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Corn Growth & Development Related to Herbicide Use

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Post-Emergence Herbicides

- The application of many of these is restricted beyond certain corn plant heights or leaf stages.
  - Where both height & leaf stage are listed on a label, the more restrictive of the two should be used for decision-making.
  - The reasons for these label restrictions are both physical and physiological.

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Physical Reasons for Label Restrictions:

Crop & Weed Canopies

- Large corn canopies may intercept more of a broadcast herbicide application than will that of the intended "victims" (i.e., the weeds).
- Larger corn plants often also means larger weeds that are more difficult to kill.

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Physiological Reasons for Label Restrictions:

Ever Larger Leaf Area

- With every subsequent stage of corn development,
  - Leaf area per corn plant increases.
    - With broadcast applications, herbicide interception per corn plant increases.
      - Risk of herbicide injury increases.

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Physiological Reasons for Label Restrictions:

Sexual Development

- Beginning at about leaf stage V5, the uppermost (and eventually harvestable) ear is initiated, as is the tassel.
- These reproductive structures are often quite sensitive to herbicides absorbed by the plant.

Leaf stage V5 = Lowermost five leaves with visible leaf collars

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Ear Shoots on V6 Plant

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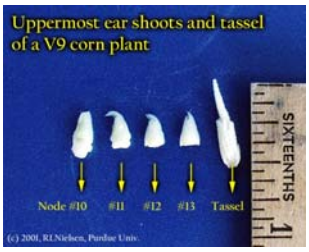
Ear Shoots on a V9 Plant



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Physiological Reasons for Label Restrictions:

Leaf Cuticle Changes Over Time

- From VE (emergence) to V4:
  - "Leaves of corn…had crystalline deposits of wax on the surface of the cuticle."
    - "These crystals reduced [herbicide] spray retention and leaf wettability by trapping air under the spray droplets."
- Rapid changes from V5 to V8:
  - "…smooth wax film on the leaves"
  - "Spray retention increased from about 30% at the V4 stage to about 80% at the V6 stage."

Source: http://www.weeds.iastate.edu/mgmt/2001/corncuticle.htm

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The Achilles' Heel of Labels

- Many labels do not clearly explain…
  - How plant height should be measured or
  - What is meant by a particular leaf stage.

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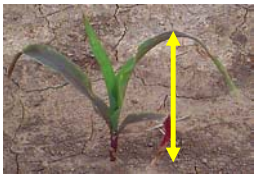
Corn Plant Height

- Most agronomists agree that corn plant height should be that of free-standing plants.
  - Measure height from the soil surface to the arch of the uppermost leaf that is at least 50% emerged from the whorl.



Herbicide Labels?

Usually not clear whether plant height refers to free-standing plants

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Corn Leaf Staging

- Corn leaf staging is technically quite simple.
  - All it requires is the ability to identify the right parts of a leaf and to be able to count.

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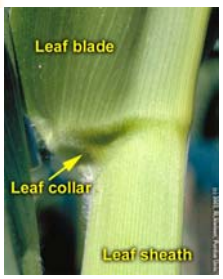
Identifying Leaf Parts



- A corn leaf consists of three distinct morphological components:
  - The leaf blade
  - The leaf collar
  - The leaf sheath

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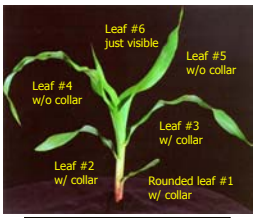
Leaf Staging Methods

- Leaf collar method
  - Count only leaves with visible leaf collar
  - Begin with lowermost leaf that is shorter than the others and has a rounded tip.
  - End with uppermost leaf with visible leaf collar.



Source of Digital Image:
http://maize.agron.iastate.edu/corntitle.html

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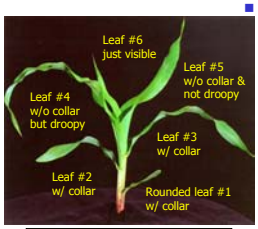
Leaf Staging Methods

Method Used by Hail Adjusters

- Droopy leaf method
  - Begin with lowermost leaf that is shorter than the others and has a rounded tip.
  - End with uppermost leaf that is at least 50% emerged from whorl.
    - Leaf tip often points down, but not always



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Compare The Two Methods

- Leaf collar method:
  - Stage late V3
- Droopy leaf method:
  - Stage between late V4 & early V5

Source of Digital Image:
http://maize.agron.iastate.edu/corntitle.html

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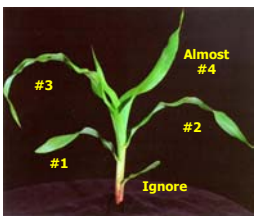
Herbicide Label Uncertainty

- Older labels ignored the first, rounded tip, leaf and ended with the uppermost leaf that was at least 50% exposed from whorl.
  - A bastardized "droopy leaf" method that results in roughly the same numerical leaf stage as the leaf collar method.



