Field Crop Pest Management Meeting

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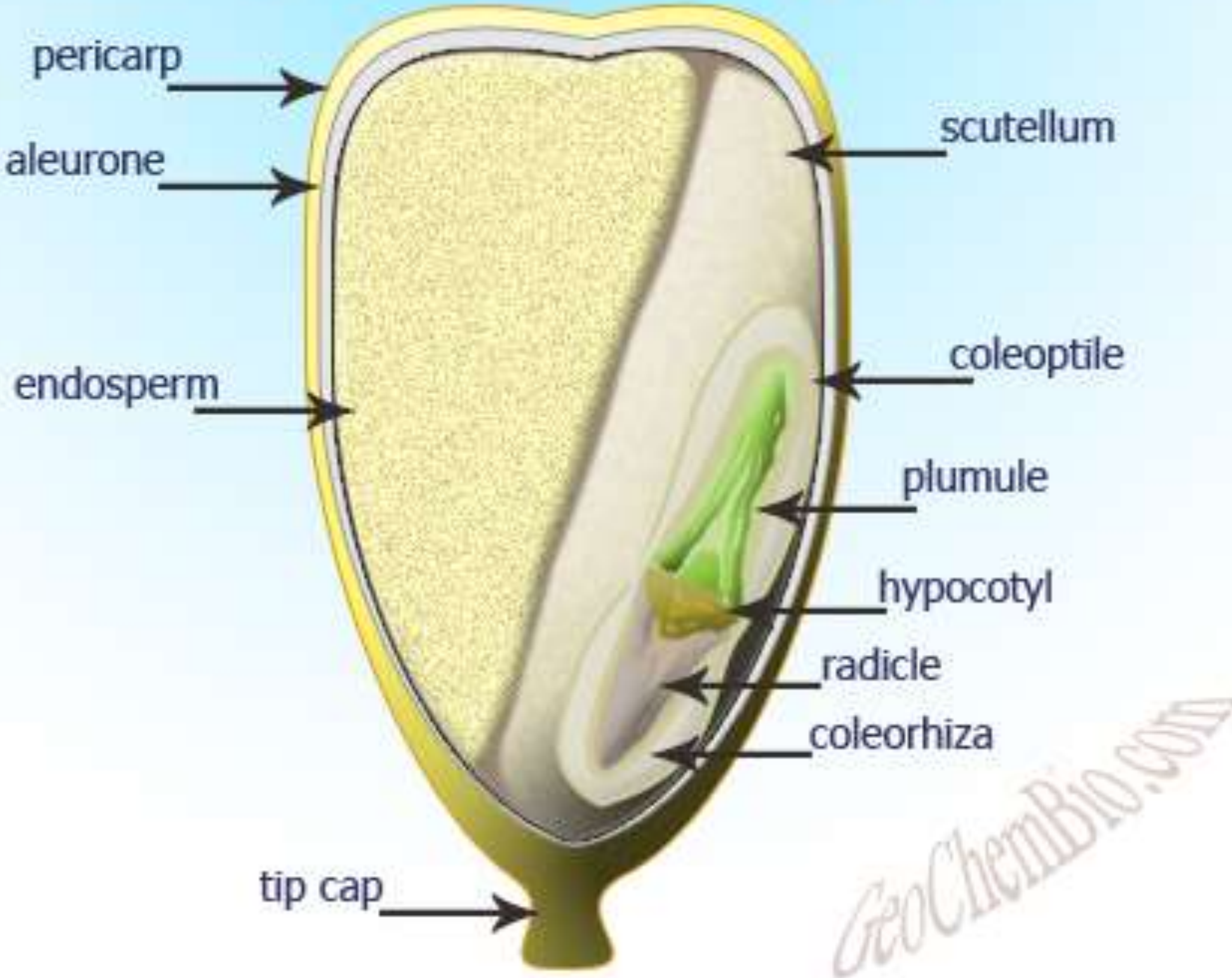
Agenda

- Corn pests and issues, focus on 2013
  - Germination thru leaf diseases
- Alfalfa pests
- Giant ragweed
- Acetochlor and water quality
- I raided the slide sets for just about everything I have seen in the past 5 years plus slides and pictures online.

Germination

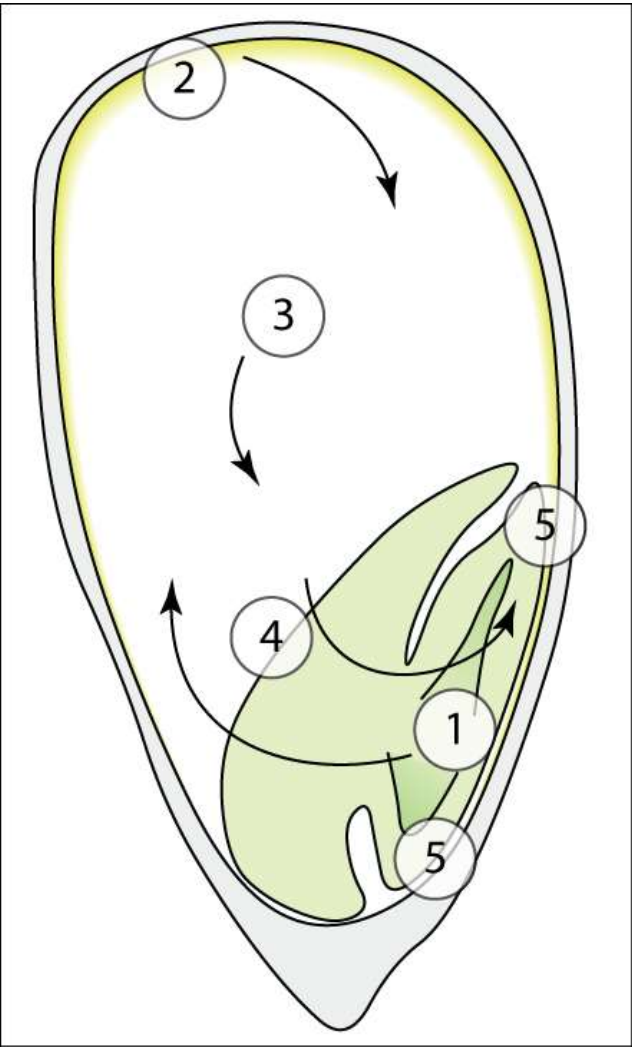
- Starts of enzymatic activity that results in cell division and elongation and, ultimately, embryo emergence through the seed coat.
- Corn kernels must absorb (imbibe) about 30 % of their weight in water before germination begins.
- Corn will germinate and emerge slowly and unevenly when soil temperatures are less than 50F – ideal is actually 86F
- Repeated wetting and drying cycles can decrease seed viability.

Corn seed



pericarp
aleurone
endosperm
tip cap
scutellum
coleoptile
plumule
hypocotyl
radicle
coleorhiza
GeoChemBio.com

