

# Utility of Harvest Aids in Indeterminate and Determinate Soybeans

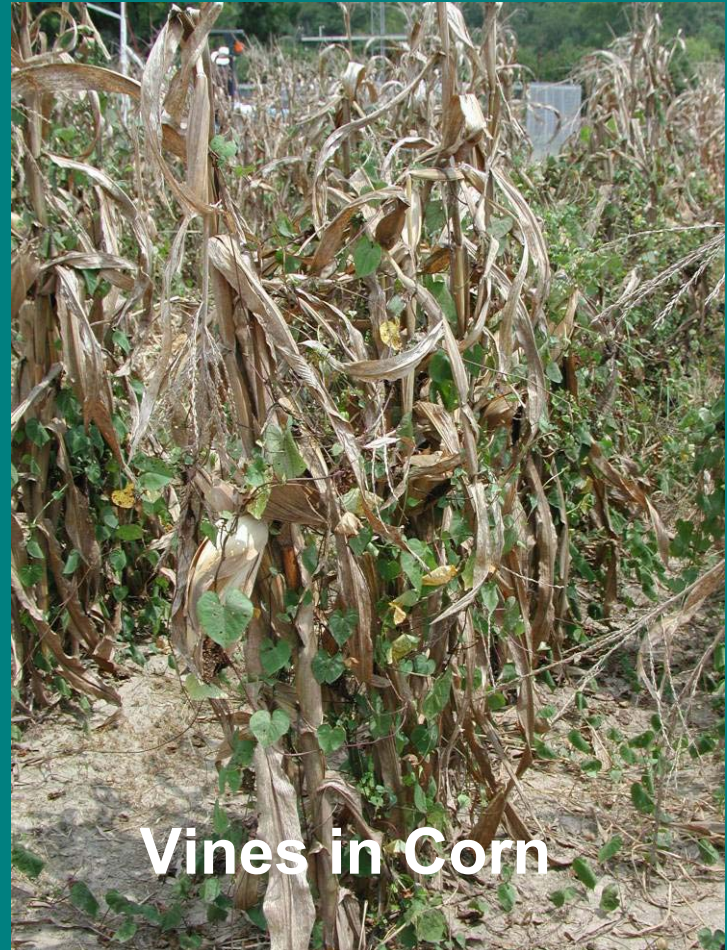
Jim Griffin and Joey Boudreaux



# Need For Harvest Aids?



**Vines in Sugarcane**



**Vines in Corn**

**Desiccation of Weeds**

# Need For Harvest Aids?

- The need for desiccation of soybeans has increased
- “Green Bean Syndrome” - retention of green leaves and presence of green stems and pods
- Causes:
  - Diseases/insects
  - Stress
- Harvest delay problems



# Soybean Production in 1980's

- Maturity Group V, VI, VII, and VIII determinate varieties were grown in Louisiana.
- Growers were discouraged from planting Group V's because of "seed quality" problems; Group VI and VII varieties were most popular.
- Some years growers harvested soybeans into late November.

# Soybean Production in 1990's

- Maturity Group IV indeterminate varieties were introduced.
- These varieties began to dominate the acreage.
- Why? They could be planted early and harvested early and in some years could escape late season dry weather and insect and disease problems.
- Indeterminate soybeans are different from determinate soybeans.

# Indeterminate vs. Determinate Soybeans

- **Indeterminate Soybeans:**
  - Photoperiod sensitive
  - Flowering initiated at the bottom of the plant and proceeds upward; terminal buds continue to grow several weeks after flowering
  - Can be considerable difference in seed maturity with bottom seed reaching maturity first
  - This can result in plants retaining leaf material longer to help fill the uppermost seeds
- **Determinate Soybeans:**
  - Photoperiod sensitive
  - Flowering initiated in middle of the plant and proceeds upward and downward; terminal bud growth ceases when flowering begins
  - May be some slight difference in seed maturity on the plant but most seeds mature at the same time
- **Differences in growth habit between determinate and indeterminate soybeans can affect the need for harvest aids/defoliant.**

# Soybean Harvest Aids

- Because Group IV varieties tend to hold leaves longer than other varieties, use of a harvest aid to remove leaves may expedite harvest.
- The feeling among many in Louisiana is that a harvest aid should be a standard part of a soybean production system, particularly in Group IV's.
- In Louisiana, most harvest aids are used to desiccate soybean rather than weeds.
- Earlier harvest may allow growers to take advantage of higher price for early delivery.
- In the sugarcane area, earlier harvest will allow for timely seedbed preparation and planting of sugarcane.

# Need For Harvest Aids – Earlier Harvest?





# Soybean Harvest Aids

## Gramoxone Label

- Spray volume:
  - 20 GPA for ground and 5 GPA for air
- Timing:
  - Indeterminate varieties: Apply when at least 65% of the seed pods have reached a mature brown color or when seed moisture is 30% or less
  - Determinate varieties: Apply when plants are mature, i.e., beans are fully developed, 1/2 of leaves have dropped, and remaining leaves are yellowing.
  - Confusing??

# Soybean Harvest Aids

## Sodium Chlorate Label

- **Spray volume:** 20 to 30 GPA for ground and 4 to 10 GPA for air. Usually 6 to 8 nozzles per row are necessary to obtain good coverage of leaves with ground application.
- **General information:** Weather conditions that favor good defoliation are high temperature, high humidity, low wind velocity, and high to adequate soil moisture. Plant conditions that favor good defoliation are ample fertility and moisture, and complete insect control. Leaves should be green and turgid.

