Corn Growth and Development
Outline

• Stress and yield loss
• Growth staging
• Vegetative stages
• Reproductive stages
• Conclusions
Stress and crop yield loss

- At each growth stage of corn, certain aspects of management must be considered.
- Each stage has its own problems which may interfere with growth at that stage.
- Problems include adverse soil conditions, weeds, insects, diseases, and other disorders.
- Problems that occur early in the season may contribute to the yield loss experienced at the end of the season during harvest.
- We will examine problems for the stages of corn throughout the growing season.
Growth staging

- Growth stages may overlap in a field
- A growth stage for a field begins when at least 50 percent of the plants have reached or are beyond a certain stage.
- The Corn Field Guide provides scouting information by growth stage for many diseases and insects of corn.
Determining growth staging

• Leaf collar method
  – The collar is where the leaf blade visually breaks away from the sheath and the stalk
  – The number of visible collars = vegetative growth stage (V stages)
Determining growth staging

• Leaf collar method
  – Leaves still in the whorl – DO NOT count these leaves
  – Leaves with a visible collar – COUNT these leaves
Vegetative stages

- **Vegetative Stages**
  - **VE**: Shoot emerges from soil
  - **V1**: Collar is visible on lowest leaf
  - **V2**: Collar is visible on two lowest leaves
  - **V(n)**: Each successive collar visible
  - **VT**: Lowest branch of tassel visible, before silks
VE - Emergence

• VE: When the young shoot pushes through the soil surface

• Problems to watch for:
  – Early and late planting
  – Flooding, soil crusting
  – Root rots
  – Seed decay and seedling blight
  – Seed corn maggot, white grubs, wireworms
  – Stewart’s disease, Goss’s wilt
  – Cutworms, slugs, billbugs, etc.

VE
V1 to V5

- First leaf has a rounded tip
- All other leaves have pointed tips
- The growing point is below ground
- Between V1 and VT, a new leaf (growth stage) occurs every 4-5 days in May, 3-4 days in June, and 2-3 days in July
V1 to V5

- Problems to watch for:
  - Flooding
  - Stewart’s disease, Goss’s wilt, Anthracnose leaf spot
  - Root rots, seedling blight
  - Cutworms, slugs, billbugs, etc.
  - Herbicide injury
  - Weed escapes and excess weed competition
V6

• V6 is one of the key stages for development
  – Growing point is above the soil surface
  – All leaves, ear shoots (approx. 8), and tassel are fully formed
  – Ear girth - number of rows around the ear is also determined

• Problems to watch for during V6:
  – Eyespot, common smut, Stewart’s wilt
  – Stalk borer
  – Nutrient deficiencies
V10+

- Stalks need to be split to stage
  - Need a larger knife & spade
  - Each leaf is attached to a specific node
  - Need to line up which leaf goes to which node on the stalk
  - Split lower stalk lengthwise to determine uppermost leaf node
  - Approximately ≤ ¼ inch above the condensed area is the 5th node
  - First four nodes cannot be distinguished from one another
  - This method required until VT
V10-VT

• V10-VT
  – In late June and early July new leaves appear every 2-3 days
  – Hybrids & environment will cause variability in the total number of leaves

• V12-VT
  – Ear length - number of kernels per row - is determined over a wide range of time, from approx. V7 to V15/V16, and can be reduced by stress
  – 750 to 1000 ovules form per ear. Average kernel number at harvest is 475 to 550
V10-VT

- Problems to watch for:
  - Eyespot, Physoderma brown spot, common rust
  - Scout for nematodes
  - Corn rootworm adults begin emerging
  - Corn leaf aphid
  - Root lodging
  - Greensnap
  - Nutrient deficiencies
  - Grasshopper, armyworm
  - Goss’s wilt
VT-Tasseling

- Tasseling occurs when entire tassel is visible
- Final vegetative stage
- Occurs just prior to, or at the same time, as silking
- The tassel produces pollen grains, shedding a half million per day per plant at the peak
- Pollen shed for a field typically lasts for about a week
VT

