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Slugs, the Weather Forecast is Perfect – *(John Obermeyer and Christian Krupke)* -

- Slugs like it cool and wet.
- Crop damage and stand losses are most severe when slugs feed on hypotcotyls and mesocotyls.
- Control options are limited and difficult to implement.

Slugs are soft-bodied, legless, slimy, and grayish or mottled gastropods – relatives of snails, clams, and other aquatic animals. Their length, depending on species, can reach up to 4 inches, but is usually 1/2 to 1-1/2 inches long. Build-up of slug populations is greatest in no-till systems and weedy fields, because the optimum conditions for slug survival (wet soils, lots of residue) are most likely to occur under these conditions. Juvenile slugs, which are present now, will continue to increase in size, as will their appetite. The immediate forecast of rain, will favor the hungry, growing slugs.

Both corn and soybeans can be significantly damaged by this nocturnal pest. Their mouthparts cause a scraping type of damage, where the top layer of leaf tissue is removed. On corn, slugs feed on the surface tissue of leaves resulting in narrow, irregular, linear tracks or scars of various lengths. Severe feeding can result in split or tattered leaves that resembles hail damage. Soybean damage is not as predominant on the foliage, but rather on the hypocotyl and cotyledons. Given good growing conditions, plants usually outgrow slug damage once the crop is up. Most damage and stand losses by slugs occur when fields are too wet to plant and seed slots are not properly closed. In this situation, slugs can be found feeding on the seedlings within the slot, day or night. That is really a worst case scenario, and pretty uncommon. But once the growing point of corn or soybeans is injured, plant recovery is unlikely.

Control of slugs is difficult, if not impossible. Disruption of their environment, i.e., tillage, is typically not an option, especially on long-term no-till or highly erodible land. A metaldehyde-pelleted bait is labeled and available for use. However, spreading the pellets evenly over the field or damaged areas is another matter; a commercial mechanical dispenser is one possibility. Field trials at Ohio State have shown good results when the pellets are evenly distributed. With the significant cost and difficulty of application, consider these baits only as a last resort to protect crop stands in high slug populated areas. Remember that time is on your side – as the season advances, the risks of slug damage decrease with increasing temps and crop growth.

Where replanting is necessary from slug damage, one should strongly consider lightly tilling the area first, or at least a zone tillage for the seed row. This should help dry the area and break-up and bury crop residue. This will discourage further slug activity. Granular, liquid, and seed-applied insecticides are ineffective against slugs, as they are able to “over-slime” them, not a technical term. Bt corn has no effect on slugs. Home remedies, such as spraying plants at night with liquid fertilizer (high salt concentration), have proved futile and are obviously impractical for most large-scale plantings.

Corn seedling severely damaged by slugs.

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Asiatic Garden Beetle Grub Report – *(John Obermeyer)* -

A call and pictures from Gary Kauffman, Crop Tech, alerted us to the fact that Asiatic garden beetle grubs are making their presence felt in course-textured soils of fields in north central and northeastern counties. Seed applied insecticides, even high rates, have little effect in preventing these grubs from feeding on corn roots, more importantly the mesocotyl. Unfortunately, there is no rescue treatment available. Damaged plants, if growing points aren't compromised, may recover somewhat if grubs soon pupate (i.e., stop feeding) and ample moisture is available. Don't let the size of the small grubs fool you, they are like grubs on steroids!

Typical, spotty stand reduction by Asiatic garden beetle grubs.

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Armyworm Crossing the Road – *(John Obermeyer)* -

Andy Nicholson, Nicholson Consulting, alerted us that armyworm are on the move in Hendricks County. After noticing smashed armyworms on a county road, he stopped and inspected a neighboring wheat field and found the plants denuded well into the field. Needless to say, the combine will be quiet in this field, as much of the wheat yield is determined by the flag leaf. Gary Battles, St. Joseph County, informed us that he is finding them and their leaf feeding in wheat fields, but not yet at treatable levels. Remember, as the armyworm grow from ¾" to over an inch, the appetite rapidly increases. Once you see them "marching" from a field, it is too late. As discussed in previous Pest&Crop articles, it certainly is worth the look in high-risk crops.

Why did the armyworm cross the road?

