Pest & Crop

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Insects, Mites, and Nematodes

European Corn Borer, Deserves a Look See – *(John Obermeyer and Larry Bledsoe)*

- Timely corn planting may disperse moths out among many fields.
- Moth flight appears highest in north central and northeastern counties.
- Scouting and treatment threshold guidelines are given below.
- Indiana's lower use of Bt-corn having little effect on corn borer populations.

With optimal planting conditions for most of this spring, much of Indiana's corn is mow tall enough to be an attractive European corn borer egg-laying site. However, it seems as though the first generation ECB moth numbers are low statewide once again. This has been the trend for several years. Significant moth flights from north central, northeast Indiana and northwest Ohio have been reported but economic whorl feeding has not. One possibility is that because most of the corn was planted about the same time, moths have "diluted" themselves out amongst many attractive fields to lay eggs.

Pest managers should concentrate their scouting efforts on the tallest and healthiest corn in the field. Survey for the characteristic random or "shot hole" damage pattern down in the corn whorl of 20 consecutive plants in each of 5 areas of the field. Carefully examine the whorl leaves on each plant as some of the holes can be small. Count and record the number of plants showing foliar feeding damage. Total the number of plants showing such damage to determine the percentage of damaged plants. Also, determine if borers are still present and actively feeding. Pull out, carefully unroll, and examine the whorl leaves from one plant showing damage in each sample set, for a maximum of 5 plants in the entire field. Total the number of live borers found and determine the average number of borers per plant.

Shot hole damage in corn whorl

Use the following steps to determine whether an insecticide treatment is economically justified:

1) Preventable yield loss (bu/A) = anticipated yield (bu/A) X yield loss figure (following table) X level of infestation (decimal) X anticipated level of control (decimal). It is probably impractical to expect 100% control. A good estimate of control might be 75%.

2) Preventable dollar loss/A = Preventable yield loss (bu/A) X market value ($/bu).

3) Compare preventable dollar loss/A to cost of insecticide and application to determine if treatment is warranted.

Yield Losses Caused by European Corn Borers for Various Corn Growth Stages[1]

	Percent yield loss - #borers/plant[2]		
Plant stage	**1**	**2**	**3**
Early whorl	5.5	8.2	10.0
Late whorl	4.4	6.6	8.1
Pre-tassel	6.6	9.9	12.1
Pollen shedding	4.4	6.6	8.1
Blister	3.0	4.5	5.5
Dough	2.0	3.0	3.7

[1] These percentages are based on physiological stresses and do not include losses due to stalk breakage and/or ear dropage.
[2] For more than 3 borers/plant, use percent yield loss figure for 3 borers, or adjust loss slightly upward.

Example: A field in the early whorl stage has 80% of the plants with "shot-hole" feeding and an average of 2 live larvae per whorl. Anticipated yield is 150 bu/A and the crop is valued at $2.00 per bushel. The cost of the insecticide and application is $10.00 and 75% control can be expected. Would it pay to apply the insecticide?

1) Preventable yield loss (bu/A) = 150 bu/A X .082 (8.2% loss for 2 borers/plant) X .80 (80% infestation) X .75 (75% control) = 7.38 bu/A

2) Preventable dollar loss/A = 7.38 bu/A X $2.00/bu = $14.76/A

3) Compare preventable dollar loss/A with cost of control/A

$14.76/A (preventable $ loss/A) - $10.00/A (cost of control) = $4.76/A return from application of control.

There has been some discussion about Bt-corn negatively affecting the state's corn borer population over the last several years. Where continuous, high levels of Bt-cotton has been grown in the Southwestern United States for bollworm control, a suppression of the bollworm population has been noted and attributed to this technology. However, a low percentage of Bt-corn for corn borer is planted in Indiana, at best 10%. Obviously higher seed costs, marketing concerns, refuge restrictions and inconsistent corn borer damage have dictated lower adoption of Bt-corn. In addition, European corn borer has over a hundred potential host crops. Therefore we feel that the corn borer's low frequency of contact with the Bt toxin would have little effect on populations. The good news is that these factors should delay the corn borer's potential resistance to this valuable pest management tool.