• Problems to watch for during VT include:
  – Gray leaf spot, southern rust, northern leaf blight, and others
  – Corn earworm egg mass scouting and other insects
  – Corn rootworm damage to roots may really show now as lodging or nutrient deficiencies
  – Silking/pollen shed synchronization problems from drought/heat
  – Corn leaf aphids on tassel can throw off pollen shed
Reproductive stages

- Staging is no longer based on the vegetative appearance of the plant
- Focus only on the ear to stage the plant & field
- Look at kernels in the middle of the ear
- Six reproductive stages total (soybean has eight)
- Use number and names (Example: R1 = Silking)
Reproductive stages

• Reproductive Stages
  • R1 (silk): Any silk becomes visible outside the husk leaves
  • R2 (blister): Small, white kernels, and kernel fluid is clear
  • R3 (milk): Yellow kernels, milky white fluid in kernel
  • R4 (dough): Paste-like, or dough, kernel contents
  • R5 (dent): Kernels dent on the top due to starch accumulation
  • R6 (Physiological maturity): Physiological maturity with maximum dry matter accumulation. Black layer occurs after physiological maturity.
R1 - Silking

• At least 50% of plants have 1 or more silks emerged (use only uppermost ear)
• Pollen grains will land on silks and if receptive, fertilization will occur.
• Silks are viable and receptive to pollen for at least 5 days
• The plant uses the most water per day (0.35 inches) during R1 – Very sensitive to stresses
• Silks have highest water content among all parts of the corn plant
• Drought causes silk elongation to slow down and pollen shed to speed up
R1 - Silking

- Problems to watch for during R1:
  - Drought
  - Corn rootworm adults
  - Japanese beetle
  - Corn earworm
  - Foliar diseases
R2 – Blister stage

• Occurs about 10-12 days after silking
• Kernel is:
  – Visible and resembles a blister
  – Filled with clear fluid and embryo is barely visible
  – Approx. 85% moisture content
• If severe stress occurs now or during R3, kernels can be aborted from the tip downward.
• Kernel abortion will occur until the plant has a sufficient supply of carbohydrates for the remaining kernels.
R3 – Milk stage

• Occurs approx. 18-20 days after silking
• Kernel is colored yellow with the inside containing ‘milky’ white fluid. Kernel moisture content is approx. 80%
• Starch is beginning to accumulate in the kernel
R4 – Dough stage

- Occurs approx. 24-26 days after silking
- Interior of kernel has thickened to a dough or paste-like substance
- Kernel moisture content is approx. 70% and kernels may begin to dent at the base of the ear
- Stresses will reduce kernel weight now
R2-Blister to R4-Dough

• Problems to watch for:
  – Foliar disease
  – Head smut
  – European corn borer
  – Grasshopper
  – Barren stalks, poor pollination
  – Nutrient deficiencies
R5 – Dent stage

• Occurs approx. 31-33 days after silking
• Kernels dented in at top with the “milk line” separating the liquid and solid (starch) portions
• Within R5, kernels are often staged according to the progression of the milk line; i.e. ¼, ½, and ¾
• Beginning of R5 - kernels have 60% moisture content
• Stresses will reduce kernel weight now
R6 – Physiological maturity

- Occurs approx. 66-70 days after silking
- R6 is reached after the milk line disappears and the starch has reached the base of the kernel
- Kernels have reached maximum dry matter accumulation
- Kernel moisture is about 35% at physiological maturity
- Black layer occurs after physiological maturity, serving as a visual verification that the plant is mature; it typically occurs at 30% moisture but varies by hybrid and environment
- Only external stress can reduce yield now, such as plant lodging or insect feeding
R5-Dent to R6-Physiological maturity

• Problems to watch for:
  – Ear rots
  – Stalk rots
  – Anthracnose top dieback
  – Stalk lodging
  – Abnormal ear fill which identifies periods of stress
Conclusions

• Certain management considerations must be taken into account during the various stages of corn growth.
• Each stage has its own set of problems.
• Many insects, diseases, and disorders are problems during multiple corn growth stages.
• This knowledge can help growers to be aware of the potential problems of corn throughout the season.