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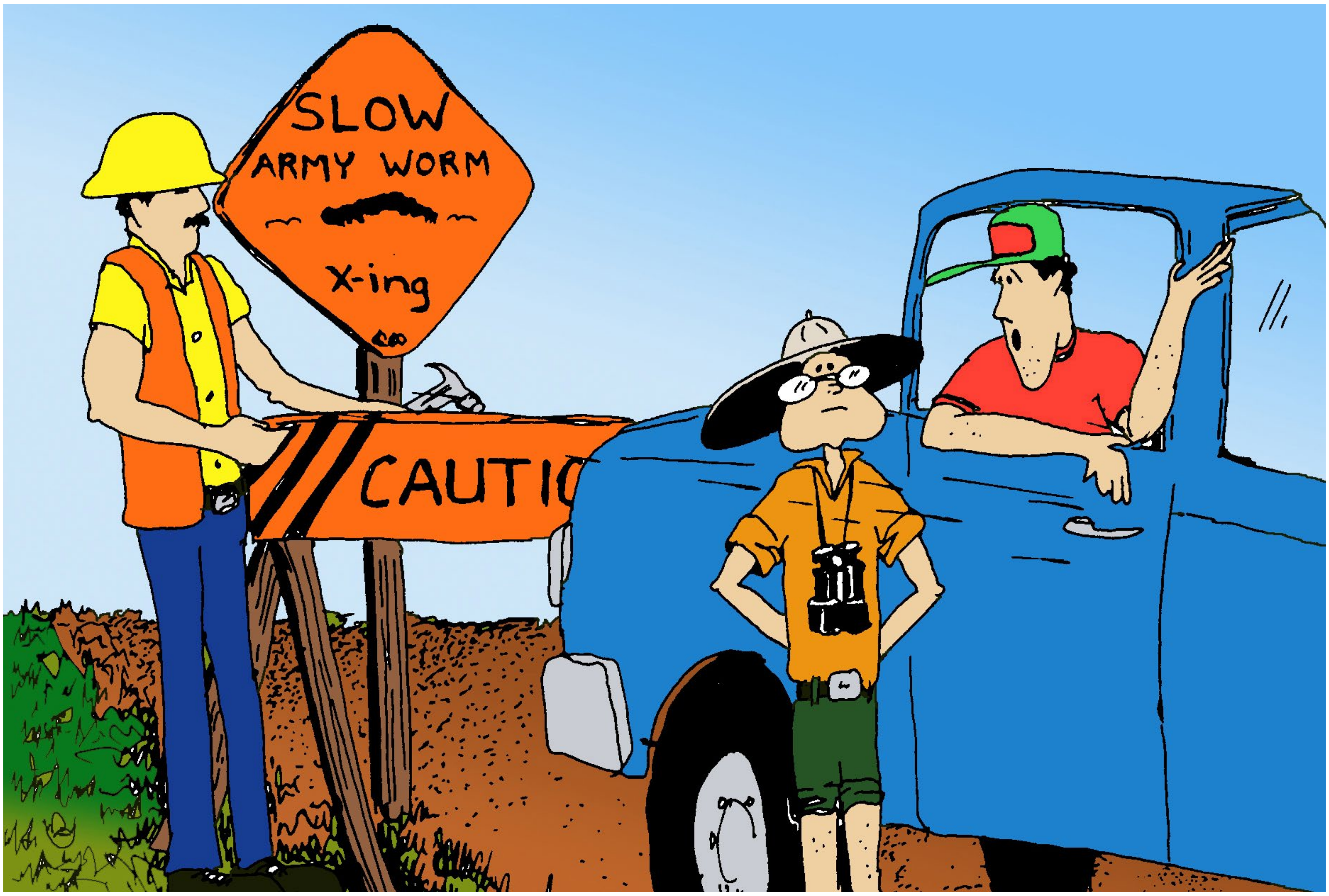
Armyworm Pheremone Trap Report

County	Cooperator	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12
Dubois	SIPAC Ag Center	0	0	0	101	193	16	0	3	31	6	8	
Jennings	SEPAC Ag Center	0	1	1	56	57	9	4	32	4	4	13	
Knox	SWPAC Ag Center	0	13	26	42	189	57	2	10	20	13	89	
LaPorte	Pinney Ag Center	0	0	3	352	936	382	154	445	750	100	112	
Lawrence	Feldun Ag Center	4	108	216	246	650	348	112	31	40	74	61	
Randolph	Davis Ag Center	0	29	41	528	1232	300	72	10	298	44	21	
Tippecanoe	Meigs	0	2	15	107	730	243	98	95	86	21	70	
Whitley	NEPAC Ag Center	0	34	90	537	1689	1349	855	665	1265	334	127	

Wk 1 = 3/16/17 - 3/22/17; Wk 2 = 3/23/17 - 3/29/17; Wk 3 = 3/30/17 - 4/5/17; Wk 4 = 4/7/18 - 4/12/17; Wk 5 = 4/13/17 - 4/19/17; Wk 6 = 4/ 20/17 - 4/26/17; Wk 7 = 4/27/17 - 5/3/17; Wk 8 = 5/4/17 - 5/10/17; Wk 9 = 5/11/17 - 5/17/17; Wk 10 = 5/18/17 - 5/24/17; Wk 11 = 5/25/17-5/31/17



Don't you think that's carrying the "Protect Your Wildlife" idea a bit too far?