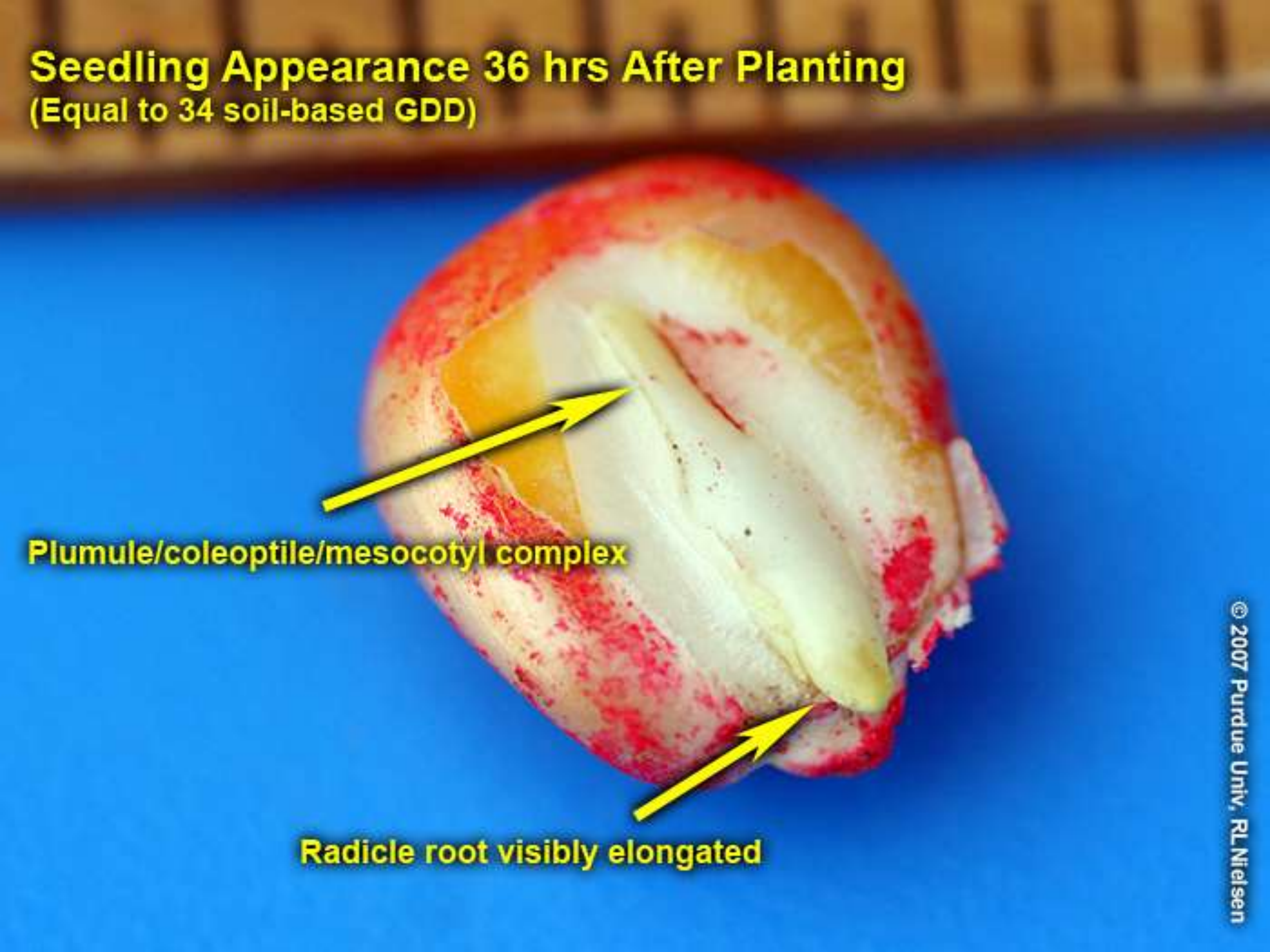
How Corn Seeds Mobilize Stored Starch



1. The embryo releases a hormone, which diffuses throughout the seed.
2. Aleurone cells respond to the hormone by producing the enzyme, amylase.
3. Amylase digests the starch that is in the endosperm, producing glucose.
4. As the glucose is produced, and diffuses throughout the endosperm, the scutellum imports the glucose, and transfers it to the embryo proper.
5. The cells of the root and shoot use the glucose for growth.


Kernel Appearance 12 hrs After Planting
(Equal to 10 soil-based GDD)
© 2007 Purdue Univ, RLNielsen


Kernel Appearance 36 hrs After Planting
(Equal to 34 soil-based GDD)
Radicle root visibly elongated
© 2007 Purdue Univ, RLNielsen

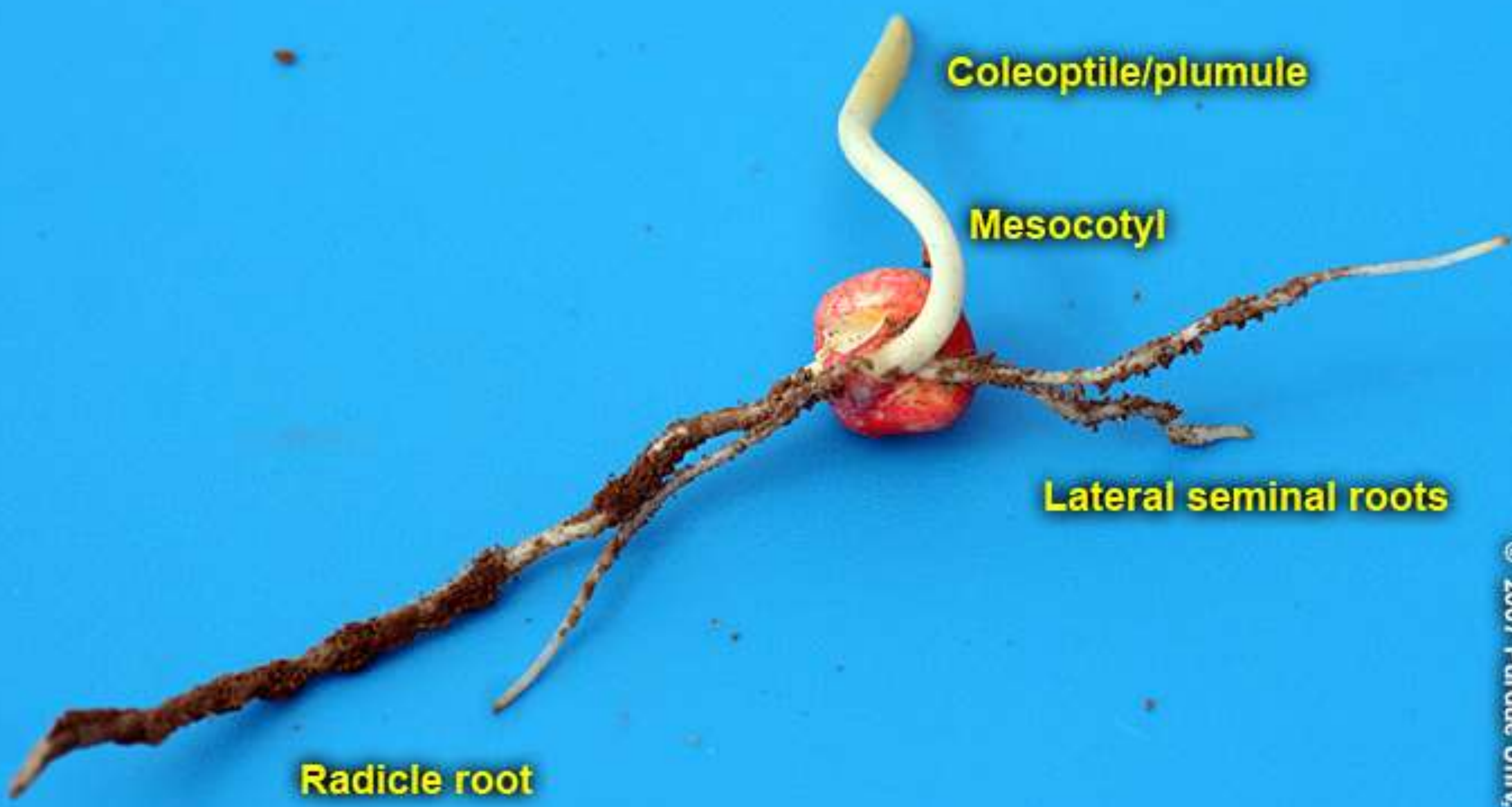

Seedling Appearance 36 hrs After Planting
(Equal to 34 soil-based GDD)
Plumule/coleoptile/mesocotyl complex
Radicle root visibly elongated
© 2007 Purdue Univ, RL Nielsen


Seedling Appearance 60 hrs After Planting
(Equal to 58 soil-based GDD)
Coleoptile/plumule
Radicle root
© 2007 Purdue Univ, RLNielsen


Seedling Appearance 72 hrs After Planting
(Equal to 67 soil-based GDD)
Coleoptile/plumule
Lateral seminal roots
© 2007 Purdue Univ, RLNielsen

Seedling Appearance 82 hrs After Planting
(Equal to 79 soil-based GDD)

Seedling Appearance 105 hrs After Planting
(Equal to 103 soil-based GDD)




Coleoptile Prior to Emergence
The yellow leaf tissue
is visible through the
translucent coleoptilar tissue.


Growth Stage "VE" in Corn
1st true leaf
Coleoptile
© 2007 Purdue Univ, RLNielsen

Emergence

- Elongation of the **mesocotyl** elevates the coleoptile towards the soil surface.
- Mesocotyls have the capability to lengthen from at least a 6-inch planting depth. Realistically, corn can be planted at least three inches deep (if necessary to reach adequate moisture) and still emerge successfully.
- The coleoptile must reach the soil surface before its internal leaves emerge from the protective tissue of the coleoptile
- Corn typically requires from 100 to 120 GDD (growing degree days) to emerge.
  - Under warm soil conditions, as little as 5 to 7 days.
  - Under cold soil conditions, emergence can easily take up to four weeks.