A QuickTime movie of first generation European corn borer sampling can be viewed at <http://www.entm.purdue.edu/entomology/ext/fieldcropsipm/videos.htm>. For recommended insecticides, see E-219, *Corn Insect Control Recommendations–2004*. This and other field crop related publications can be viewed electronically at <www.entm.purdue.edu/entomology/ext/targets/e-series/fieldcro.htm>.

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Soybean Aphid Update – *(John Obermeyer, Larry Bledsoe, and Bob O'Neil)*

Purdue soybean aphid researchers have found soybean aphid in north central Indiana (Miami County) on early vegetative soybean plants. The timing of this sighting would be about the same time as last year. First-observation of this aphid in soybean from the overwintering host means very little toward population predictions for 2004.

However, of note, is the presence of significant soybean aphid numbers being reported in eastern Iowa. There are unconfirmed reports of some soybean fields being treated in southeastern Iowa. One confirmed report was that aphids had reached as high as 200-250/plant in portions of a field. Iowa State University entomologists are urging producers to correctly identify the aphid, monitor fields, and use thresholds before treatments are made. Sound familiar?

We certainly will be keeping watch on what occurs in future weeks with soybean aphid populations in states to the north and west of Indiana. We still feel that our greatest threat from this pest is their mass movement from areas of high infestation. You may want to refer to the article "Soybean Aphid Management Decisions for 2004" in *Pest&Crop* #1, February 23, 2004. Watch for more on this pest in future issues of the *Pest&Crop*.

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Prepare Grain Bins for Wheat Harvest - (*Linda Mason*)

- Stored grain insect infestations usually begin from poor sanitation.
- Procedures are given to prevent infestations.
- Now is the time to carry through these procedures.

The 2004 wheat harvest will soon be here. Preparing bins for storage now goes a long way toward preventing insect infestations during the summer. Several species of insects may infest grain in storage. The principal insects that cause damage are the adult and larval stages of beetles, and the larval stage of moths. Damage by these insects includes reducing grain weight and nutritional value; causing contamination (alive or dead); odor, mold, and heat damage problems that reduce the quality of the grain.

Newly harvested wheat may become infested with insects when it comes in contact with previously infested grain in combines, truck beds, wagons, other grain-handling equipment, augers, bucket lifts, grain dumps, or grain already in the bin. Insects may also crawl or fly into grain bins from nearby accumulations of old contaminated grain, livestock feeds, bags, litter, or any other cereal products.

Insect infestations can be prevented with good management practices. Now that many grain bins are empty, the following guidelines should be used before the 2004 grain is placed in bins:

- Brush, sweep out and/or vacuum the combine, truck beds, transport wagons, grain dumps, augers, and elevator buckets to remove insect-infested grain and debris.
- In empty bins, thoroughly sweep or brush down walls, ceilings, ledges, rafters, braces, and handling equipment and remove debris from bins.
- Inside cleaned bins, spray wall surfaces, ledges, braces, rafters, and floors with an approved insecticide (Reldan® (chlorpyrifos-methyl), Storcide® (chlorpyriphos-methyl and Cyfluthrin), Tempo® (cyfluthrin), Diacon II® (methoprene) or various diatomaceous earth (D.E.) products) creating a perimeter barrier. Outside, complete this barrier by treating the bases and walls up to 15 feet high, plus the soil around the bins.
- ï Remove all debris from fans, exhausts, and aeration ducts (also from beneath slotted floors, when possible).
- Remove all debris from the storage site and dispose of it properly according to area, state, and/or federal guidelines (this debris usually contains insect eggs, larvae, pupae, and/or adults, ready to infest the newly harvested grain).
- Remove all vegetation growing within ten feet of the bins (preferably the whole storage area). Then spray the cleaned area around bins with a residual herbicide to remove all undesirable weedy plants.
- Repair and seal all damaged areas to the grain storage structure. This is not only to prevent insect migration into the bin, but also to prevent water leakage, which leads to mold growth.
- Do not store newly harvested grain on old grain already in storage.
- Whenever fans are not operated, they should be covered and sealed. This reduces the opportunity for insects and vertebrates to enter the bin through the aeration system.