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Agronomy Tips

Late Soybean Planting Considerations – *(Shaun Casteel)* -

Many areas still need to plant soybeans for the first time while others may need to replant. We need set the stage for the best possible return on late plantings of soybean. If you are in the situation of planting soybeans in June, you need to consider your seeding rates, row width, and maturity group. Soybeans trip their reproductive trigger (flowering) as the day length shortens, which occurs much quicker with delayed plantings.

SEEDING RATE – Planting in the first weeks of June require 10 to 20% increase in seeding rates (~15,000 seed/acre increments for each week of delay). The higher seeding rates will help to facilitate quicker row closure and higher pod height with fewer days to flowering.

My starting recommendations for normal planting operations in April and May are: 120,000 to 140,000 seeds/acre for planters (15 to 30”), 140,000 to 160,000 seeds/acre for air seeders (~15”), and 160,000 to 180,000 seeds/acre for drills (<10”).

If you typically plant 140,000 seeds/acre with a 15-inch planter, you need to bump the seeding rate to ~155,000 seeds/acre in the first week of June then to ~170,000 seeds/acre in the second week of June, so forth and so on. Soybeans will produce fewer main-stem nodes (attachment points of trifoliates and ultimately pods) as planting is delayed, so the increasing seeding rates will also help to overcome the shortfall in node production.

ROW WIDTH – If you plant 30-inch rows, you need to look into the possibility of planting narrower rows with the limited time to flowering. We typically see a yield advantage of 5 to 10% for soybeans planted in narrow rows (15 inches or less) compared to 30-inch rows, and this difference will be even more prominent in late planting situations. Wide rows (30-inch) take nearly 25 days longer and 40 days longer to canopy compared to 15-inch and 7.5-inch rows, respectively. This delay will certainly decrease the yield potential as canopy closure would occur well after reproductive initiation.

Replant Consideration. However, you may consider a 30-inch planter to limit the damage to the existing stand of soybeans in a replant/overseeding situation. Planting at an angle will likely limit the amount of damage. In some row configurations, replanting with a GPS-guided offset will also limit mechanical damage to existing stand.

MATURITY GROUP – Full-season varieties for your respective regions can still be planted until June 15 for the northern quarter, June 20 for the central half, and June 25 for the southern quarter of Indiana. Varieties should be dropped a half maturity group after these dates and planted for another two weeks before we consider other alternatives.

Action	Northern IN	Central IN	Southern IN
Stay the course until:	June 15	June 20	June 25
Then, drop 0.5 MG and plant until:	June 30	July 5	July 10

Replant Consideration. Variety selection for replanting can be difficult, because we ideally want the whole field to mature at the same time to ease harvest operations. General rules of thumb include that a 3-week delay in planting is about 1-week delay in maturity. A shift in 1.0 maturity group (MG) unit is approximately 7 to 10 day difference in maturity. Again, these are given as guidelines and not absolutes. Field conditions in August to September can also cause hasten (hot and/or dry) or extend (adequate soil moisture such as those wet pockets that are replanted) the reproductive period, which influence maturity timeline.

Table 1. Planting date and variety (maturity group) effect on the time to emerge (VE), bloom (R1), and to mature (R8) from 2016 trial at West Lafayette. Heat map created

within each growth stage column based on calendar date (green = earlier in the year, red = later in the year). The heat map can be used as a guide to match up the planting date and varietal maturity under "normal" growing conditions.

			CALENDAR DATE TO REACH:			DAYS AFTER PLANTING TO REACH:		
Planted	Variety		Emerge (VE)	Bloom (R1)	Maturity (R8)	Emerge(VE)	Bloom (R1)	Maturity (R8)
4/20	2.8	2.9	5/2	6/11	9/8	13	53	141
	3.3	3.4	5/2	6/14	9/14	13	55	147
	3.7	3.8	5/3	6/14	9/16	14	56	149
5/22	2.8	2.9	5/28	6/26	9/17	6	35	118
	3.3	3.4	5/27	6/27	9/20	6	37	121
	3.7	3.8	5/27	6/27	9/23	6	37	125
6/3	2.8	2.9	6/10	7/7	9/23	7	35	112
	3.3	3.4	6/10	7/12	9/25	7	40	115
	3.7	3.8	6/10	7/13	9/30	7	40	119
6/13	2.8	2.9	6/19	7/20	9/28	6	38	107
	3.3	3.4	6/19	7/23	10/3	6	40	112
	3.7	3.8	6/19	7/21	10/8	6	39	118
6/29	2.8	2.9	7/5	8/2	10/10	6	34	104
	3.3	3.4	7/5	8/5	10/12	6	37	105
	3.7	3.8	7/5	8/4	10/15	6	37	109

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Effects of Flooding or Ponding on Corn Prior to Tasseling – *(Bob Nielsen)* -

Intense rainfall events (technically referred to as "toad stranglers" or "goose drownders") flood low-lying corn fields and create ponding (standing water) in poorly drained areas (depressions, compacted soil) within other fields. Other areas within fields, while technically not flooded or ponded, often remain saturated for lengthy periods of time. Recurrent heavy rainfall events, like Indiana has experienced throughout May 2017, simply "add insult to injury" by re-wetting, re-ponding, and re-flooding the same areas of the fields.

