Purdue Cooperative Extension Service

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In This Issue

Insects, Mites, And Nematodes

Armyworm Marching Here and There, But Not Everywhere - (*Christian Krupke, John Obermeyer, and Larry Bledsoe*) -

Reports of heavy but isolated infestations in both corn and wheat have come from Brad Shelton, Washington County CES, and Steve Mroczkiewicz, Syngenta, in Fountain County. Continue to examine wheat, especially where plant growth is dense, and corn adjacent to wheat or grass pasture.

As we discussed in the May 18 issue of *Pest&Crop*, follow the following scouting guidelines: In wheat, if a significant number of armyworm are present and destroying the flag leaves, or the heads, treat immediately. With corn, defoliation up to 50% can be tolerated before yield may be affected. On V5 or greater corn, this damage is usually limited to the rows bordering the grassy crop. (See armyworm insecticides table on page 2.)

Armyworm feeding on timothy grass head

Armyworm Insecticides (Read and follow ALL label rate, application, and use directions)

Crop	Product (Formulation)	Restrictions (Days to Harvest)
Corn	Ambush (EC)	30
	Asana XL	21
	Lannate (SP)	21
	Lorsban (4E)	35
	Malathion (EC)	5
	Mustang Max (EC)	30
	Penncap-M	12
	Pounce (EC)	30
	Sevin (4F, 80S, XLR)	48
Wheat	Lannate (SP)	7 (10 for grazing/ feeding)
	Malathion (EC)	7
	Mustang Max (EC)	14
	Penncap-M	15 (harvest or grazing)
	Sevin (4F, 80S, XLR)	21 grain harvest, 7 grazing forage
	Warrior	30
Grass Pasture	Malathion (EC)	0
	Mustang Max (EC)	0 (forage and hay)
	Sevin (4F, 80S, XLR)	14 (harvest or grazing)

It's Potato Leafhopper in Alfalfa Time - *(Christian Krupke, John Obermeyer, and Larry Bledsoe)*

Although economic populations of potato leafhoppers have not been observed or reported, populations will be increasing with the summer-like temperatures – these are insects that thrive in the heat. Alfalfa pest managers should begin sampling their alfalfa shortly after cutting.

Potato leafhoppers are small, wedge-shaped, yellowish-green insects that remove plant sap with their piercing-sucking mouthparts. Leafhopper feeding will often cause the characteristic wedge-shaped yellow area at the leaf tip, which is referred to as "hopper burn." Widespread feeding damage can cause a field to appear yellow throughout – if you see this visual evidence, the damage is already done and treatment will not help this cutting. Leafhopper damage reduces yield and forage quality through a loss of protein. If left uncontrolled for several cuttings, potato leafhoppers can also significantly reduce stands.

As emphasized above, treatment is preventative rather than curative – be proactive by scouting wheat.

Hopper burn, the damage has been done!

The need to treat for leafhoppers can be determined prior to the appearance of damage if fields are surveyed on a regular basis. To assess leafhopper populations and the potential for damage, take at least 5 sets of 20 sweeps with a 15" diameter sweep net in representative areas of a field. Carefully examine the contents of the sweep net, count the number of adults and nymphs, and calculate the number of leafhoppers per sweep. Use the guidelines given below to determine the need for treatment. Usually the best results are obtained when treating small alfalfa, so be sure to scout the alfalfa regrowth for leafhoppers after cutting. For recommended insecticides see Extension Publication E-220, *Alfalfa Insect Control Recommendations* - 2007 which can be viewed at <http://www.entm.purdue.edu/Entomology/ext/targets/e-series/e-list.htm>.

Management Thresholds for Potato Leafhoppers

Alfalfa Stem Height in Inches	Leafhoppers (Adults/ Nymphs) Per Sweep
under 3	0.2
4 - 6	0.5
7 - 12	1.0
greater than 12	1.5

Soybean Aphid Season Has Begun - *(Christian Krupke, John Obermeyer, and Larry Bledsoe)*

Many of you may recall our proclamations of soybean aphid plague for 2007. We will soon see if our predictions will hold true – last week (May 23) we started finding aphids on V1 and V2 soybeans in northern Indiana, typically one of our hotspot areas. Researchers in Minnesota have reported finding the aphid in early-planted beans there as well. This is the earliest documented report of aphids in Indiana soybeans, beating the previous record of May 31, which was recorded in our last outbreak year, 2005. What this means for soybean pest managers is a beginning to the scouting season in early planted beans. Aphid numbers are low right now (<20/plant), but this is already more aphids than we saw at any time in 2006, so stay tuned.