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Bottom Line:

Check with your chemical technical representative to verify which definition is appropriate for the herbicide you intend to use.

- Newer labels purport to define leaf stages according to the leaf collar method.
  - Is some question about whether the first, rounded tip, leaf is counted, however.

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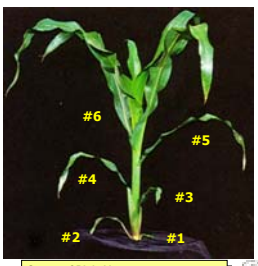
Pop Quiz!

- Using the leaf collar method, what is the leaf stage of this plant?

ANSWER:
Late stage V6 to early V7



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When Lower Leaves Go Kaput

- Determining growth stages on older plants is often more difficult because lower leaves naturally wither away as the plant develops.
  - But the missing leaves must still be accounted for when staging the plant.

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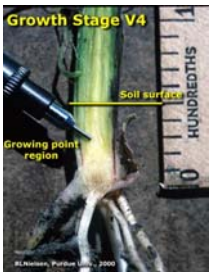
Stalk Elongation to the Rescue

- Stalk elongation is increasingly evident after growth stage V4.
  - From VE to V4, stalk elongation is very insignificant. During this time, all the above-ground plant tissue consists of leaves and rolled-up leaves.



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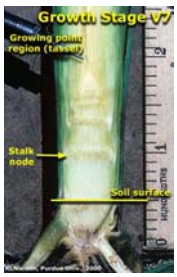
Recognizing Stalk Nodes

- After growth stage V4, the pace of stalk elongation picks up.
  - Individual stalk nodes can easily be detected after splitting a stalk down the middle.



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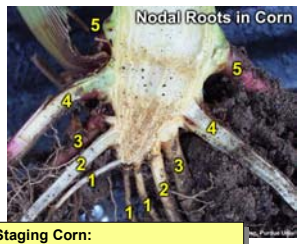
Identifying Individual Nodes

- Stalk nodes serve as the point of origin for roots, leaves, tillers, and ears.
  - Careful stalk splitting will verify that Node #5 is usually the first individually recognizable stalk node.



Key Trivia for Staging Corn:

Stalk node #5 is the point of attachment for Leaf #5.

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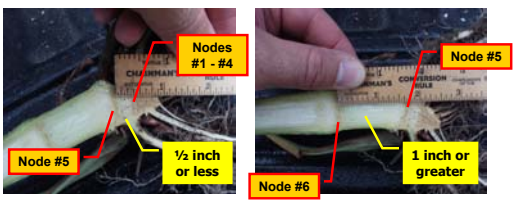
Help in Identifying #5 Node



The internode length between Node #4 and Node #5 is usually less than ½ inch, whereas that between Node #5 and Node #6 is 1 inch or longer.

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Once #5 Node is Identified…

- Identify which leaf sheath connects to that node, then count upward to uppermost leaf with visible leaf collar to determine leaf stage of plant.

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Final Thoughts:

Stress, Corn, & Herbicides

- Effects of severe stress can include…
  - Shorter than expected plants for growth stage due to stunted stalk elongation.
  - Altered plant metabolism that increases sensitivity to herbicides or decreases the plants' ability to detoxify herbicides.
  - Excellent growing conditions may increase risk of injury by increasing rate of herbicide uptake.

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Final Thoughts:

Symptomology & Diagnostics

- Sometimes, the morphological symptomology of herbicide injury points to the time of application.
  - By which plant parts are affected
  - By recovery, or lack thereof, subsequent to damage

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Plants can confirm…

- Plant injury by Hornet™ + 2,4-D herbicides
  - Lower 9 to 10 leaves appeared normal in color and size
  - Remainder of leaves, stalk, and tassel severely stunted and malformed
- Plant appearance + GDD data supported V9 or V10 as timing of application.
  - Beyond V5 or V6 label limits

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Hungry for More?

- Check out one of these fine Web sites…

Welcome to …
KingCorn.org
The Corn Growers' Guidebook