Soybean and Wheat Production

Wisconsin CCA Training
December 17, 2003

Dr. Roger Borges
UW - UWEX Soybean and Small Grain
SOYBEAN YIELD IS A COMPLEX SERIES OF INTERACTIONS

YIELD

Soil type

Management

Fertility

Herbicide

Weather

Variety

Diseases

SCN

Weeds

Insects
WISCONSIN SOYBEAN PRODUCTION
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
## TABLE 3. CENTRAL REGION SOYBEAN TEST (Page 4 of 4)

2000 Performance of Public and Commercial Entries at Three Central Wisconsin Locations.

**FON** = FOND DU LAC, **GAL** = GALESVILLE, **HAN** = HANCOCK

<table>
<thead>
<tr>
<th>Originator/Brand Entry</th>
<th>Maturity Herb. Group Toler.</th>
<th>2000 3-Test Average</th>
<th>2000 Yields</th>
<th>Disease</th>
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* Yields preceded by a "*" are not significantly different (0.10 level) than the highest yielding cultivar.

** Herb. Toler.: Herbicide Tolerance: RR = Tolerance to "Roundup" herbicide, STS = Tolerance to Sulfonyleurea herbicides, CN = Conventional herbicide tolerance.

***Hancock site was affected by Sclerotinia disease (White Mold) in 2000. The disease severity are % of plants expressing White Mold Disease and helps explain the lower yields for select varieties.

Results that are shaded provide the best estimate of relative variety performance.
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
VE - EMERGENCE

• 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
VC - COTYLEDON

- Unifoliolate leaves have unrolled
- Leaves are opposite
V1 STAGE

• One trifoliolate
• One node above the unifoliolate
• Trifoliolates are produced singularly and alternately
V2 – 2\textsuperscript{ND} NODE

- Two trifoliolates
- Nodules have been established
- Check for proper nodulation
- If absent determine cause and prepare to apply N
SOYBEAN NODULATION

- Symbiotic relationship
- Native and introduced bacteria
- Necessary for high yields
- Chemicals, cold, hot, moisture all affect bacteria health
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 NO$_3$ will inhibit N$_2$ fixation

• A small amount of N \textbf{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>Stage</th>
<th>Description</th>
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<tbody>
<tr>
<td>R1</td>
<td>Beginning Bloom (flower)</td>
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<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>
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<tr>
<td>R6</td>
<td>Full Seed</td>
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<td>R7</td>
<td>Beginning Maturity</td>
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<td>R8</td>
<td>Full Maturity</td>
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SOYBEAN REPRODUCTIVE DEVELOPMENT

Days after flowering

- R1 to R2: Indeterminate Growth
- R2 to R3: Vegetative Growth
- R3 to R4: Flowering
- R4 to R5: Pod Development
- R5 to R8: Seed Filling
BEGINNING FLOWERING

- R1
- One open flower at any node
MIDSEASON MANAGEMENT CONSIDERATIONS

- Soybean Diseases
- Weeds and Herbicides
- Midseason N applications

HARVEST MANAGEMENT

- Harvest timing and storage
- Identity preservation (IP)
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

• 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%
SHOULD I REPLANT?
SOYBEAN CYST NEMATODE

- widespread distribution
- no obvious symptoms
- quick reproduction
- long-term survival
- substantial yield loss
- 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
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
WISCONSIN WHEAT PRODUCTION
KEYS TO SUCCESS

• Fertilize and lime based on a sound soil testing program
• Do not till or plant when soils are too wet or dry
• Plant on dates recommended for your area
• Make informed variety selections
• Use seed treatments as necessary
• Use optimum plant populations for your date of planting
• Don’t plant too deep, 1” to 1.5” is optimum
• Monitor and control weeds as necessary
• Monitor and control foliar diseases
• Harvest carefully and timely
Management Practices by Stage of Growth

Pre-planting

Planting and fall management

Spring management to heading

Post heading to harvest
PRE-PLANTING DECISIONS

• Tillage
• Variety Selection
• Seed Treatments
EFFECT OF PLANTING DATE ON WINTER WHEAT YIELD ARLINGTON, WI 2000

Grain yield (bu/acre)

Planting Date

Sept 1
Sept 17
Sept 30

Kaskaskia
KW 39
Glacier

This presentation is available at
http://soybean.agronomy.wisc.edu
USES OF SEED TREATMENTS

• Manage seed and soil borne pathogens

• A single fungicide will not control all of the pathogens present

• Disease conditions vary from year to year

• In Wisconsin, to control bunt, smuts, and seedling blight (seedling phase of scab)
EFFECT OF SEED TREATMENT ON WINTER WHEAT YIELD ARLINGTON, WI 2000

Grain yield (bu/a)

Sept. 1 Sept. 17 Sept. 30
Planting date

Control DividendXL DividendXL+Gaucho

30 35 40 45 50 55 60 65 70

Grain yield (bu/a)

Sept. 1 Sept. 17 Sept. 30
Planting date

Control DividendXL DividendXL+Gaucho
GROWTH STAGES OF WHEAT

• At least five scales used to describe stages of wheat

• Most widely used is Zadoks, others are Feekes and Haun

• Understanding growth stages is important to match management decisions to plant development
Zadoks 0 to 9
Germination and coleoptile emerged

• Planting depth and soil temp influences the length of this stage

• First leaf just emerging
Zadoks 10 to 15
Seedling Development

• Seedling emergence

• GS 13 = single shoot with three leaves

• GS 15 = single shoot with five leaves
Zadoks 20 to 25
Tillering

• Fall or Spring

• GS 20 = main shoot

• GS 25 = main shoot plus 5 tillers
Zadoks 30 to 39
Stem Elongation

• GS31 = 1st node detectable

• GS 37 = flag leaf just visible

• GS 39 = flag leaf collar just visible

• Many foliar fungicides are applied now
Flag Leaf is the leaf that contribute the most carbohydrates for grain filling
Zadoks 40 to 49
Boot Stage

• GS 43 = boot swelling

• GS 49 = first awns visible
**Zadoks 50 to 59**

**Head Emergence**

- GS 50 = first spikelets of head
- GS 59 = head emergence complete

**Zadoks 60 to 69**

**Flowering**

- GS 60 = beginning of flowering
- GS 69 = flowering complete
Zadoks 70 to 79
Milk Stage
• GS 71 = watery (a)
• GS 77 = late milk (b)

Zadoks 80 to 89
Dough Stage
• GS 85 = soft dough (c)
• GS 87 = hard dough (d)
• GS 92 = ripe kernel (e)  harvest time
BARLEY YELLOW DWARF IN WHEAT
BARLEY YELLOW DWARF

• Caused by Barley Yellow Dwarf Virus

• Symptoms
  ✓ Yellow leaves
  ✓ Yellow flag leaf
  ✓ Stunting
  ✓ Shows up in spring
  ✓ Mistaken for nutrient deficiency
  ✓ Mistaken by environmental problem

• Diagnosis
  ✓ Lab serological (antibody) only real test
  ✓ >= 5 strains
Thank You

Questions?
Comments
Good Luck!