What are the prospects for recently submerged corn fields or plants simply enduring days and days of saturated soils? The flippant answer is that suffering crops will survive until they die.

What I mean to say is that no one can tell you with certainty the day after the storm whether a ponded area of a corn field will survive or whether there will be long-term yield consequences until enough time has gone by such that you can assess the actual recovery of the damaged plants. We can, however, talk about the factors that increase or decrease the risks of severe damage or death to flooded soils.

- Plants that are completely submerged are at higher risk than those that are partially submerged.
    - Plants that are only partially submerged may continue to photosynthesize, albeit at limited rates.

- The longer an area remains ponded, the higher the risk of plant death.
    - Most agronomists believe that young corn can survive up to about 4 days of outright ponding if temperatures are relatively cool (mid-70's^{o}F or cooler); fewer days if temperatures are warm (mid-70's^{o}F or warmer).
    - Soil oxygen is depleted within about 48 hours of soil saturation. Without oxygen, the plants cannot perform critical life sustaining functions; e.g. nutrient and water uptake is impaired and root growth is inhibited (**Wiebold, 2013**).

- Even when surface water subsides quickly, the likelihood of dense surface crusts forming as the soil dries increases the risk of emergence failure for recently planted crops.
    - Be prepared with a rotary hoe to break up the crust and aid emergence.

- The greater the deposition of mud or old crop residues on plants as the water subsides, the greater the stress on the plants due to reduced photosynthesis.
    - Ironically, such situations would benefit from another rainfall event to wash the mud deposits from the leaves.

- Mud and crud that cakes the leaves and stalks encourage subsequent development of fungal and bacterial diseases in damaged plant tissue. In particular, bacterial ear rot can develop when flood waters rise up to or above the developing ears of corn plants (Nielsen, 2003).
- Extended periods of saturated soils AFTER the surface water subsides will take their toll on the overall vigor of the crop.
    - Some root death will occur and new root growth will be stunted until the soil dries to acceptable moisture contents. As a result, plants may be subject to greater injury during a subsequently dry summer due to their restricted root systems.
    - Nutrients like nitrogen are rapidly remobilized from lower leaves to upper, newer leaves; resulting in a rapid development of orange or yellow lower leaves.
    - Because root function in saturated soils deteriorates, less photosynthate is utilized by the root system and more accumulates in the upper plant parts. The higher concentration of photosynthate in the stems and leaves often results in dramatic purpling of those above-ground plant parts (**Nielsen, 2012**).
    - Damage to the root system today will predispose the crop to the development of root and stalk rots later by virtue of the photosynthetic stress imposed by the limited root system during the important grain filling period following pollination. Monitor affected fields later in August and early September for the possible development of stalk rots and modify harvest-timing strategies accordingly.

- Concomitant (I found a new word in the dictionary!) with the direct stress of saturated soils on a corn crop, flooding and ponding can cause significant losses of soil nitrogen (N) from either denitrification of nitrate-N in heavier soils or leaching of nitrate-N in coarser soils.
    - Significant loss of soil N will cause nitrogen deficiencies and possible additional yield loss.
    - On the other hand, if the corn dies in the ponded areas it probably does not matter how much nitrogen you've lost.

- Lengthy periods of wet soil conditions favor the development of seedling blight diseases in young corn seedlings, especially those caused by Pythium fungi (**Sweets, 2014**).
    - Fungicidal seed treatments effectively protect the seed and seedling for only about 3 weeks after planting. After that, especially if seedling development has been delayed by cold or excessive soil moisture, the risk of infection increases quickly. Fields that looked acceptable one week can be devastated by seedling blight by the next week if conditions are favorable for the disease and seedling development has not yet reached about V3 to V4.
    - Poorly drained areas of fields are most at risk for the development of these diseases and so will also be risky for potential replant operations.

- The risk of diseases like common smut and crazy top also increases when soils are saturated or plants are submerged and temperatures are cool (**Pataky and Snetselaar, 2006**; **Jackson-Ziems, 2014**, **APS, 2015**).
    - The fungus that causes crazy top depends on saturated soil conditions to infect corn seedlings.
    - The common smut fungal organism is ubiquitous in soils and can infect young corn plants through tissue damaged by floodwaters. There is limited hybrid resistance to either of these two diseases and predicting damage is difficult until later in the growing season.