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Black Light Trap Catch Report - (John Obermeyer)

County/Cooperator	5/25/04 - 5/31/04							6/1/04 - 6/8/04						
	VC	BCW	ECB	SWCB	CEW	FAW	AW	VC	BCW	ECB	SWCB	CEW	FAW	AW
Dubois/SIPAC		1	5				1							11
Jennings/SEPAC			1							9				2
Knox/SWPAC	1	1	4				1		1	13				2
LaPorte/Pinney Ag Center		1	4				2			25				2
Lawrence/Feldun Ag Center			3							4				
Randolph/Davis Ag Center			32							48				6
Tippecanoe/TPAC Ag Center			14				1							
Vermillion/Hutson							2			3				2
Whitley/NEPAC			7				1	1		192				13

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

Plant Diseases

Fusarium **Head Blight of Wheat** - (*Gregory Shaner*)

- The disease is widespread this year

Fusarium head blight (scab) is widespread and severe on wheat in Indiana. From colleagues in other states, I understand that the disease is widespread in the soft wheat region of the eastern US. The frequency of blighted heads in Indiana wheat ranges from 5% to more than 50%. Frequencies in the range of 5% to 15% are probably most common. When we examined wheat that was in the mid milk stage, the extent of blight on affected heads varied from a few spikelets to the entire head. On heads that were only partially blighted, the symptoms were most often at the tip of the head, but some were blighted in the middle or only at the base. The amount of the head blighted tends to increase over time, as the fungus spreads internally in the rachis. However, the percentage of heads blighted in a field will probably not change much after the mid milk stage.

Grain in blighted heads is already shriveled. Additionally, some kernels that appear to be of normal size at the milk stage are probably infected and will shrivel somewhat as the grain dries down.

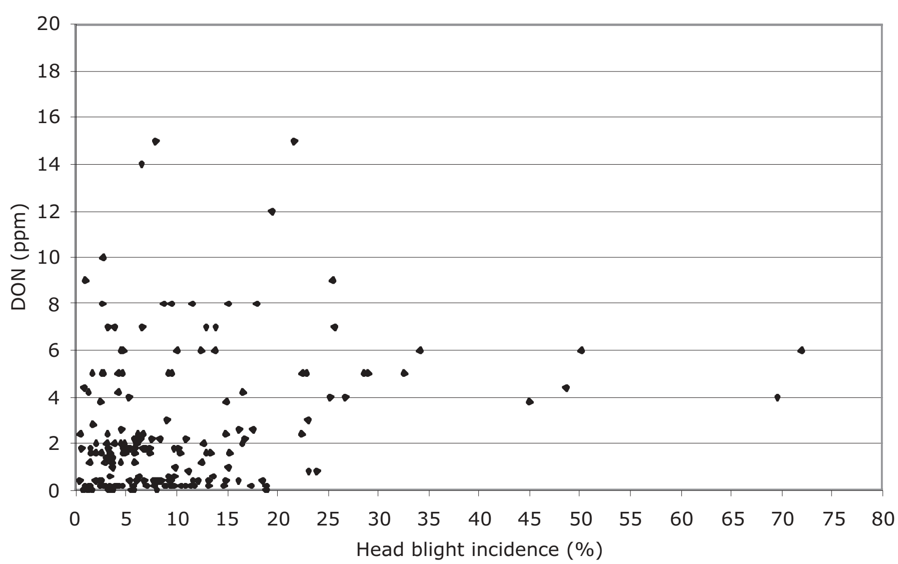
The big concern at this stage is grain quality. The scab fungus, *Fusarium graminearum*, produces trichothecene toxins in grain. The most important of these is deoxynivalenol (DON), also known as vomitoxin. This is a stable chemical that will persist through milling and baking, so wheat millers are understandably concerned when there is a problem with head blight. There is not a precise threshold of DON in grain that renders it unfit for milling, but a concentration above 2 ppm can pose problems for milling.

