiated until about V5.

If weather conditions over the next few weeks continue to favor sluggish plant development, the risk of further damage to plants from soil-borne disease and insects will increase. Corn plants are very dependent on the energy reserves of the kernel until about leaf stage V3, at which point the plants normally begin transitioning from dependence on kernel reserves to dependence on the nodal root system that develops from the crown of the plant (Nielsen, 2007). Until a plant fully completes this transition (usually by V5 or V6), it is susceptible to stunting or death due to kernel or mesocotyl injury. Consequently, the slower the progress towards V5 or V6, the more at-risk a plant is to continued stressful conditions.

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