- Wind damage to corn during severe storms results in either stalk breakage (aka "green snap") or root lodging (plants uprooted and laying nearly flat to the ground). The risk of permanent damage is greater during late vegetative development and less with younger plants.
    - The yield effect of "green snap" damage depends on the percentage of field affected and whether the stalk breakage occurs above or below the ear, but is usually serious regardless. Obviously, stalk breakage below the ear results in zero yield for that plant. Stalk breakage above the ear results in significant yield loss due to the loss of upper canopy photosynthesis capacity for that plant.
    - Root lodged corn will recover or straighten up to varying degrees depending on the growth stage of the crop. Generally, younger corn has a greater ability to straighten up with minimal "goose-necking" than older corn. Yield effects of root lodging depend on whether soil moisture remains adequate for root regeneration, the severity of root damage due to the uprooting nature of root lodging, and the degree of "goose-necking" that develops and its effect on the harvestability of the crop.

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Prevalent Purple Plants Perennially Puzzle Producers – *(Bob Nielsen)* -

Like the swallows that return every year to San Juan Capistrano, it seems that purpling of young corn returns every year to more than a few fields in Indiana. While somewhat attractive from an ornamental perspective, the sudden appearance of the pretty purplish hue in young corn fields, clearly evident from the window of a pickup tooling down country roads at 60 mph, often causes grief and consternation for landlords and tenants alike.

Biochemical Cause of Purpling. Purpling of corn plant tissue results from the formation of reddish-purple anthocyanin pigments that occur in the form of water-soluble cyanidin glucosides or pelargonidin glucosides (Kim, 1998). A hybrid's genetic makeup determines whether corn plants are capable of producing anthocyanin. A hybrid may have none, one, or many genes that can trigger production of anthocyanin. That is the reason why purpling may appear in only one of two hybrids planted in the same field. Purpling can also appear in the silks, anthers and even coleoptile tips of a corn plant.

Agronomic Cause of Purpling. Well, you may say, that's fine but what triggers the production of the anthocyanin pigments in young corn at this time of year? The answer is not clearly understood, but most agree that these pigments develop in young plants in direct response to a number of stresses that limit the plants' ability to fully utilize the photosynthates produced during the day.

It has been my experience that the most common factors that correlate with the development of purple corn plants is the combination of bright, sunny days and less than favorable cool nights (40's to 50's F) when corn plants are in the V3 to V6 stages of development (3- to 6-leaf collar stages). This combination translates to a lot of photosynthate produced during the day, but low rates of photosynthate metabolism during the night. That combination of weather factors results in high concentrations of sugary photosynthates in the leaves. Since the anthocyanin occurs in the form of a sugar-containing glucoside, the availability of high concentrations of sugar in the leaves (photosynthesis during bright, sunny days) encourages the pigment formation. Hybrids with more anthocyanin-producing genes will purple more greatly than those with fewer “purpling” genes. In most cases, the purpling will slowly disappear as temperatures warm and the plants transition into the rapid growth phase (post-V6).

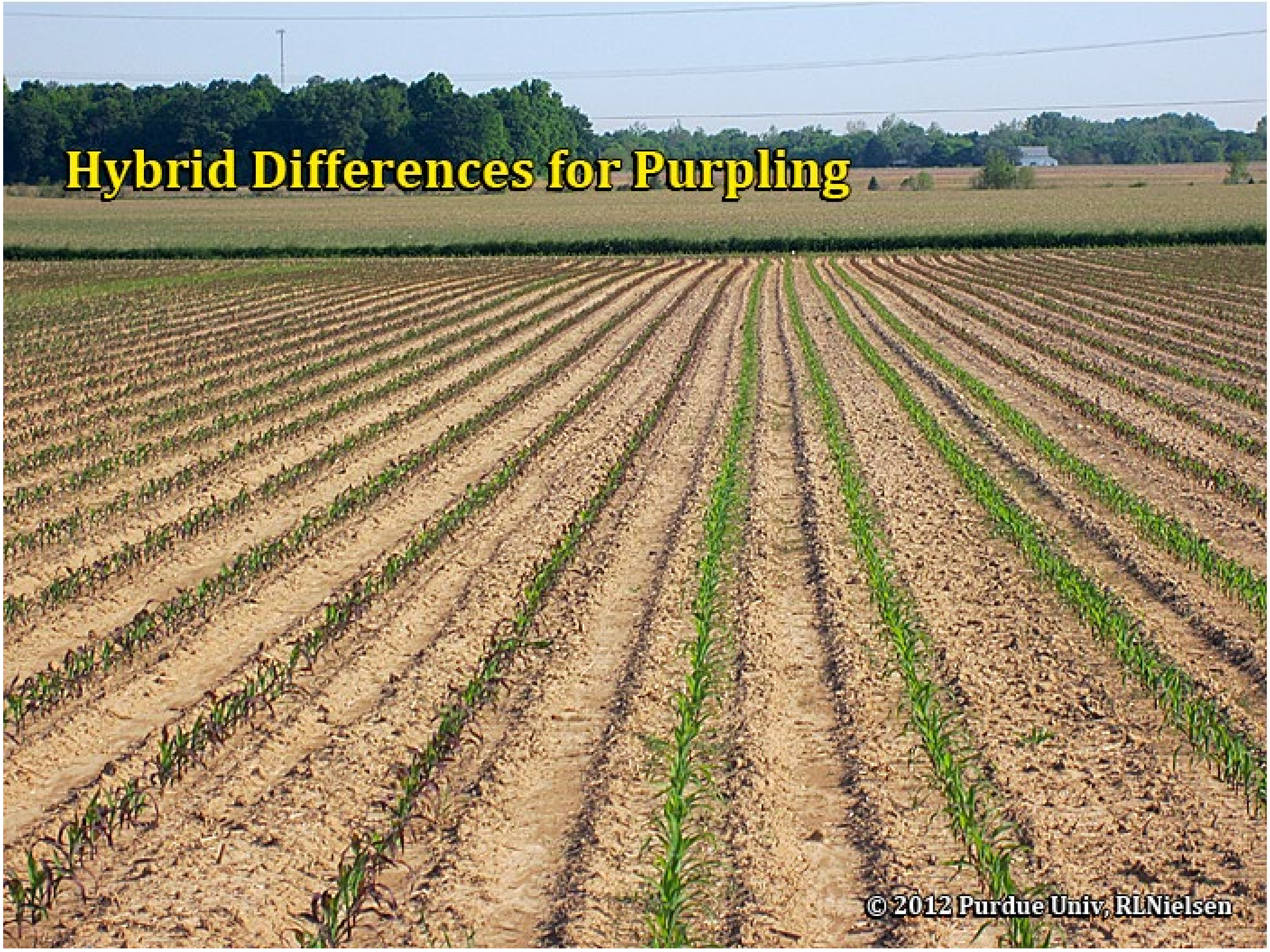
Other stresses that restrict photosynthate metabolism in young corn plants include several that restrict root growth, including herbicide injury, soil phosphorus deficiency, soil compaction caused by tillage or planter traffic, excessively wet soils, excessively dry soils, insect injury, and disease injury. The negative effects of such root stresses on photosynthate metabolism can amplify the intensity of the purpling already triggered by a combination of cool nights and bright, sunny days.