How does severity of head blight in the field relate to DON in grain? The more head blight in a field, the more DON one would expect to find in the grain. However, there may not be a close relation between the percentage of blighted heads in the field and DON. Head blight was common in Indiana last year, particularly in the south. The figure below shows the relationship between the percentage of blighted heads in the field and DON content of the harvested grain, from cultivar trials conducted at four locations in Indiana. DON was consistently high in fields where the frequency of blighted heads was greater than 25%. For fields where blight was seen on less than 25% of the heads, DON levels ranged from essentially zero up to 15 ppm. Several plots that had very little visible head blight had more than 4 ppm DON in the grain.

There is some reason to think that last year was an unusual situation, in that many grain samples from fields that did not have a lot of visible head blight nonetheless had high levels of DON. Whether we will see this pattern again this year remains to be seen. We have rated head blight incidence in cultivar trials at five sites in Indiana, and will evaluate grain quality and DON levels after harvest.

For fields where head blight is present, growers should turn up the air on the combine in order to blow as many shriveled kernels as possible out with the chaff. This should improve the quality of the harvested grain and reduce the level of DON. Millers are able to further screen grain to eliminate more shriveled kernels.

Relation between incidence of head blight in the field and concentation of DON in wheat grain, Indiana, 2003



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Soybean Cyst Nematode – (*Andreas Westphal and Gregory Shaner*)

- Resistant varieties and crop sequence considerations are the most effective means of nematode management.

The mild spring of 2004 has allowed planting corn and soybean earlier than usual. Unfortunately, good plant growth conditions are also conducive for obligate plant parasites. The soybean cyst nematode (SCN), *Heterodera glycines*, is an everlasting problem in soybean production. First cases of severe SCN damage have been observed in 2004. Efforts have been made to manage this soil-borne pest. Under current production conditions, use of resistant varieties and crop sequence considerations are the most effective means of nematode management. The use of resistant varieties is very effective if the right source of resistance is being used. The difficulty in soybean cyst nematode is the occurrence of different populations of the nematode. That means that SCN in certain fields can overcome resistance of soybean varieties. In the past we have classified these populations as "races" of the nematode. When certain populations were identified per field a variety with resistance towards that populations of nematodes was chosen. Due to the everlasting change in nematode genetics and due to some shortcomings of the way these "races" were identified - severe SCN damage was observed when parts of the nematode field population were capable of reproducing on the otherwise resistant variety. To improve the accuracy of predicting whether SCN can reproduce on a particular variety a new system to describe these populations was developed. This system classifies populations as "HG-types" of the nematode. This is a refined method that tests nematode field populations if they can reproduce on particular resistance sources. This information is then used to choose a soybean variety with a resistance source that is effective against the particular nematode population. Key to the successful use of this decision tool is to choose the right variety. This system is challenging since SCN continues to change and growers continuously need new types of SCN resistance. Efforts at Purdue University have resulted in the development of CystX. This trade name describes soybean varieties with broad resistance to SCN.

Cultural strategies are difficult to implement. Crop sequences with the non-host corn are beneficial in not permitting nematode reproduction in the corn year. The rotation with other crops is limited due to the vast crop area that is planted with soybean and corn. There has been some indication from southern parts of the Midwest that the incorporation of wheat in the crop sequence might be beneficial in reducing SCN populations. It is not known whether this would apply for Indiana growth conditions. SCN interacts with other soil-borne organisms, be it plant pathogens or beneficial microbes. For other plant-parasitic nematodes it has been well established that microbial communities can suppress the reproduction and damage potential of the nematode. Work is underway at Purdue University to investigate the effects of such microfloras and how different tillage practices may impact SCN population densities.

Agronomy Tips

Cold Weather Impacts on the Soybean Plants – (*Ellsworth P. Christmas***)**

- Slow soybean growth and light green to nearly yellow colored leaves. Why?

A number of individuals have expressed concerns regarding the very slow emergence and growth of soybeans. The name of the game is low temperatures, both of the air and the soil. For the past two weeks, nighttime air temperatures across the northern two-thirds of Indiana were at or above 50°F, while the southern one-third of the state had air temperatures above 50°F. Soil temperatures fared a little better with nighttime lows at or below 60°F at Wanatah and in the mid to low 60's at Lafayette and Dubois during the past two weeks, but in all cases above 50°F.