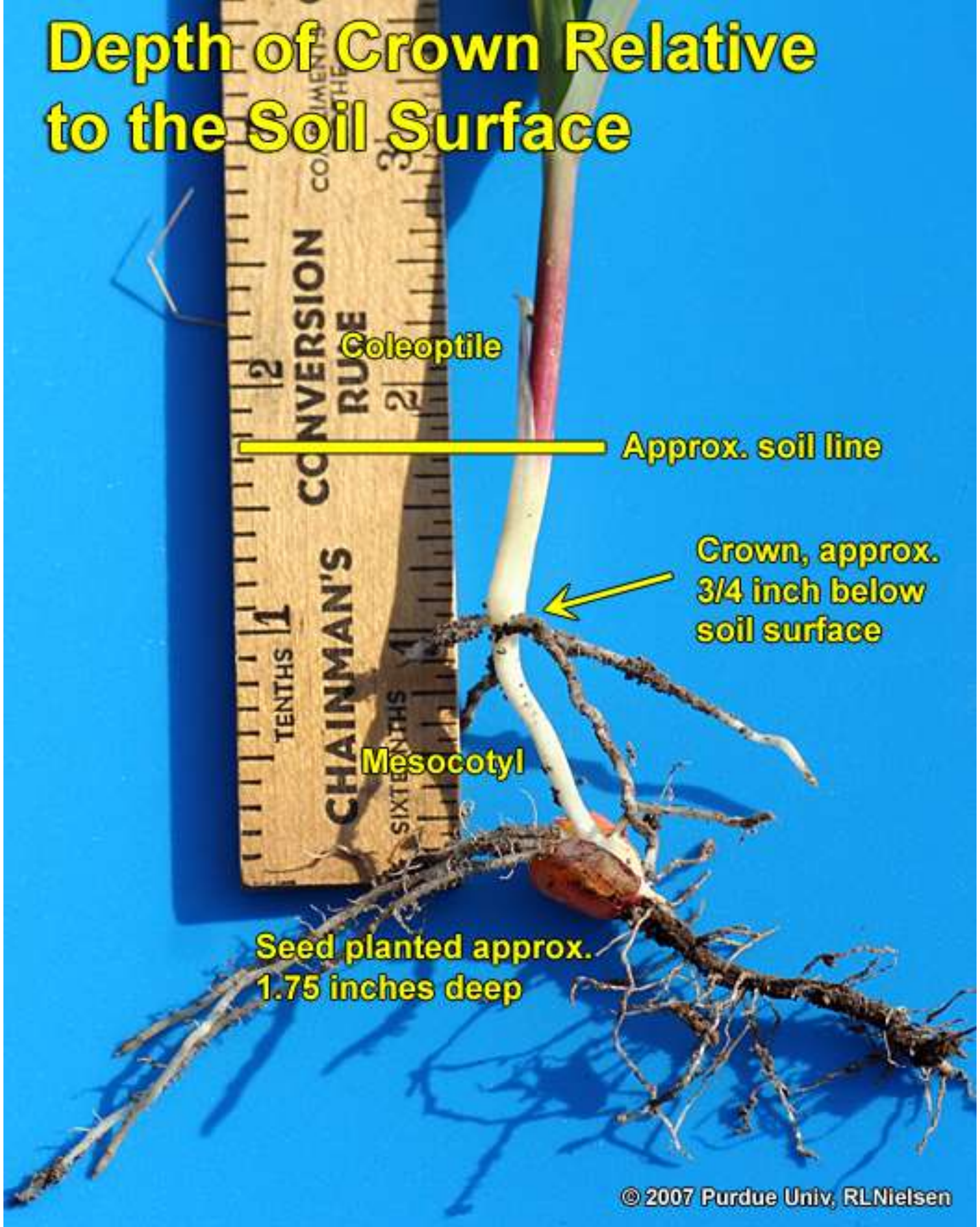
Rapid, uniform germination and emergence of corn

- Adequate and uniform soil moisture at the seed zone.
- Adequate and uniform soil temperature at the seed zone.
- Adequate and uniform seed-to-soil contact
- Surface soil free from crust


Seedling Appearance 5 Days After Planting
(Equal to 114 soil-based GDD)
1st true leaf
Coleoptile
Mesocotyl
Lateral seminal roots
Radicle root
© 2007 Purdue Univ, RLNielsen

Crown Formation

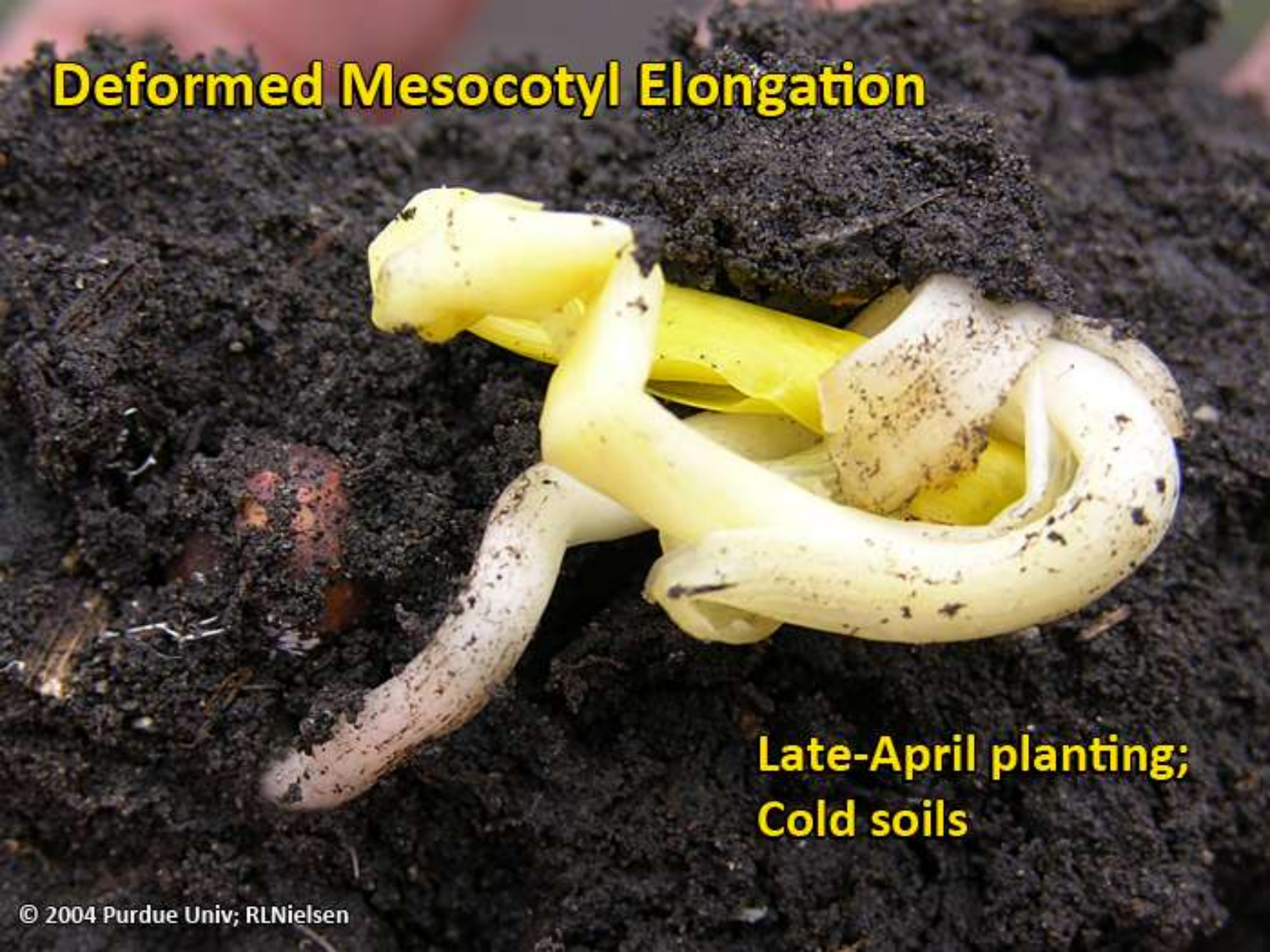
- As the coleoptile nears the soil surface, exposure to the red light wavelengths of solar radiation causes a change in the supply of one or more growth hormones from the coleoptile to the mesocotyl tissue and mesocotyl elongation comes to a stop
- Since the depth at which the emerging seedling senses red light is fairly constant, the resulting depth of the crown (base) of the coleoptile is nearly the same (1/2 to 3/4 inch) for seeding depths of one inch or greater.
- When corn is seeded very shallow (less than about 1/2 inch), the crown of the coleoptile will naturally be closer to the soil surface if not right at the surface. Subsequent development of the nodal root system can be restricted by exposure to high temperatures and dry surface soils.