What About Yield Losses? Does the leaf purpling lead to yield losses later on? It is important to recognize that the cause of leaf purpling, not the purpling itself, will determine whether yield loss will occurs. If the main cause is simply the combination of bright, sunny days and cool nights, then the purpling will disappear as the plants develop further, with no effects on yield.

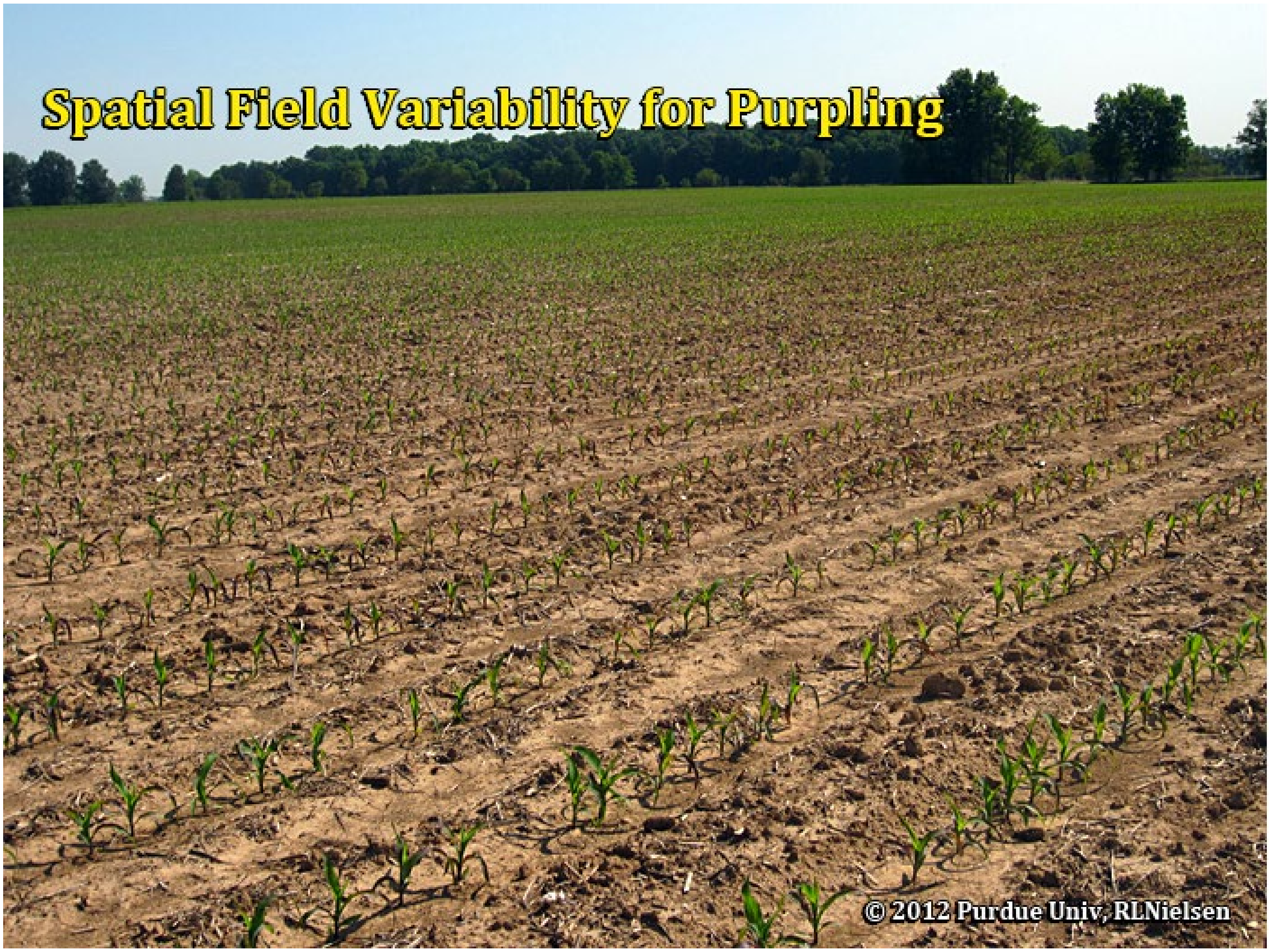
If the major contributor to the purpling is restriction of the developing root system, then the potential effects on yield will depend on whether the root restriction is temporary (e.g., cool temperatures and wet soils) or more prolonged (e.g., soil compaction, herbicide injury). Young plants can recover from temporary root restrictions with little to no effect on yield. If the restriction of the root development lingers longer and plants become stunted, then some yield loss may occur... not because of the purpling, but rather because of the effects of the lingering root restriction and eventual stunted plants.