Soybean seed will begin the process of germination at soil temperatures of 50°F or above, but the process is very slow. The most rapid emergence occurs at soil temperatures of 70 to 80°F, which has been the case across most of Indiana since Monday June 7.

The low nighttime air temperatures experienced during the past two weeks can result in very slow vegetative growth. Research data shows that chilling the soybean plant for one week at temperatures slightly lower than the temperatures of the past two weeks can result in reduced leaf elongation, rate of leaf emergence, and CO_2 uptake. Usually, all of these will return to normal when temperatures return to levels at or above 75°F.

Low soil temperatures also result in a reduction of nodule formation and activity. Soybean plants that had just emerged prior to the cold soil temperatures may exhibit nitrogen deficiencies once air temperatures return to normal and the plants grow rapidly. This is the result of a demand by the plant for nitrogen greater than that available from the cotyledons and the soil. Once soil temperatures warm to a level suitable for nodule activity and the plant has reached the V4 to V5 stage of vegetative growth, the leaves will become a darker green color and the plant will resume normal growth.

All of these stresses may result in a plant with lower internodes shorter than normal, hence short plant for their age. Most of the stresses discussed above should not have any long-term effects on the soybean crop with the exception of the fungal disease potential.

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Wrapped & Twisted Whorls in Corn - (*Bob Nielsen*)

The curious phenomenon often referred to as the "twisted whorl syndrome" has been reported again this year. The occurrence of the twisted whorl syndrome is not uncommon, but rarely affects a large number of fields in any given year or, usually, a large percentage of plants within a field. This past weekend, though, I walked two fields in west central Indiana that averaged 30 to 42% of the plants with wrapped and twisted whorls. Needless to say, the growers were a bit concerned about the future of their crops.

The growth stage of both of the affected fields was late V5 to early V6 (five to six visible leaf collars, somewhat less than knee-high), suggesting a planting date of late April to early May. The lowermost six leaves were normal appearance, although the sixth leaf showed some crinkled (accordion-like) tissue near the base of the leaf blade. Beginning with the seventh leaf, the whorl was tightly wrapped and often bent over at right angles to the ground.

The frequency of twisted whorls in the first field ranged from 30 to 54%, while the same hybrid in the second field (different grower, 18 miles distant) exhibited 20 to 44% affected plants. Another hybrid also planted in the second field exhibited far fewer affected plants (1 to 7%). Such differences among hybrids have commonly been reported in past incidences of the phenomenon.

I'll freely admit that we do not fully understand why this symptom develops. For some reason, the upper whorl of affected plants does not unfurl properly, as if the rolled leaf tissue has lost its elasticity. Younger leaves developing deeper in the whorl are unable to emerge from the tightly wrapped upper leaves. The subsequently tightly twisted whorl then bends and kinks from the pressure exerted from the younger leaves' continued growth.

Field exhibiting twisted whorls

One's natural instincts would blame the twisted growth on herbicide injury. Indeed, where cell growth inhibitor or growth regulator herbicides are applied pre-plant or pre-emergence, shoot uptake of the herbicide by the emerging seedlings can indeed cause twisted growth of the young plants. Late application of growth regulators can also cause twisted whorls in older plants when leaves and whorl intercept a substantial amount of the herbicide. Widespread occurrence of the twisted whorl syndrome is not, however, usually accompanied by the common thread of any particular herbicide application.

Some have questioned whether wind damage can give rise to this phenomenon by somehow damaging the young inner whorl leaves. I've not often tracked the occurrence of strong winds with the development of the twisted whorl symptom, but it's no secret that there were a number of strong storm and wind events throughout the state over the past couple of weeks.