Soybean aphid, the suckers are back!

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

County/Cooperator	5/15/07 - 5/21/07							5/22/07 - 5/28/07						
	VC	BCW	ECB	SWCB	CEW	FAW	AW	VC	BCW	ECB	SWCB	CEW	FAW	AW
Dubois/SIPAC Ag Center	0	0	0	0	0	0	1	0	1	1	0	1	0	6
Jennings/SEPAC Ag Center	0	0	0	0	0	0	0							
Knox/SWPAC Ag Center	0	0	0	0	0	0	3	0	0	0	0	0	0	0
LaPorte/Pinney Ag Center	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Lawrence/Feldun Ag Center	0	1	0	0	0	0	2	0	0	0	0	0	0	1
Randolph/Davis Ag Center	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Tippecanoe/TPAC Ag Center	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Whitley/NEPAC Ag Center	0	0	1	0	0	0	9							

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

Due to the holiday the above table will be updated when our reports become available.

Agronomy Tips

Growing Points of Interest - (Bob Nielsen)

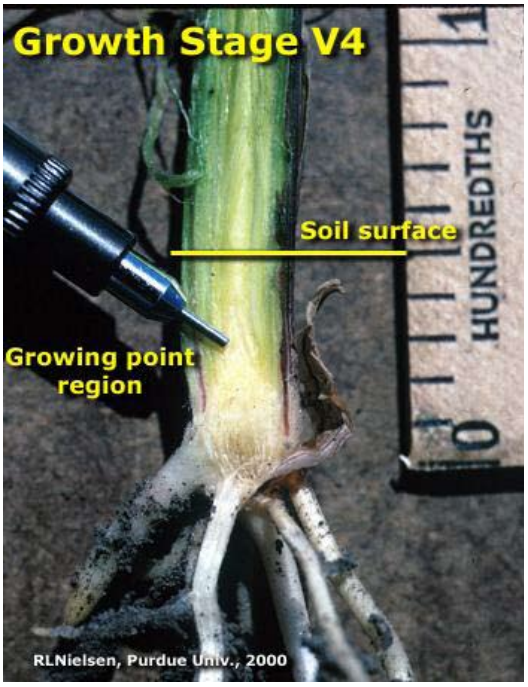
- Recovery from early season damage to corn is often dependent on the health of growing point region.

There is something about 30 mph winds and sand/grit/soil blasting across corn fields at seedling height that makes one curious about the ability of corn to recover from early season damage. The same can be said following a thunderstorm accompanied by strong winds and damaging hail (Nielsen, 2007b). Whenever corn is damaged early in the growing season, growers are sometimes faced with the decision of whether or not to replant the field.

One of the most important, and most difficult, steps in making a replant decision is estimating the surviving plant population in the field. Corn is remarkably resilient to aboveground damage early in the season, yet growers often underestimate the ability of corn to recover from such damage. Consequently, much of the replanting that occurs each year is a waste of money and effort. Use the worksheet in my replant publication (AY-264-W) to estimate yield and dollar returns to corn replanting.

The health and condition of the corn plant's growing point (apical meristem) plays a major role in determining whether a damaged corn plant will recover or not. A plant damaged aboveground but with a healthy, undamaged growing point will usually survive. However, damage to the growing point area will either kill the plant or severely stunt its recovery.

The growing point is that meristematic area of the corn plant where leaves and, eventually, the tassel are initiated. Morphologically, the growing point area is located near the top of the young plant's stalk tissue. Prior to stalk internode elongation, the growing point is initially located 1/4 to 3/4 inch below the soil surface, near the crown of young seedlings at growth stages VE (emergence) to about V4 (four leaves with visible leaf collars [Nielsen, 2007a]).