If the primary cause of the purpling is the hybrid's genetic response to the combination of cool nights and bright, sunny days, then the purpling symptoms will be more spatially uniform throughout a field. If other stress factors are also restricting root development and/or function, then the purpling symptoms may be spatially variable throughout the field and correlated to soil type, drainage characteristics, or elevation of the landscape. Spatially variable patterns of purple corn may indicate the potential for lingering, yield-limiting stresses that should be more thoroughly investigated.

Intense purpling of a late V3 plant.



Hybrid differences for purpling.



Spatial field variability for leaf purpling.

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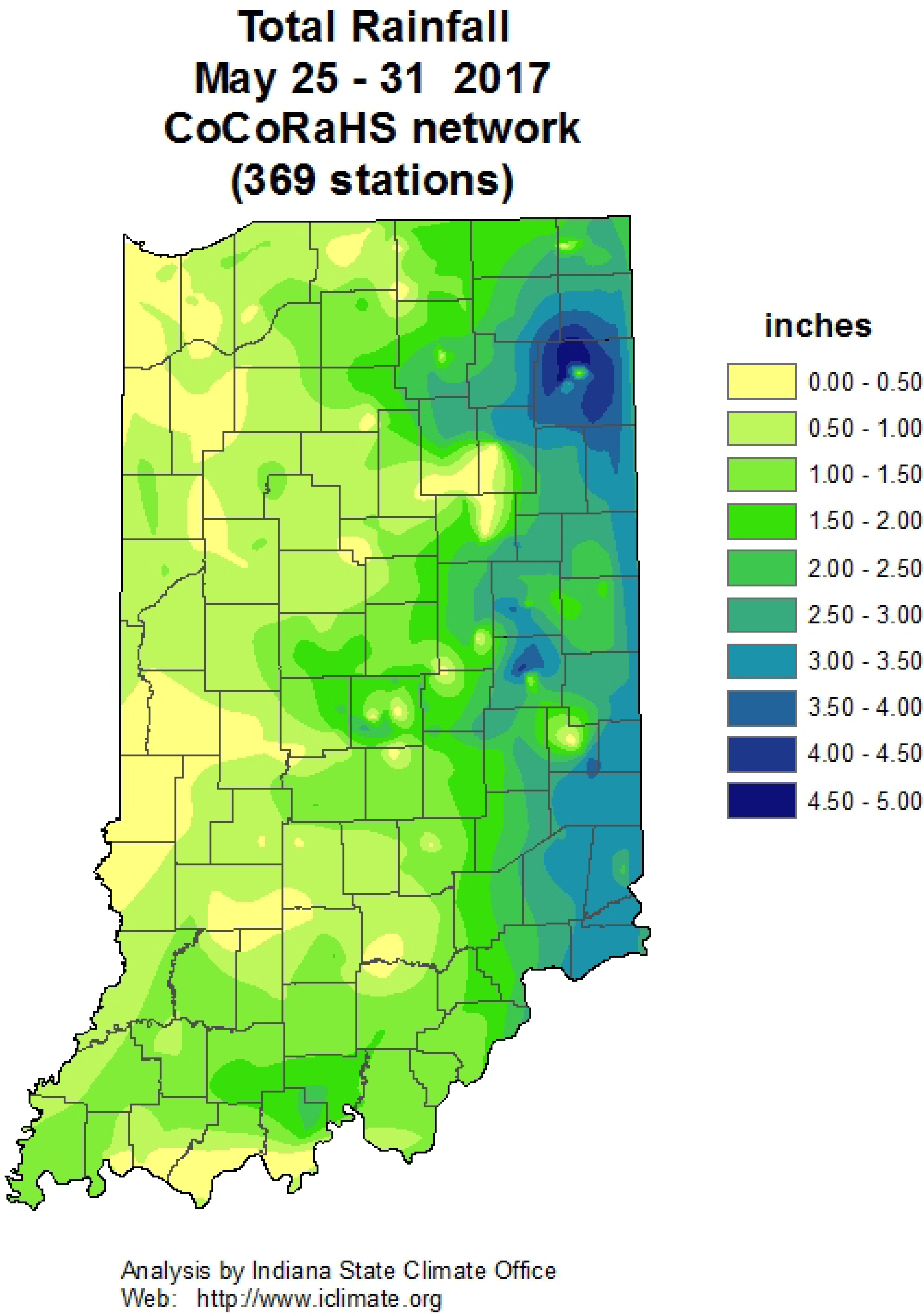
WEATHER UPDATE