Depth of Crown Relative to the Soil Surface
Coleoptile
Approx. soil line
Crown, approx. 3/4 inch below soil surface
Mesocotyl
Seed planted approx. 1.75 inches deep
© 2007 Purdue Univ, RLNielsen

Imbibitional Chilling Injury

- Due to cold soil temperatures during the initial 24 to 36 hours after seeding when the kernels imbibe water and begin the germination process
- Kernels naturally swell or expand. If the cell tissues of the kernel are too cold, they become less elastic and may rupture during the swelling process
- Symptoms include swollen kernels that fail to germinate or stopping growth of the radicle root and/or coleoptile.
- Can occur during the emergence process causing stunting or death of the seminal root system, deformed elongation of the mesocotyl ("corkscrew" symptom).
- It is not clear how low soil temperatures need to be for injury
  - Some sources simply implicate temperatures less than 50F
  - Others suggest the threshold soil temperature is 41F


Deformed Mesocotyl Elongation
Early May planting;
Cold soils
© 2008 Purdue Univ; RLNielsen


Deformed Mesocotyl Elongation
Late-April planting;
Cold soils
© 2004 Purdue Univ; RLNielsen

Too much water: Things to consider
Seed to seedling stage

- Soils are saturated, there is no pore space.
- Oxygen demand by the seedling increases rapidly because of rapid cell division and elongation depends on adequate oxygen.
- The heaviest demand for oxygen is centered in the growing point. The growing point stays below ground for at least three weeks.
- Seeds with low vigor are less likely to withstand short exposures to low oxygen availability.
- Anaerobic respiration produces small amounts of energy and may keep the seedling alive for several days. Most seedlings can tolerate 3 or 4 days of flooding, but will often succumb to periods longer than 7 days.


Sarah Schramm

Seed and Seedling Diseases Symptoms:

- Disease damage may appear similar to some environmental stress, but there are general and specific symptoms can help with diagnosis.
- General effects: reduced emergence, slow growth and stunting in a random or circular pattern, wilting, chlorosis/yellowing, post-emergence damping-off.
- Specific symptoms of seed and root infections include: rotted seed and seedlings before or after emergence; red/yellow discoloration of leaves; complete or partially rotted roots with firm or soft, brown-reddish- to gray lesions or decay; discolored and soft coeleoptile; death of leaf tips; wilting; and sunken, discolored lesions on mesocotyl.

Seed and Seedling Diseases
Disease Development

- Some common fungal pathogens are the cause: Fusarium, Stenocarpella (Diplodia), Pythium, Rhizoctonia, Colletotrichum, and Penicillium.
- Which pathogens will vary and depend on location, seed quality (cracked or infected seed), soil temperatures <55°F, soil water content, soil compaction, rate of emergence and growth, hybrid/inbred, fertilizer burn, herbicide injury, crusted soil, high temperatures (Penicillium infection), and population of flea beetles (Stewart's wilt).
- Favorable conditions are cool, wet, and compacted soil, and poor seed quality.

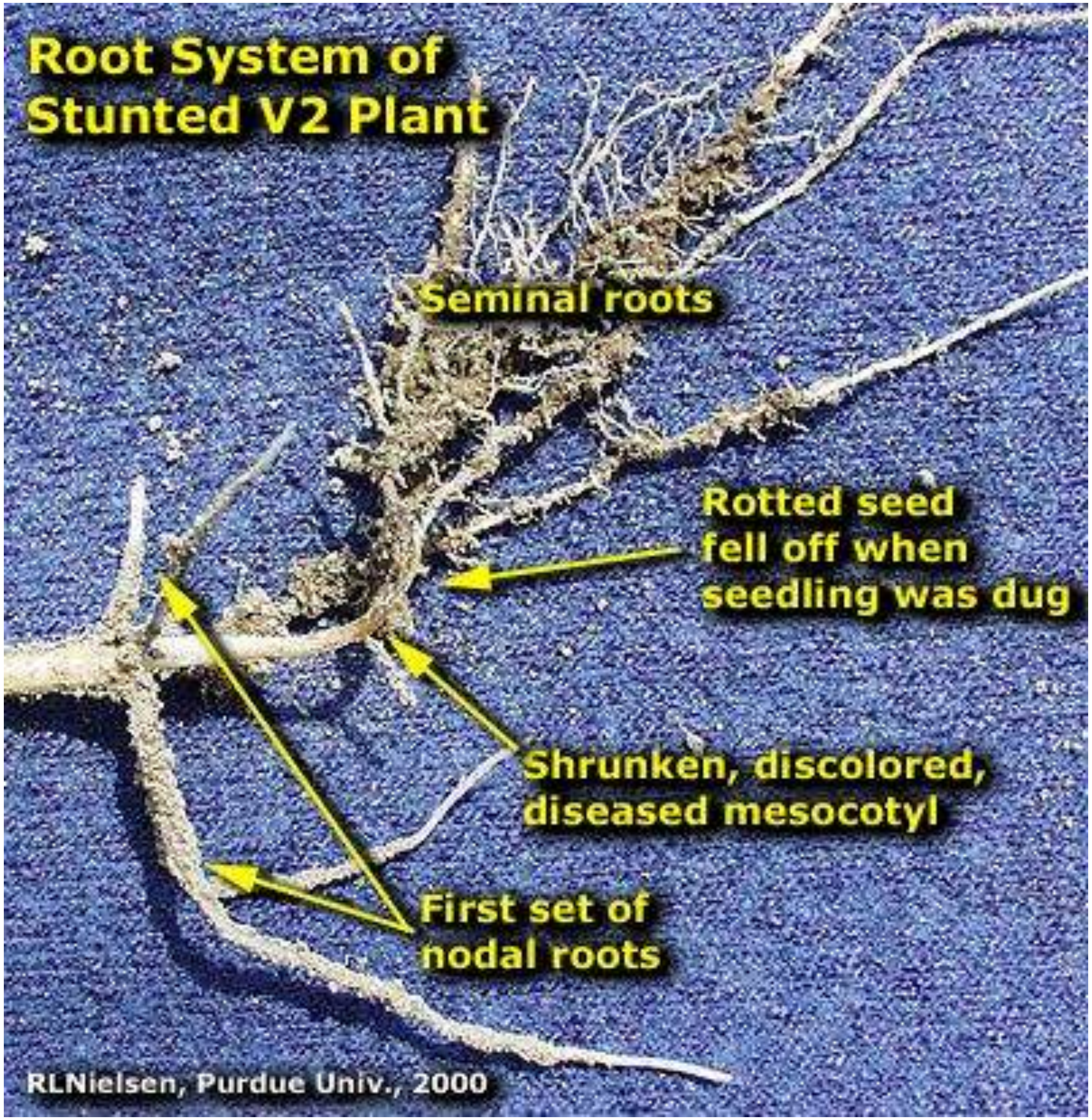
Pythium seedling blight

University of Delaware

Pythium

- Disease caused by may be especially favored by the cool weather and wet soil conditions
- Moisture is especially important to Pythium because water is needed for the pathogen to produce motile zoospores, which chemically detect plant roots and swim toward them and infect. As many as 14 species of Pythium infect corn, some of which are also able to infect soybean and sorghum
- Produce specialized survival structures, called oospores, which protect them from harsh conditions. This also enables them to survive for many years, even in the absence of crop plants.


Stunted Plant
Leaf Stage V2
RLNielsen, Purdue Univ., 2000


Root System of
Stunted V2 Plant
Seminal roots
Rotted seed
fell off when
seedling was dug
Shrunken, discolored,
diseased mesocotyl
First set of
nodal roots
RLNielsen, Purdue Univ., 2000

Successful germination ≠ Successful emergence

- **Symptoms** include corkscrewed coleoptile, swollen mesocotyl and true leaves emerged from side of coleoptile.
- **Exposure to light** at deeper soil depths than usual due to cloddy seedbeds, dry seedbeds, sandy soils, or open slots in no-till.
- **Injury from certain herbicides**, particularly under stressful environmental conditions.
- **Surface crusting, cloddy seedbeds, rocky seedbeds, planter furrow compaction, or otherwise dense surface soil** that physically restrict mesocotyl elongation and coleoptile penetration.
- **The mesocotyl should remain firm, white and healthy** through at least the 6-leaf stage, if not longer. If it is mushy, discolored, or damaged prior to this stage, then it is likely part of the crop problem being investigated


Deformed Mesocotyl Elongation
Early June planting;
tilled wet; planted wet;
compacted seed furrow
© 2011 Purdue Univ; RLNielsen


Leafing Out Underground
Mid-April planting;
Cold soils;
Surface soil crust
© 2012 Purdue Univ; RLNielsen


One Kernel Not Germinated
One Pre-Emergence Seedling
© 2007, Purdue Univ, RLNielsen

Uneven maturity makes a difference..

- Differences in growth stage between corn plants causes stress.
  - More mature plants are more competitive than less mature
  - A two leaf stage difference means 5-10% yield loss for the smaller plant
- Corn plants are under less stress when there is less variability.