The growing point remains below ground until V5 to V6. Stalk internodes begin to elongate shortly before V5, eventually elevating the growing point above the soil surface. From this point forward, the growing point becomes increasingly exposed and vulnerable to aboveground damage.

Prior to V6, while the growing point is belowground, corn can tolerate quite a bit of aboveground injury from "single event" damage by frost, hail, wind, cutworm feeding, sandblasting, tire traffic, 28% N solution burn, etc. However, repeated injury to young plants (e.g., multiple days of sandblasting) or extended periods of sub-optimal temperatures (i.e., "darned" cold weather) and cloudy conditions following the damage may prevent photosynthetic recovery (renewal of green leaves) long enough to eventually kill the plant even though the growing point is technically not injured.

Growing point location in corn at different growth stages can be viewed here: [Image Gallery]

While corn younger than V6 can tolerate a fair amount of aboveground frost damage to exposed leaf tissue, lethal cold temperatures (28F or less for several hours) can "penetrate" the upper soil surface (especially dry soils) and damage or kill the growing point of a young corn plant. Corn younger than V6 is also susceptible to belowground damage from soil insects, disease, and flooding or ponding.

Human nature being what it is, most growers can't avoid walking damaged corn fields the day of or the day following the injury to begin assessing the consequences of damage to their corn field. Unfortunately, most of the time a fair assessment of the recovery potential of damaged plants cannot be made that soon. Damaged corn fields need to be left alone for several days, sometimes up to a week, after the damage occurs to give the plants some time to exhibit visible recovery.

Splitting open a damaged corn plant is a time-honored practice when assessing the consequences of early-season damage to corn. The stalk tissue near the growing point region should remain firm and yellowish-white, as should the growing point region itself. Discolored or mushy tissue near the growing point usually spells trouble for the injured plant. Injury that occurs close to the growing point area (e.g., hail damage, stinkbug feeding) may alter normal hormonal activity and eventually cause deformed regrowth of stalk or leaf tissue.

Visible recovery of leaf development from the whorl of surviving plants will be evident within 3 to 10 days after a

damage event, depending on temperature and soil moisture conditions. Warmer temperatures and adequate soil moisture encourage rapid recovery, while cooler temperatures and/or drought stress slow the rate of recovery. Given sufficient time, surviving corn plants will exhibit new leaf tissue expanding from the whorls, while dead corn plants will still look, well… dead.

Related References:

Nielsen, R.L. (Bob). 2003 (rev.) Estimating Yield and Dollar Returns to Corn Replanting. Purdue Univ. Coop. Ext. Service Pub. No. AY-264-W. [On-Line]. Available at <http://www.agry.purdue.edu/ext/pubs/AY-264-W.pdf>. (Verified 5/27/07).

Nielsen, R.L. (Bob). 2007a. Determining Corn Leaf Stages. Corny News Network, Purdue Univ. [On-Line]. Available at <http://www.kingcorn.org/news/timeless/VStageMethods.html>. (Verified 5/27/07).

Nielsen, R.L. (Bob). 2007b. Recovery From Hail Damage to Young Corn. Corny News Network, Purdue Univ. [On-Line]. Available at <http://www.kingcorn.org/news/timeless/HailDamageYoungCorn.html>. (URL verified 5/27/07).

Recovery From Hail Damage to Young Corn - (*Bob Nielsen*)

- Yield loss from hail damage is based on reductions in plant population and leaf area.
- Allow a damaged field enough time to demonstrate the degree to which it may recover from hail damage.

As is usual in Indiana, late spring thunderstorms rumbling across the state often include damaging hail. Looking out the kitchen window the morning after such a storm can be one of the most disheartening feelings in the world to a corn grower.

Yield loss in corn due to hail damage results primarily from 1) stand reduction caused by plant death and 2) leaf area reduction caused by hail damage to the leaves (Vorst, 1993). Assessing the yield consequences of hail damage in corn therefore requires that the severity of each of these factors be estimated.

Click for Hail Damage Photo Gallery

Assessing Plant Survival

As with most early-season problems, evaluation of hail-damaged fields should not be attempted the day after the storm occurs because it can be very difficult to predict survivability of damaged plants by simply looking at the damage itself. Young corn has an amazing capacity to recover from early season damage but patience is required to allow the damaged plants enough time to visibly demonstrate whether they will recover or not. Damaged but viable plants will usually show noticeable recovery from the whorl within 3 to 5 days with favorable weather and moisture conditions.