Precipitation



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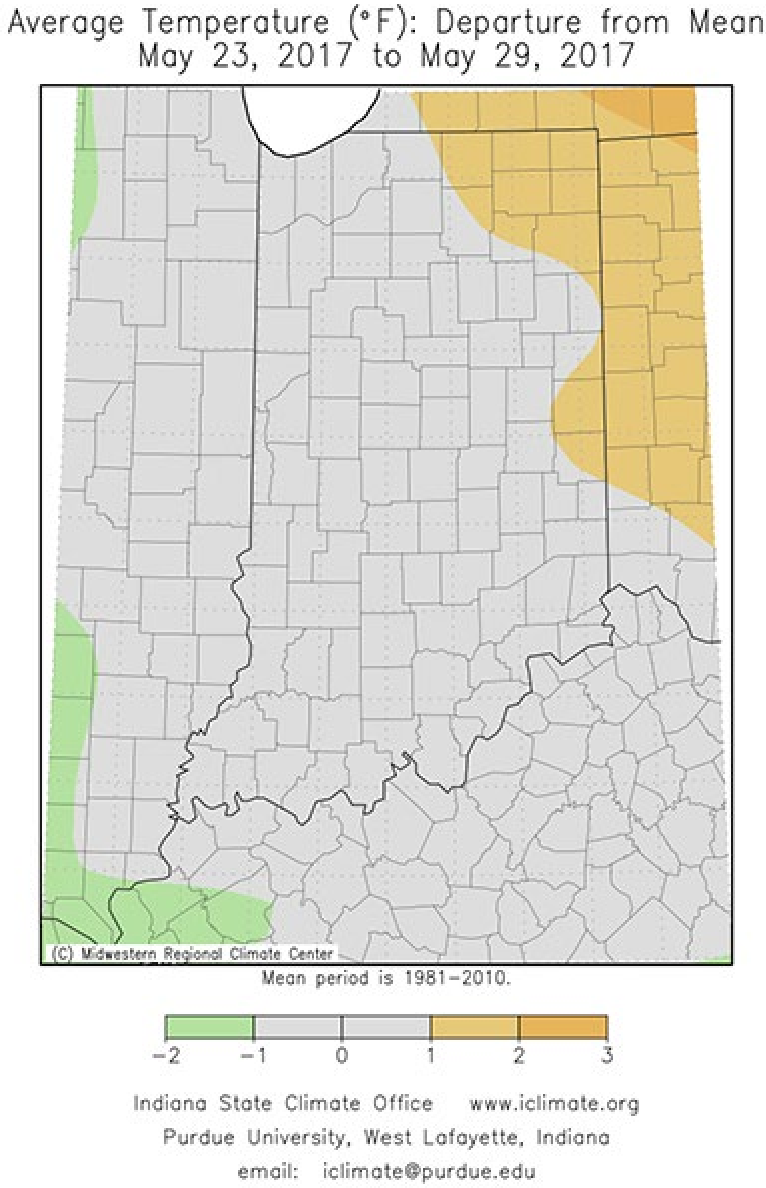
Temperature



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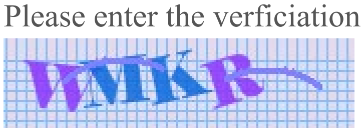

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