Take Home Message on Planting Depth

- Make sure seed is at least 1.5 inches deep
- Better off shooting for 2 inches
- Make sure there is good seed to soil contact in reduced tillage or notill situations

Black Cutworm

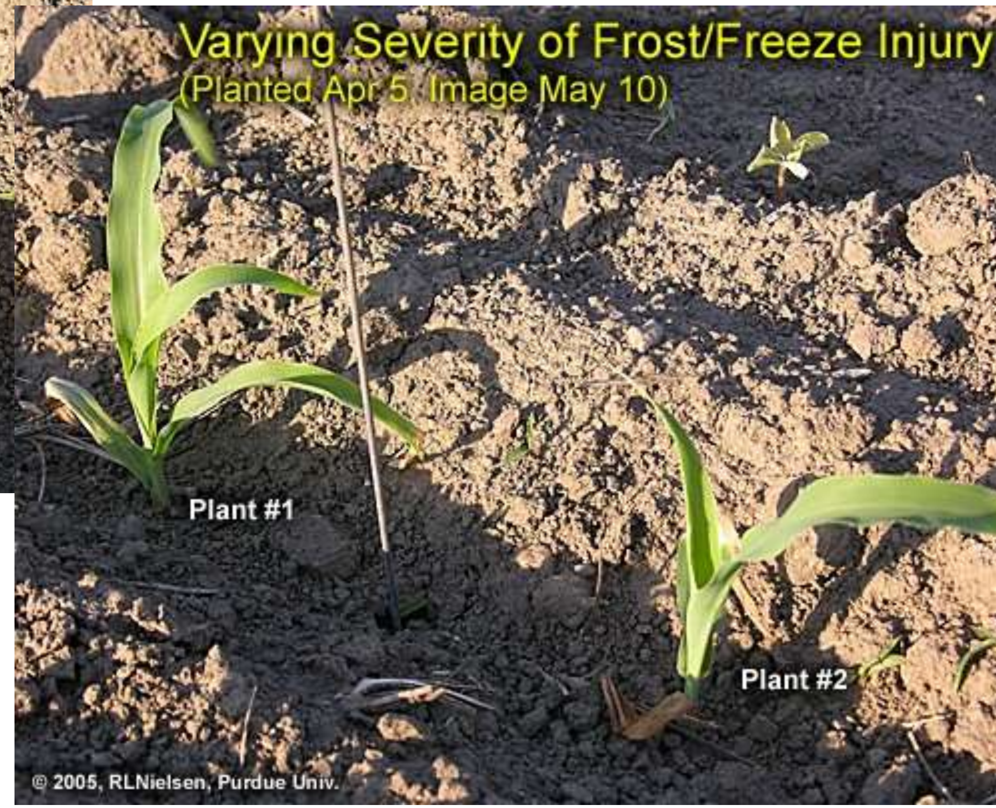
Black cutworm

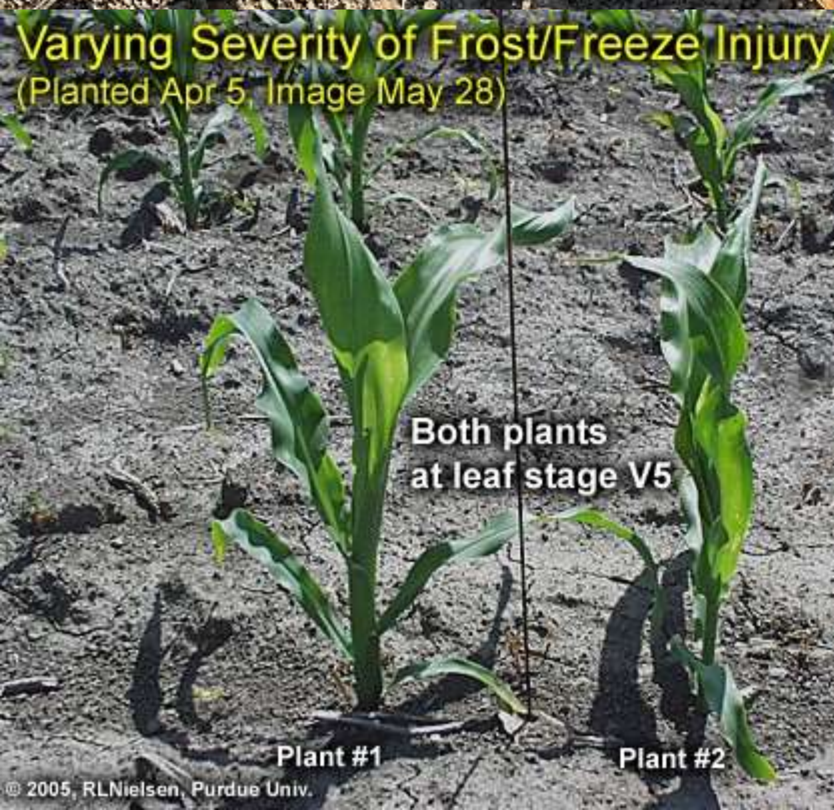
- Black cutworm problems most often develop in corn-planted and pre-existing vegetation (i.e., weedy fields, no till plantings, etc.).
- Fields adjacent to areas of permanent vegetation are also potential trouble spots.
- The following risk factors affect the probability of a black cutworm problem developing:
  - fall plowed - problem less likely
  - late spring plowed - problem more likely
  - corn following beans - problem more likely
  - late planted - problem more likely
  - minimum tillage - problem more likely