One thing you can do shortly after the storm, however, is to evaluate the relative condition of the main growing point area of the stalk. The growing point, or apical meristem, of a young corn plant is an area of active cell division located near the tip of the pyramid-shaped top of the stalk tissue inside the stem of the plant (Nielsen, 2004). The growing point region is important because it is responsible for creating all the leaves and the tassel of a corn plant.

Initially, the growing point is located below ground but soon elevates above ground beginning at about the 5th leaf collar stage. Slicing a stalk down the middle and looking for the pyramid-shaped upper stalk tissue can identify the vertical position of the growing point. If hail has damaged the growing point or cut off the stalks below the growing point, then those plants should be counted as victims and not survivors.

Remember that yield loss in corn is not directly proportional to the reduction in the number of plants per acre when the damage occurs early in the growing season (Table 1). The surviving plants surrounding an absent plant can compensate by increasing their potential ear size or by developing a second ear. A 25 percent reduction in plant population should reduce yield by less than 10 percent. A 50 percent reduction in plant population should reduce yield by less than 25 percent.

Click for Hail Damage Photo Gallery

Assessing Defoliation Severity

Leaf damage by hail usually looks worse than it really is. Tattered leaves that remain green and connected to the

plant will continue photosynthesizing. It takes a practiced eye to accurately estimate percent leaf death by hail. With that caution in mind, percent damage to those leaves exposed at the time of the hailstorm can be estimated and used to estimate yield loss due to defoliation alone.

The effects of leaf death on yield increases as the plants near silking, and then decreases throughout grain fill. Therefore, the grower needs to determine the leaf stage of the crop when the hail damage occurred.

Remember that leaf staging for the purposes of hail damage assessment is slightly different than the usual leaf collar method. The yield loss estimates listed in Table 2 are based on leaf stages as defined by the "droopy leaf" method (Nielsen, 2007a). If you are walking damaged fields many days after the storm, you can stage the crop that day and backtrack to the day of the storm by assuming that leaf emergence in corn occurs at the rate of about 1 leaf every 80 GDDs from emergence to V10 (ten fully visible leaf collars) or every 50 GDDs from V10 to the final leaf (Nielsen, 2007c).

Once percent leaf damage and crop growth stage have been determined, yield loss can be estimated by using the defoliation chart provided below in Table 2. This table is a condensed version of the season-long table published in the Purdue Extension publication ID-179, Corn and Soybean Field Guide or in NCH-1, Assessing Hail Damage in Corn (Vorst, 1993).

Click for Hail Damage Photo Gallery

Assessing Consequences of Whorl & Stem Bruising

The eventual yield effects of severe bruising of leaf tissue in the whorl or the stalk tissue itself in older plants are quite difficult to predict. Consequently, it can be difficult to determine whether to count severely bruised plants as survivors or whether they should be voted off the field. The good news is that observations reported from an Ohio on-farm study suggest that bruising from hail early in the season does NOT typically result in increased stalk lodging or stalk rot development later in the season (Mangen & Thomison, 2001).

Early season bruising of leaf tissue or stem tissue may, however, have other consequences on subsequent plant development; the occurrences of which are hard to predict. Areas of bruised whorl leaf tissue often die and can then restrict continued expansion of whorl leaves, resulting in the type of 'knotted' whorl reminiscent of frost damaged plants. These same bruised leaves would be more susceptible to secondary invasion by bacteria contained in splashed soil that might have been introduced into the damaged whorls if the hailstorm was accompanied by driving rains.