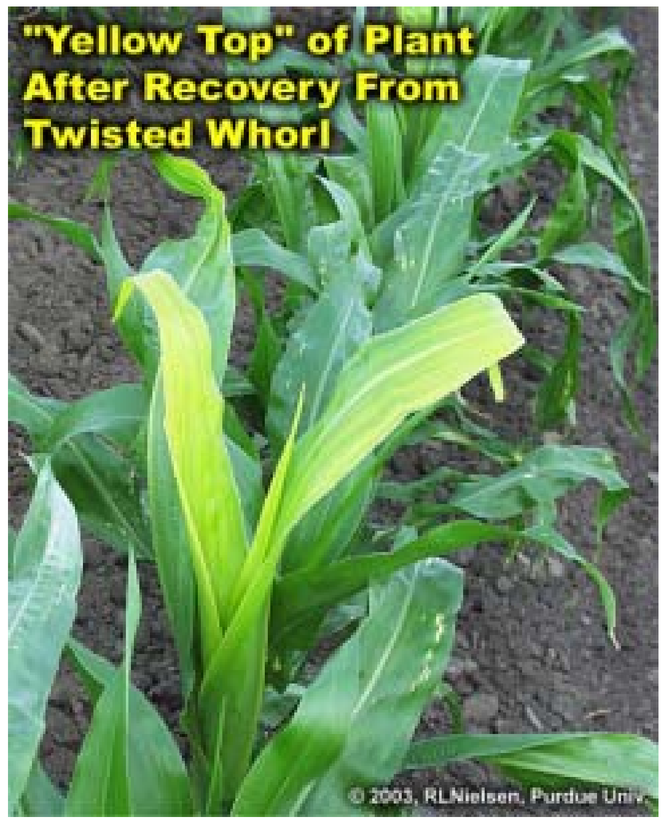
Single plant iwth twisted whorl, leaf stage V6

In other situations over the years, this phenomenon has often been associated with a sharp transition from periods of slow corn development (typically, cool cloudy weather) to periods of rapid corn development (typically, warm sunny weather plus ample moisture). Some have argued that it is the reverse, transitioning from rapid periods of development to slow. Or... maybe it is a transition from rapid development to slow and back to rapid that triggers the symptoms.

Whatever the cause, the appearance of the twisted whorl plants is indeed unsettling and one would think that the whorls could never unfurl properly. Given another week, though, twisted whorls of most of the plants will unfurl and affected plants subsequently develop normally. Indeed, some plants in the fields I walked last weekend were already beginning to unwrap.

If you didn't notice the twisted whorls to begin with, you may notice the appearance of "yellow tops" across the field after the whorls unfurl. The younger leaves that had been trapped inside the twisted upper leaves emerge fairly yellow due to the fact that they had been shaded for quite some time. In addition to being fairly yellow, the leaves will exhibit a crinkly surface caused by their restricted expansion inside the twisted whorl. Another day or two will green these up and the problem will no longer be visible.

"Yellow tops" of plants after recovery from twisted whorl



Closer view of "yellow top" of plant after recovery from twisted whorl

The Good News: Yield effects from periods of twisted growth caused by weather-related causes are minimal, if any. By the time the affected plants reach waist to chest-high, the only evidence that remains of the previous twisted whorls is the crinkled appearance of the most-affected leaves.