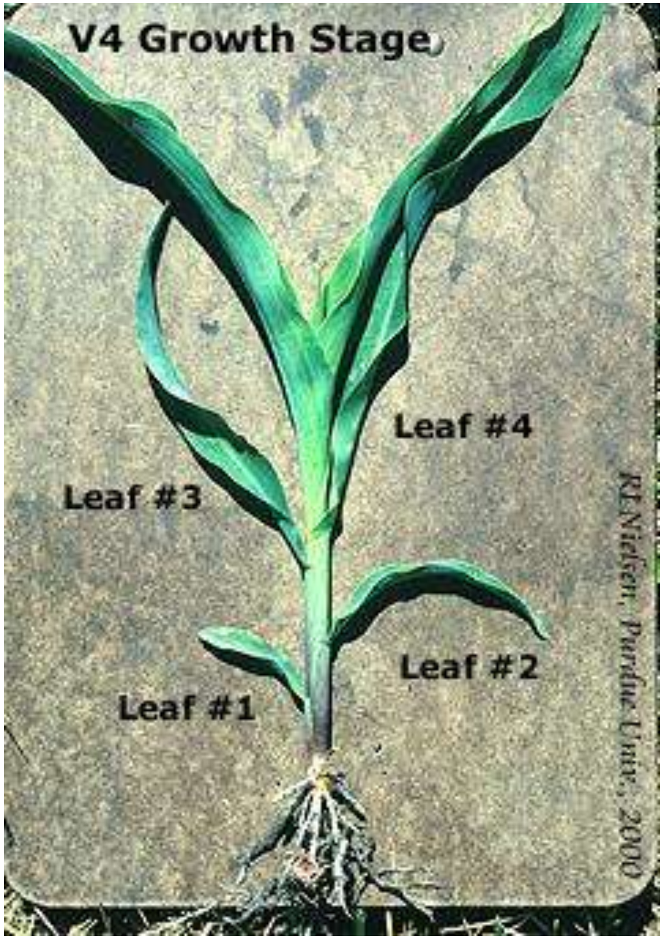

5 6 7 8 9 10 11 2F 1 2 3 4 5 6 7 8 9 10 11
17 18 19 20 21 22 23 24 25 26 27 29 30 31 32 33 34 35

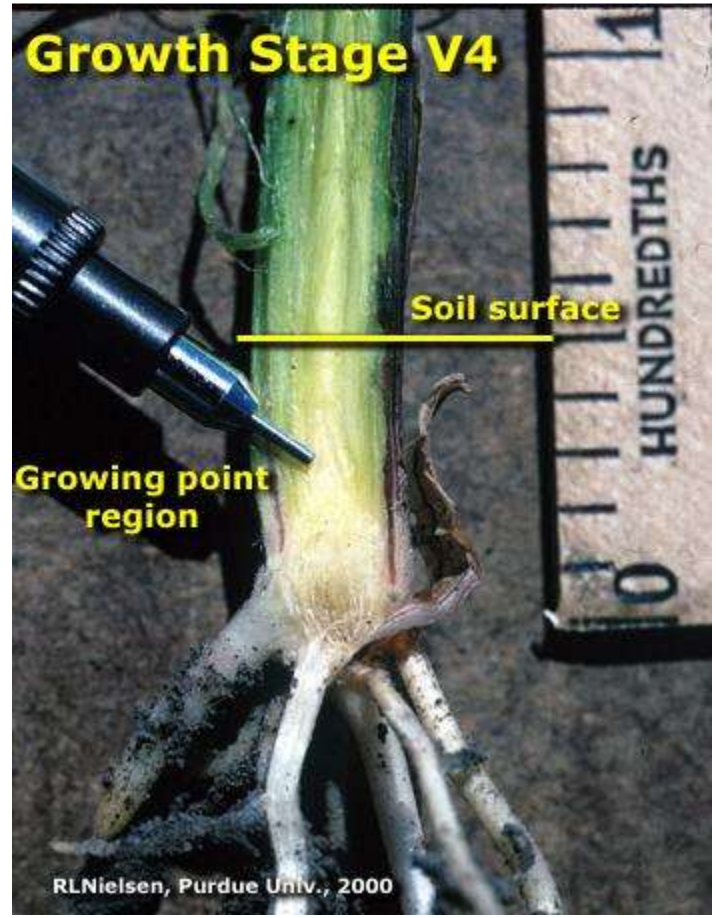
Wireworm

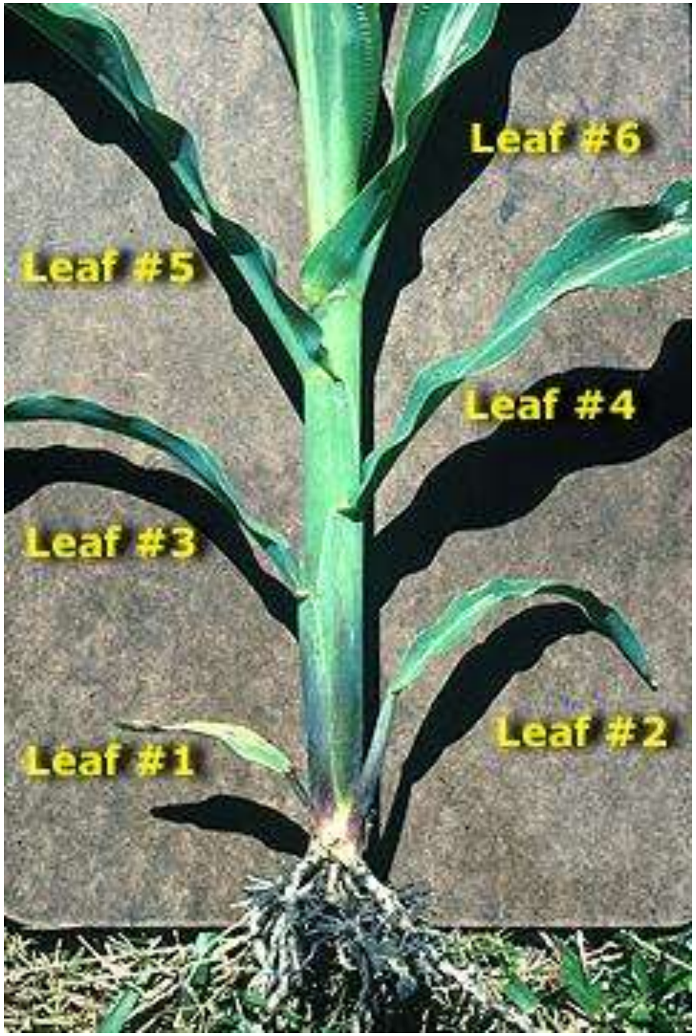

Varying Severity of Frost/Freeze Injury
(Planted Apr 5, Image May 4)
Plant #1
Plant #2

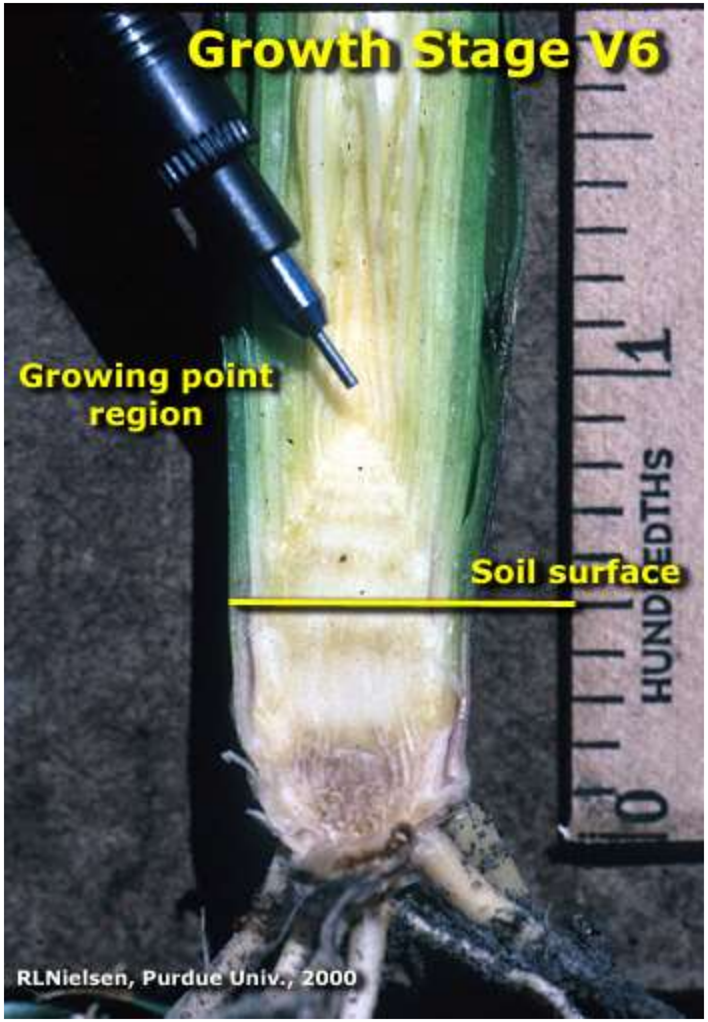

Varying Severity of Frost/Freeze Injury
(Planted Apr 5, Image May 10)
Plant #1
Plant #2
© 2005, RLNielsen, Purdue Univ.


Varying Severity of Frost/Freeze Injury
(Planted Apr 5, Image May 28)
Both plants
at leaf stage V5
Plant #1
Plant #2
© 2005, RLNielsen, Purdue Univ.


V4 Growth Stage
Leaf #4
Leaf #3
Leaf #2
Leaf #1
RLNielsen, Purdue Univ., 2000


Growth Stage V4
Soil surface
Growing point
region
HUNDREDTHS
RLNielsen, Purdue Univ., 2000


Leaf #6
Leaf #5
Leaf #4
Leaf #3
Leaf #2
Leaf #1


Growth Stage V6
Growing point region
Soil surface
HUNDREDTHS
1
0
RLNielsen, Purdue Univ., 2000

Too much water: Things to consider

- 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.
  - young corn can survive up to about 4 days of outright ponding if temperatures are relatively cool (mid-60's F or cooler)
  - fewer days if temperatures are warm (mid-70's F or warmer).
- Soil oxygen is depleted within about 48 hours of soil saturation. Without oxygen, nutrient and water uptake is impaired and root growth is inhibited (Wiebold, 2013).
- Corn younger than about V6 (six fully exposed leaf collars) is more susceptible to ponding damage than is corn older than V6.

Effects of Flooding or Ponding on Young Corn

R.L. (Bob) Nielsen, Agronomy Dept., Purdue Univ., West Lafayette, IN 47907-2054
Email address: rnielsen at purdue.edu

Too much water: Things to consider

- 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.
- 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).

Effects of Flooding or Ponding on Young Corn
R.L. (Bob) Nielsen, Agronomy Dept., Purdue Univ., West Lafayette, IN 47907-2054
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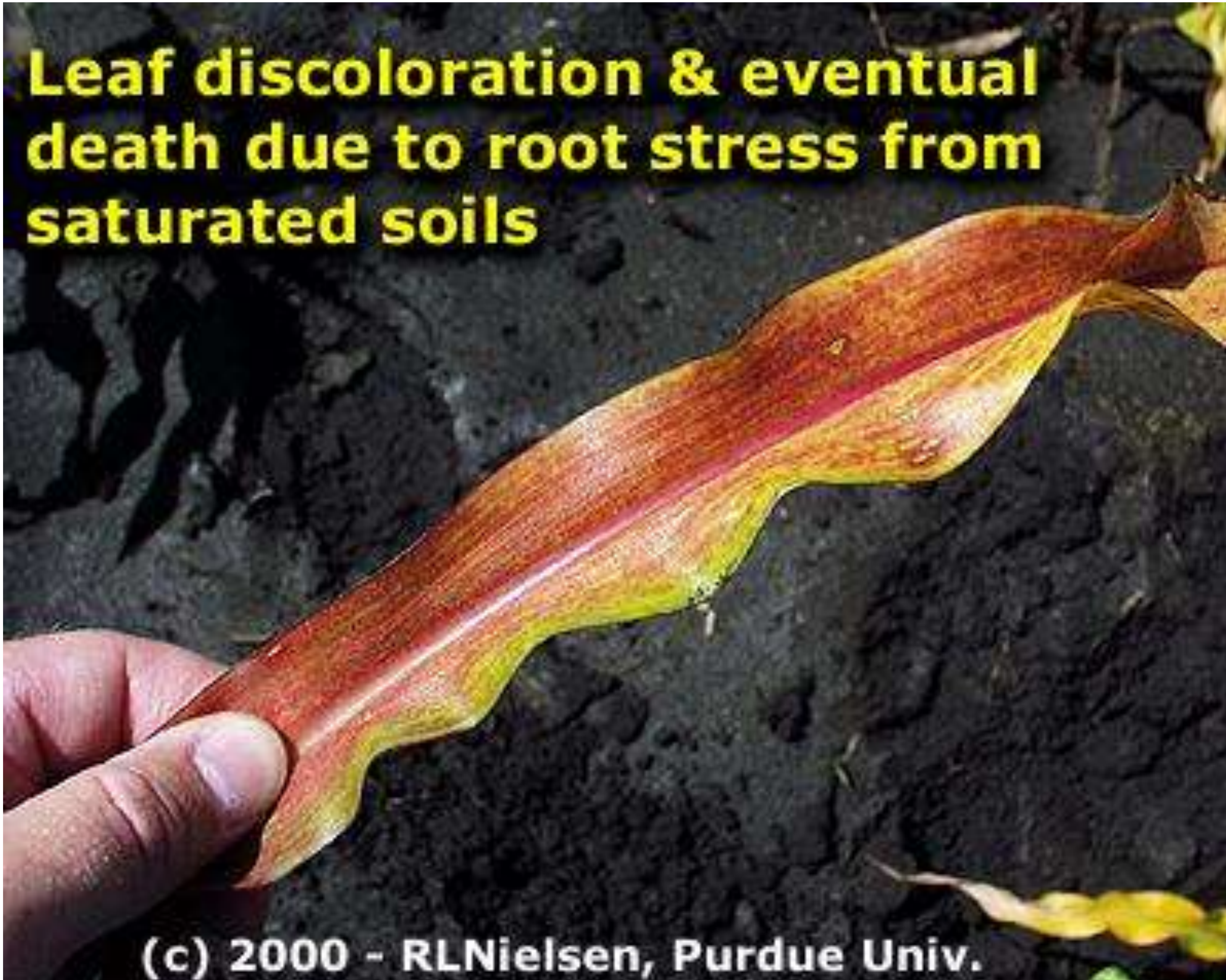

