Soybean Growth and Development
Outline

• The soybean plant
• Growth staging
• Vegetative stages
• Reproductive stages
  – Bloom
  – Pod development
  – Seed development
  – Maturity
• Conclusions
The soybean plant

• Domesticated about 4,500 years ago in China
• The U.S. grows the most soybeans in the world
• North central states grow majority of soybeans
• Nine different maturity groups: 00 (in the north) to IX (in the south)
• Group II and III grown in Iowa
• Symbiotic relationship exists between soybean and nitrogen fixing bacteria
Soybean plant parts

- **Trifoliate leaf**: a compound leaf made of three leaflets
- **Petiole**: connects the stem and leaf
- **Growing point**: where active growth takes place
- **Axillary bud**: bud found where petiole and stem meet
- **Unifoliate leaf**: single leaf, not compound
- **Cotyledons**: first leaves of newly emerging plant
- **Hypocotyl**: the seedling’s stem below the cotyledons
- **Branched tap root**: main root of the plant
- **Lateral roots**: roots growing laterally into the soil
- **Nodules (enlarged)**: where nitrogen fixing bacteria live
Stress and crop yield loss

• At each growth stage of soybean, certain aspects of management must be considered.
• Various problems are associated with each stage and can 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 various problems for the stages of soybean 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 Soybean Field Guide 2nd Edition provides disease scouting information by growth stage.
Vegetative Stages

- VE: Emergence
- VC: Unrolled unifoliate leaves
- V1: First unrolled trifoliate leaf
- V2: Second unrolled trifoliate leaf
- V(n): Each successive unrolled trifoliate leaf
Vegetative stages VE-V1

- **VE**: emergence (7-14 days after planting)
- **VC**: unifoliate leaves unroll
- **V1**: 1\textsuperscript{st} trifoliate leaf unrolls (7-10 days after VE)
Vegetative stages VE-V1

- Problems to watch for:
  - Soil temperature, crusting
  - Flooding, frost, hail
  - Bean leaf beetle feeding
  - Pythium root rot, Phytophthora root and stem rot
  - Common early season pathogens like Fusarium, Rhizoctonia, Phomopsis, and a few other early season root “rots”
  - Weed competition
Vegetative stage V2

- **V2**: 2\textsuperscript{nd} trifoliate leaf unrolls
  - 6 to 8 inches tall
  - Nitrogen fixation can begin

- Problems to watch for:
  - Bacterial blight
  - Septoria brown spot
  - Rhizoctonia root rot
  - Flooding
  - Some problems may appear anytime during the season
Vegetative stage V(n)

- **V(n): successive vegetative stages**
  - As the plant continues to develop trifoliate leaves, V stage increases accordingly
  - Vegetative growth continues for a time after reproductive stages start, but plants are then known by reproductive characteristics

- **Problems to watch for during V(n) stages:**
  - Begin scouting for soybean cyst nematodes in later V stages, early R stages
  - Soybean aphid scouting in mid-June
  - Grasshoppers, potential for spider mites
  - Many problems mentioned on previous slides
  - Herbicide injury
Reproductive stages

- **Reproductive Stages**
  - R1: Beginning bloom
  - R2: Full bloom
  - R3: Beginning pod development
  - R4: Full pod
  - R5: Beginning seed
  - R6: Full seed
  - R7: Beginning maturity
  - R8: Full Maturity
Reproductive stages: R1 & R2

Beginning and full bloom

- R1: Beginning bloom occurs when at least 1 flower is open at any node
- R2: Full bloom occurs when either of the two top nodes have an open flower
Reproductive stages: R1 & R2
Beginning and full bloom

• Problems to watch for:
  – Bacterial pustule, Fusarium wilt, powdery mildew, Septoria brown spot
  – Sudden death syndrome
  – Grasshoppers, spider mites, soybean aphid
  – Flooding, Drought
Reproductive stage: R3 & R4
Beginning and full pod

- R3: Beginning pod is when pods are 3/16 inch long at 1 of the top 4 nodes on the main stem with a fully developed leaf
- R4: Full pod is when pods are ¾ inch long in the same location as above
Reproductive stage: R3 & R4
Beginning and full pod

- Problems to watch for:
  - Cercospora leaf blight, brown stem rot, stem canker
  - White mold, downy mildew, frogeye leaf spot
  - Green cloverworm, soybean looper, soybean aphid
  - Japanese beetle, spider mite
  - Nutrient deficiencies
Reproductive stage: R5 & R6
Beginning and full seed

• R5: Beginning seed is when seeds are 1/8 inch long in the pod at 1 of the 4 top nodes on the main stem

• R6: Full seed is when green seeds fill pod capacity at the same location as above
Reproductive stage: R5 & R6
Beginning and full seed

- Problems to watch for:
  - Anthracnose, charcoal rot, pod and stem blight
  - Sudden death syndrome, brown stem rot, white mold
  - Grasshoppers, Japanese beetles, bean leaf beetles, stink bugs
  - Hail
  - Drought
Reproductive stage: R7 & R8
Beginning and full maturity

• R7: Beginning maturity occurs when 1 pod on the main stem reaches mature color
• R8: Full maturity occurs when 95 percent of pods reach mature color
Reproductive stage: R7 & R8
Beginning and full maturity

• Problems to watch for:
  – Green stem
  – Stem diseases (pod and stem blight, charcoal rot, Anthracnose)
  – Seed diseases (Phomopsis, white mold, purple seed stain, etc.)
  – Grasshoppers, bean leaf beetles, stink bugs
  – Lodging
Conclusions

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