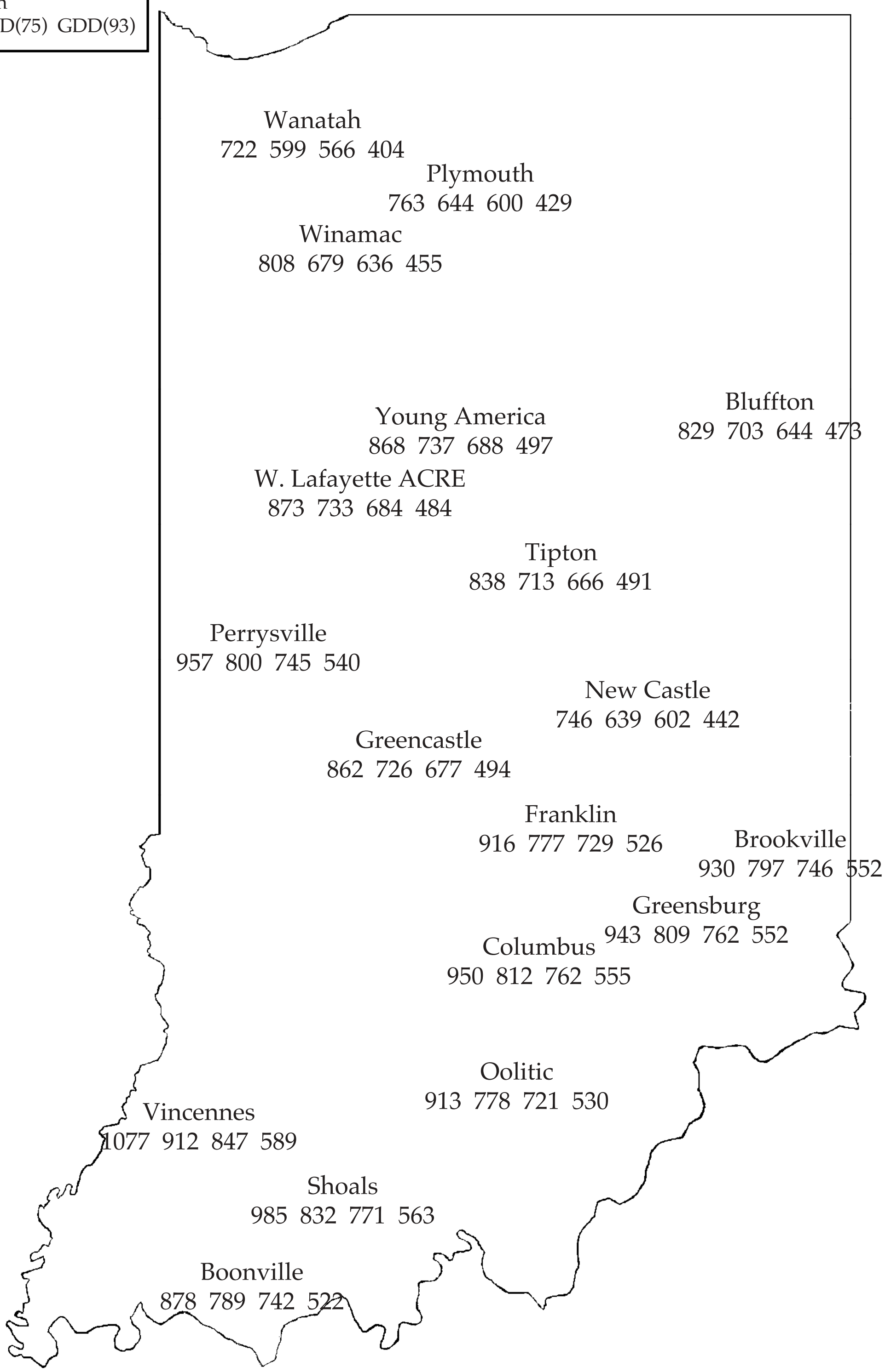
Don't forget, this and other timely information about corn can be viewed at the Chat 'n Chew CafÈ on the Web at <www.kingcorn.org/cafe>. For other information about corn, take a look at the Corn Growers' Guidebook on the Web at <www.kingcorn.org>.

Weather Update

Temperatures as of June 9, 2004

GDD(5) = Growing Degree Days from April 7 (5% of Indiana's corn planted), for corn growth and development
GDD(42) = Growing Degree Days from April 21 (42% of Indiana's corn planted), for corn growth and development
GDD(75) = Growing Degree Days from April 30 (75% of Indiana's corn planted), for corn growth and development
GDD(93) = Growing Degree Days from May 14 (93% of Indiana's corn planted), for corn growth and development

MAP KEY
Location
GDD(5) GDD(42) GDD(75) GDD(93)



4" Bare Soil Temperatures 6/9/04

Location	Max.	Min.
Wanatah	87	70
Winamac	89	74
Bluffton	85	75
Chalmers	78	74
W Laf Acre	93	77
Tipton	86	73
Farmland	87	73
Perrysville	82	75
Crawfordsville	79	72
Liberty	93	69