Leaf discoloration & eventual death due to root stress from saturated soils
(c) 2000 - RLNielsen, Purdue Univ.


6-3-2009

Corn Smut

Common smut of corn (Syn. boil smut, blister smut)
Pataky, J. K., and K. M. Snetselaar. 2006. Common smut of corn. *The Plant Health Instructor*. DOI:10.1094/PHI-I-2006-0927-01

Crazy Top of Corn


6-24-2009

Corn Rootworm Control

- Rotate crops
- Control options
  - Use corn rootworm resistant varieties
  - Use soil insecticides
- Seed treatment of Poncho and Cruiser are ineffective
  - Seed treatment of Poncho and Cruiser 1250 are only slightly more effective than250

Corn Rootworm Control
Preventing Resistance to Resistance

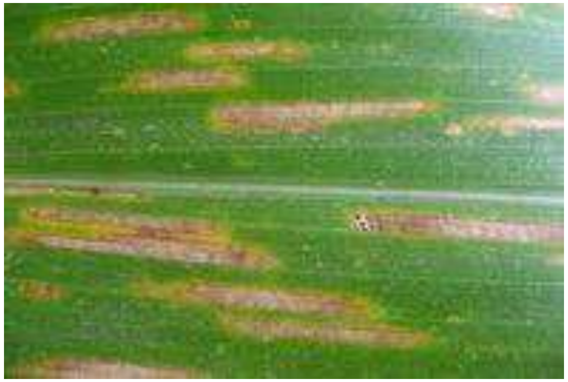
- Use a different Bt corn hybrid, preferably with multiple Cry proteins in a corn field
- Practice crop rotation and avoid planting continuous corn
- Control any volunteer corn
- Use a soil insecticide at planting to ensure control of larvae and prevent corn lodging
- Monitor the efficacy of control

Western Corn Rootworm Bt Resistance Now Includes mCry3A Toxin
December 19, 2013 By: Rhonda Brooks, Farm Journal Seeds & Production Editor

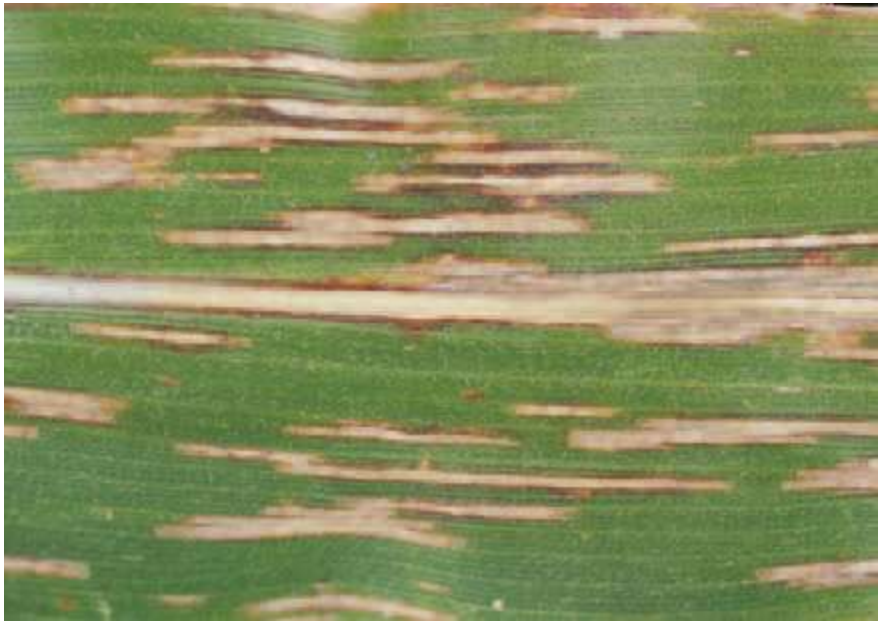

Gray Leaf Spot

- can be most severe in fields of continuous no-till corn where air drainage is poor
- Enough inoculum in the air to see in fields that are not in notill or high residue
- Fields along streams and rivers are particularly vulnerable because of the extended periods of dew and high humidity

Gray leaf spot:
Symptoms



- Symptoms are gray, rectangular lesions that are restricted by the leaf veins
- An individual lesion resembles a paper match
- This disease produces a toxin that requires sunlight; therefore the disease usually begins on the field edges and moves in.



Resistant hybrids (left), gray leaf spot lesions may be smaller with jagged margins. On more susceptible hybrids (right), gray leaf spot lesions are long and rectangular.

Gray leaf spot:
Disease cycle

leaf sheath

- Cercospora zeae-maydis can survive only on infested corn debris
- Infested corn debris on the soil surface is the source of primary inoculum for the next corn crop. Typically leaf sheaths.
- These airborne spores are the means by which the fungus infects the new corn crop.

Gray leaf spot:

Disease cycle

- Disease needs high humidty and free moisture
- Lower leaves first, why weed control can be a factor
- If dryness occurs in season infection goes “dormant”
- Plants more susceptible after tasseling

Gray leaf spot
Control

- Crop rotation
  - At least 1 year
- Resistant Hybrids
  - No immunity
  - Cure can be worse than the disease
- Increase tillage to reduce corn residue
  - Must bury debris
- Fungicides-Scout for presence of the disease as you approach tasseling

Estimated corn yield loss based on percentage of infected leaf tissue.

Percentage Ear Leaf Area affected by early dent stage(r5)	Approximate Yield Loss
5% or less	0-2%
6-25%	2-10%
25-75%	5-20%
75-100% (leaf death)	15-50%

Source: Patrick Lipps, 1998. Gray leaf spot and yield losses in corn. Crop Observation and Recommendation network. Issue 98-23.

Northern Corn Leaf Blight (NCLB)

- In 2013 seemed to be everywhere
- Doesn't seem to come from the same field
- Fields along streams and rivers are particularly vulnerable because of the extended periods of dew and high humidity

Northern Corn Leaf Blight (NCLB)

Symptoms

- NCLB is recognized by long, elliptical lesions typically cigar-shaped
- Lesions may be as large as 3/4 inch in width and 2 inches in length
- Lesions produce olive-green or black fungal spores when humidity is high, which can give the lesions a dark or dirty appearance

NCLB: Disease cycle

- Northern corn leaf blight (NCLB), caused by the fungus Exserohilum turcicum
- Infested corn debris on the soil surface is the source of primary inoculum for the next corn crop
- These airborne spores are the means by which the fungus infects the new corn crop.

NCLB: Disease cycle

- Disease needs high humidty and free moisture
- If lesions have reached the ear leaf or higher during the two weeks before and after tasseling, yield loss could occur.
- Hybrid corn yield could be reduced as much as 30 percent if lesions are present prior to or at tasseling.
- Scout fields for the disease at or prior to tasseling.