If the plant tissue bruising extends as deep as the plant's growing point, that important meristematic area may die; thus killing the main stalk and encouraging the development of

Table 1. Expected Grain Yield Due to Various Planting Dates and Final Plant Populations

Planting date	Plant population (final) per acre													
	10,000	12,000	14,000	16,000	18,000	20,000	22,000	24,000	26,000	28,000	30,000	32,000	34,000	36,000
	Percent of optimum yield													
10-Apr	62	68	73	78	82	85	88	91	92	93	94	94	93	91
15-Apr	65	71	76	81	85	88	91	94	95	96	97	96	96	94
20-Apr	67	73	78	83	87	90	93	96	97	98	99	98	98	96
25-Apr	68	74	79	84	88	92	94	97	98	99	100	100	99	97
30-Apr	68	74	79	84	88	92	95	97	99	100	100	100	99	97
5-May	67	73	79	83	87	91	94	96	98	99	99	99	98	97
10-May	65	71	77	82	86	89	92	94	96	97	97	97	96	95
15-May	63	69	74	79	83	87	89	92	93	94	95	95	94	92
20-May	59	65	71	75	80	83	86	88	90	91	91	91	90	89
25-May	55	61	66	71	75	79	81	84	85	86	87	87	86	84
30-May	49	55	61	65	70	73	76	78	80	81	81	81	80	79
4-Jun	43	49	54	59	63	67	70	72	74	75	75	75	74	73
9-Jun	36	42	47	52	56	60	62	65	66	67	68	68	67	65

Source: Nafziger. 1994. J. Prod. Ag 7:59-62. Yield response to planting date extrapolated beyond May 25 with concurrence of author.

Note: The highlighted area represents the optimum ranges (98 to 100% yield) of plant populations and planting dates for productivity levels greater than about 125 bushels per acre. Optimum plant populations for soils with historical yields less than about 100 bushels per acre will likely not respond to final plant populations greater than about 24,000 plants per acre. (R.L. Nielsen, Purdue Agronomy)

tillers. If the plant tissue bruising extends into the area near, but not into, the growing point; subsequent plant development may be deformed in a fashion similar to any physical damage near the hormonally active growing point (stinkbug, stalk borer, drill bits used by malicious agronomists).

Click for Hail Damage Photo Gallery

Example of Assessing Damage

Let's say that your field of corn was at the 7-leaf stage (approximately V5 by the leaf collar method) when hail damage occurs. After walking the field several days later, you determine only 20,000 of your original 30,000 plants per acre will survive the hail damage. Let's further assume that your original planting date was 25 April. Your surviving stand of 20,000 now has an upper yield potential of 92% of "normal" (Table 1). Therefore, the yield loss due to plant death itself would be about 8%.

Let's also assume that you estimate the average percent leaf death by defoliation to be 50% (which to most of us would look devastating). The combination of leaf stage and percent defoliation would translate into an additional 2% yield loss (Table 2), resulting in a total estimated yield loss due to both stand reduction and defoliation of approximately 10%.

Table 2. Estimates of percent yield loss in corn due to leaf defoliation at selected leaf stages.

Leaf stage[a]	Percent leaf defoliation			
	25	50	75	100
	Approximate % yield loss			
7-leaf	0	2	5	9
8-leaf	0	3	6	11
9-leaf	1	4	7	13
10-leaf	1	6	9	16
11-leaf	1	7	12	22
12-leaf	2	9	16	28
13-leaf	2	10	19	34
14-leaf	3	13	25	44

[a]Leaf stage according to the "droppy leaf" method (see Nielsen, 2004a). the corresponding leaf stage according to the leaf collar method would be approximately 2 less than the "droopy leaf" values shown above (e.g., 7-leaf ~ V5).
Adapted from the National Crop Insurance Association's "Corn Loss Instruction" (Rev. 1994).

Related References

Mangen, Todd and Peter Thomison. 2001. Early Season Hail Damage in Corn: Effects of Stalk Bruising and Tied Whorls. Ohio State Univ. Cooperative Ext. Service Special Circular 179-01. [On-Line]. Available at <http://ohioline.osu.edu/sc179/sc179_16.html>(URL verified 5/27/07).

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Vorst, J.J. 1993. Assessing Hail Damage to Corn. Purdue Univ. Cooperative Ext. Service Publication NCH-1. [On-Line]. Available at <http://www.ces.purdue.edu/extmedia/NCH/NCH-1.html> (URL verified 5/27/07).

For other Corny News Network articles, browse through the CNN Archives at <http://www.kingcorn.org/news/archive.html>.

For other information about corn, take a look at the Corn Growers' Guidebook at <http://www.kingcorn.org>.

Weather Update