Soybean yield is a complex series of interactions involving factors such as management, soil type, fertility, herbicide, weather, variety, diseases, SCN, weeds, and insects.

Yield Components of Soybean:
- Number of pods
- Beans per pod
- Seed weight
- Beans per plant/branch
- Plants/Branches per area
- Grain

Soybean Production in Wisconsin:
- Keys to Success:
  - Fertilize and lime based on a sound soil testing program
  - Do not till or plant when soils are too wet
  - Plant on dates recommended for your area
  - Select varieties best suited to your area
  - Use seed treatments and inoculate as necessary
  - Use optimum plant populations for your row spacing
  - Don’t plant too deep, 1” to 1.5” is optimum
  - Monitor and control pest populations as necessary
  - Harvest carefully and timely

Management Practices by Stage of Growth:
- Pre-planting
- Post planting, early season
- Post flowering
- Harvest

PREPLANTING DECISIONS:
- TILLAGE
- VARIETY SELECTION
- HERBICIDE CHOICES
- FERTILITY PROGRAM
Soybean Maturity Zones

Soybean Growth and Development

Vegetative Stages
- V-Stages
- VE, VC, V1, V2, V3, Vn

Reproductive Stages
- R-Stages
- R1, R2, R3, ..., R8
- Starts at Flowering

Soybean Morphology

- Note growing points
- Nodes are counted when the leaflet above that node is opened

SOYBEAN GERMINATION

Germination and Emergence Problems
**Emergence Stage – VE**
- 5 TO 14 DAYS AFTER PLANTING
- CHECK FOR NEED TO ROTARY HOE
- ASSESS HAIL DAMAGE

**HAIL DAMAGE**
- Assess mortality
- Know the growing points
- Determine remaining stand
- Use calendar date and stand to determine replant options

**Should I replant?**

**Cotyledon stage – VC**
- Unifoliolate leaves have unrolled
- Leaves are opposite

**First Trifoliate stage – V1**
- One trifoliolate
- One node above the unifoliolate
- Trifoliolates are produced singularly and alternately

**Second Trifoliate Stage – V2**
- Two trifoliolates
- Nodules have been established
- Check for proper nodulation
- If absent determine cause and prepare to apply N
Nitrogen Needs of the Soybean Crop

- Protein production requires nitrogen (N)
  \[ N \times 6.25 = \text{Protein} \]
- A 50 bu/a crop of 38% protein seed requires 180 lbs of N/a for seed protein alone.
- About 50% of the N comes from the nodules N fixation.
- Soil NO₃ will inhibit N₂ fixation.
- A small amount of N may increase yields in certain low N, high yielding environments.

V3 – Third Node

- 3 nodes above unifoliolate
- Cotyledons gone
- Axillary buds allow plants to recuperate from damage

V6 Stage

- New V stages every 3 days
- 50% leaf loss = 3% yield loss

Reproductive Stages and Development

<table>
<thead>
<tr>
<th>R1</th>
<th>Beginning Bloom (flower)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R2</td>
<td>Full Bloom</td>
</tr>
<tr>
<td>R3</td>
<td>Beginning Pod</td>
</tr>
<tr>
<td>R4</td>
<td>Full Pod</td>
</tr>
<tr>
<td>R5</td>
<td>Beginning Seed</td>
</tr>
<tr>
<td>R6</td>
<td>Full Seed</td>
</tr>
<tr>
<td>R7</td>
<td>Beginning Maturity</td>
</tr>
<tr>
<td>R8</td>
<td>Full Maturity</td>
</tr>
</tbody>
</table>

Soybean Reproductive Development

- One open flower at any node
Midseason Management Considerations

- Soybean Diseases
- Weeds and Herbicides
- Midseason N applications

Full Flower – R2

- Open flower at one of the two uppermost nodes

Beginning Pod – R3

- Pod 3/16" long at one of the four uppermost nodes
- 60-75% of flowers abort and never contribute to yield

Full Pod – R4

- Pod is ¾" long at one of the four uppermost nodes
- Beginning of critical yield determining period

Beginning Seed – R5

- Seed is 1/8" long in pod at one of the four uppermost nodes
- Large demand for water and nutrients
- R5.5 is max node #, height and leaf area

Seed and Pod Development Through the R5 Stage
Full Seed – R6

- Pod containing a green seed that fills the pod cavity at one of the four uppermost nodes

Beginning Maturity – R7

- One pod anywhere with its mature color

Full Maturity – R8

- 95% of the pods have reached their mature color
- Harvestable 7-10 days after R8
- Plant populations can be assessed

Harvesting and Storage

- Manage Moisture
  - 13% is optimal for storage and sales
- Carefully adjust (and readjust your combine)
  - Header losses can account for 80% of harvest losses
- Cut low, 3.5” stubble contains 5% of the crop, 6.5” stubble, 12%
- Identity preservation (IP)

Yield Loss from Defoliation

- 100% Defoliation
- 75% Defoliation
- 50% Defoliation

Soybean Cyst Nematode

- widespread distribution
- substantial yield loss
- no obvious symptoms
  - quick reproduction
  - long-term survival
- look for:
  - yellow plants
  - look for stunted plants
  - look for SCN females on roots
- collect soil samples
  - if < 500, alternate growing corn and SCN-resistant soybean varieties
  - if > 500, grow several years of corn until egg counts decrease below 500
Brown Stem Rot
- Risk throughout WI
- BSR can negate good management practices
- Soybean is the only host
- Soybean variety selection is key to control
- Crop rotations can minimize infection
- More severe BSR is observed in no-till

White Mold
- Wide host range
- Soybean variety selection is key to control
- Crop rotations can minimize infection
- No-till can help by reducing sclerotia numbers
- Canopy management – Row spacing and seeding rate

Management effects on disease
Wisconsin rotation/tillage/variety experiment

Phytophthora Root Rot
- Many races of PRR exist in WI
- Some varieties have specific race resistant genes
- Improve soil drainage
- Rotate crops
- Avoid soil compaction
- Ridge soil during cultivation to stimulate root growth
- Apron or Ridomil seed treatments are effective

Managing Soybean Disease

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Management</th>
<th>Yield Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSR</td>
<td>Variety selection, Rotation</td>
<td>12%/10% loss of leaf</td>
</tr>
<tr>
<td>White mold</td>
<td>Variety selection, Canopy mgmt.</td>
<td>6%/10% loss/10% incidence</td>
</tr>
<tr>
<td>SDS</td>
<td>Variety selection</td>
<td>Variable 0 to 20-50%</td>
</tr>
<tr>
<td>Phytophthora root rot</td>
<td>Variety selection, Seed treatment</td>
<td>Variable, 0-20%</td>
</tr>
<tr>
<td>Virus complex</td>
<td>Seed selection, Variety selection, Insect control</td>
<td>77</td>
</tr>
</tbody>
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