NCLB: Control

- Resistant hybrids
- Crop rotation and reducing tillage may help less so than Grey Leaf Spot
- Fungicides – Scout for presence of the disease at or near tasseling

When to apply a fungicide

Consider a fungicide application if:

The hybrid is rated as susceptible or moderately susceptible

AND

50 percent of the plants in a field have disease lesions present on the third leaf below the ear leaf or higher prior to tasseling

OR

Consider a fungicide application if:

The hybrid is rated as moderately resistant

AND

50 percent of the plants in a field have disease lesions present on the third leaf below the ear leaf or higher prior to tasseling

AND

Additional factors or conditions that favor disease development are present (residue present, favorable weather conditions)

Fungicide(s)				Gray Leaf Spot	Northern Corn Leaf Blight
Class	Active ingredient (%)	Product/ Trade name	Rate/A (fl oz)		
Strobilurin Group 11	azoxystrobin 22.9%	Quadris 2.08 SC	6.0-15.5	E	G
	pyraclostrobin 23.6%23.3%	Headline 2.09 EC/2.08 SC	6.0-12.0	E	VG
Triazole Group 3	propiconazole 41.8%	Tilt 3.6 EC PropiMax 3.6 EC Fitness 3.6 EC	2.0-4.0	G	G
Mixed mode of action	azoxystrobin 7.0% propiconazole 11.7%	Avaris 200 SC Quilt 200 SC	7.0-14.0	E	VG
	azoxystrobin 13.5% propiconazole 11.7%	Quilt Xcel 2.2 SE	10.5-14.0	E	VG
	pyraclostrobin 13.6% metconazole 5.1%	Headline AMP 1.68 SC	10.0-14.4	E	VG
	trifloxystrobin 32.3% prothioconazole 10.8%	Stratego YLD 4.18 SC	4.0-5.0	E	VG

What is up with this alfalfa?

June 5, 2013

Spittle Bug

April

May

June

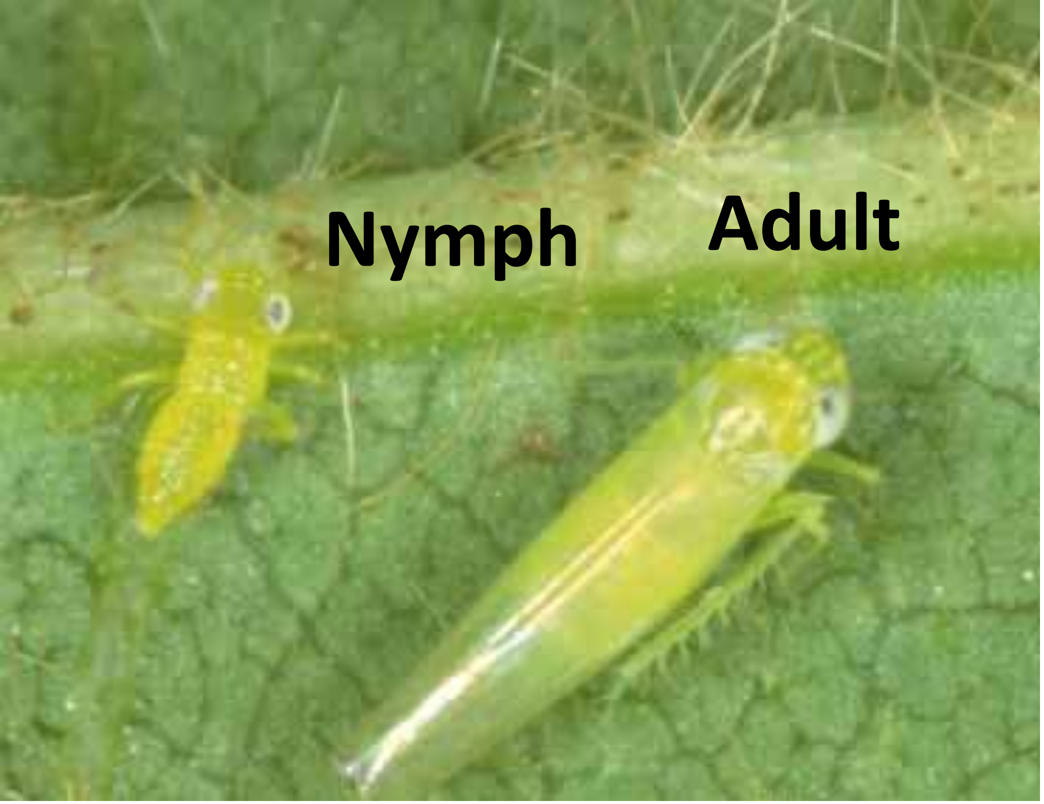
Alfalfa Weevil

Growing degree days-GDD

- Alfalfa growth is based on 41°F
- Alfalfa Weevil growth is based on 48°F
- Degree Day = (Max temp + Min temp) – Base temp
- Total the daily degree days after March 1 to get the accumulated GDD
- Examples:
- Day 1 (36+34)/2-48= 0 Degree Days
- Day 2 (59+41)/2-48= 2
- Day 3 (70+55)/2-48= 14.5
- Accumulated GDD 16.5

Growing Degree Days for Peak (50%) Occurrence of Stage - 48°F base

Stage or Event	Degree Days*
eggs hatch	280
instar 1	315
instar 2	395
instar 3	470
instar 4	550
cocooning	600
pupa	725
adult emergence	815



Potato Leafhoppers

- Adults live for 4-7 weeks
- Females deposit 2-3 eggs per day in plant stems
- Pale, green nymphs emerge in 7-10 days
- the fastest development occurs at 86 degrees F.
- They go through five instars in about 2 weeks
- At least two overlapping generations occur in Iowa every year.


6/23/2012

White Clover

- Stolon growth
  Stem flat on ground
- Shallow rooted
- Grows best:
  - With little competition
  - Moist soils
- Maybe growing where other plants aren't

Giant Ragweed

Giant Ragweed Advantage

- Early emergence
- Emergence through growing season
- Rapid growth rate due to large leaf area allows it to compete with crops and other weeds
- Will grow above other plants

How much competition?

- Research that examined giant ragweed competition in corn demonstrated that season long competition from just 2 giant ragweed plants per 110 square feet can reduce corn yield by 13%.
- Giant ragweed is even more competitive in soybeans than in corn
  - Just 1 plant per 110 square feet reduced yields by 50%
  - When giant ragweed plants emerge with the crop and interfere with soybeans for at least 4 weeks, yields can be reduced more than 25% if weather conditions are unfavorable for crop development.

Giant Ragweed
Issues Affecting Control

- Crop Rotation and Tillage
  - More where minimum tillage
  - Less with notill and conv
- Stem-Boring Insects and Control with Glyphosate
- Herbicide Resistance
  - ALS inhibitors such

  as Classic® and FirstRate®

Giant Ragweed Control

- Need to control early flush with clean tillage or burndown
- Burndown options
  - Atrazine with dicamba, 2,4-D ester or glyphosate
  - Glyphosate with dicamba or 2,4-D ester
  - Lumax or Lexar

Giant Ragweed Control

- Preemergence should be atrazine containing with Hornet or Lumax/Lexar
- Most postemergence herbicides work, may be best in tandem or herbicides with multiple active ingredients
- Total post
  - Needs to be early
  - Need residual

Weed Science Society of America Herbicide Group 15

Seedling growth inhibitors (shoot)	chloroacetamides
alachlor	Intrro
acetochlor	Harness/Surpass, Breakfree, Degree, Warrant
dimethenamid	Outlook
metolachlor	Dual, Cinch

Table 3.7.1. Effectiveness of selected corn herbicides on annual weeds.

Broadleaf Annual Weeds

Preemergence Herbicides	**Wild Buck wheat**	**Common Lambsquarters**	**Wild Mustard**	**Redroot Pigweed**	**Common Ragweed**	**Velvet leaf**
†Dual II Magnum/†Cinch	Poor	Poor	Poor	Good	Poor	None
†Harness/†Surpass	Poor	Fair	Poor	Excel	Fair	Poor
*†Intrro (Micro-Tech?)	Poor	Fair	Poor	Good	Poor	None
*†Outlook	Poor	Poor	None	Good	Poor	None

[1]Effectiveness ratings for *atrazine and Princep are not accurate for triazine-resistant lambsquarters, pigweed, and ragweed.

*Restricted-use pesticide; may be purchased and used only by certified applicators or used by someone under the direct supervision of a certified applicator.

†Not for use in Nassau and Suffolk Counties; pesticide labels that indicate “Not for use on Long Island, N.Y.” mean that use is prohibited in Nassau and Suffolk Counties only.

Table 2.2-8. Relative effectiveness of corn herbicides on grasses, grasslike species, and broadleaf weeds.

Herbicide	Lambs quarters	TR Lambs quarters	Eastern Black Night shade	Pig weed	TR Pigweed	Common Ragweed	Smart weed	Velvetleaf	Corn Safety
Dual, Cinch	6	6	7+	8	8	6	N	N	Fair-Good
Harness, Degree, Surpass, Topnotch	7	7	8+	9	9	7+	7	6	Good

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