# Soybean Reproductive Growth Stages

## R1 to R5

- **R1 Beginning Flower**
  - Open flower at any node on main stem
- **R2 Full Flower**
  - Open flower at one of the two uppermost nodes on main stem
- **R3 Beginning Pod**
  - Pod is  $\frac{3}{16}$  inch long at one of the four uppermost nodes on main stem
- **R4 Full Pod**
  - Pod is  $\frac{3}{4}$  inch long at one of the four uppermost nodes on main stem
- **R5 Beginning Seed**
  - Seed is  $\frac{1}{8}$  inch long in a pod at one of the four uppermost nodes on main stem

# Soybean Reproductive Growth Stages

## R6 to Harvest

- **R6 Full Seed**
  - A pod containing a green seed that fills the pod cavity located at one of the four uppermost main stem nodes
- **R6.5 Full Seed**
  - All normal pods on four uppermost nodes have pod cavities filled and beans in the pods are separating from the white membrane inside the pod. Seed at 50% moisture and at physiological maturity. Leaf senescence begins.
- **R7 Beginning Maturity**
  - One normal pod on main stem has reached mature color. All seeds at 100% dry matter accumulation (around 3 weeks prior to harvest)
- **R8 Full Maturity**
  - 95% of pods have reached mature color (around 2 weeks prior to harvest)
- **Harvest**
  - Harvest maturity with seeds at 13% moisture

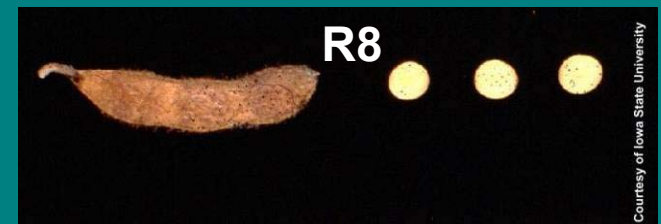
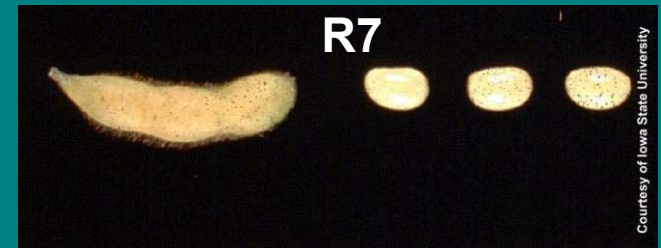
# Soybean Harvest Aid Research Methods

- Research conducted in Group IV indeterminate soybeans and Group V and Group VI determinate soybeans
- Harvest Aids:
  - Gramoxone Inteon (2L) @ 1pt/A + 0.25% NIS
  - Gramoxone Inteon 1 pt/A + Aim 1.4 oz/A + 0.25% NIS
  - Sodium chlorate (6L) @ 4 qt/A
- Application Timing:
  - Based on moisture of soybean seed collected from uppermost 4 nodes of plants
  - Seed moisture of 60, 50, 40, 30, and 20% (seed weighed, dried, and re-weighed); represented average seed moisture
  - Based on application at approximately weekly intervals

# Harvest Aids

## Seed Moisture vs. Growth Stage

<b>% Moisture</b>	<b>R Stage</b>
60	R6 (no leaf senescence)
50	R6.5 (physiological maturity)
40	R7 (leaves senescing/some pods have reached mature color)
30	R8
20	Harvest



# Harvest Aid Group IV Test - 2005

## Asgrow 4403RR (Planted April 21)

Problem: Soybeans from all treatments harvested on the same date.

<b>Application timing</b> (Avg. seed moisture)	<b>Yield</b> <b>Bu/A</b>	<b>Application date</b>	<b>Days to harvest</b>
<b>60%</b>	<b>63.2 c</b>	<b>8/04</b>	<b>28</b>
<b>50%</b>	<b>67.8 b</b>	<b>8/09</b>	<b>23</b>
<b>40%</b>	<b>72.3 a</b>	<b>8/14</b>	<b>18</b>
<b>30%</b>	<b>72.0 ab</b>	<b>8/18</b>	<b>14</b>
<b>20%</b>	<b>74.7 a</b>	<b>8/24</b>	<b>8</b>
<b>NTC</b>	<b>72.0 ab</b>	<b>-</b>	<b>0</b>

**Average seed moisture of 50% represents R6.5 (physiological maturity).**

# Harvest Aid Group IV Test - 2006

## Asgrow 4403RR (Planted May 12)

<b>Application timing</b> (Avg. seed moisture)	<b>Yield Bu/A*</b> <b>P=(0.06)</b>	<b>Moisture at harvest (%)</b>	<b>100-Seed weight (g)</b>	<b>Days harvested before NTC</b>
<b>60%</b>	<b>55.1 a</b>	<b>12.7</b>	<b>13.3 ab</b>	<b>14</b>
<b>50%</b>	<b>59.9 a</b>	<b>13.2</b>	<b>14.5 a</b>	<b>14</b>
<b>40%</b>	<b>59.8 a</b>	<b>13.0</b>	<b>13.9 ab</b>	<b>9</b>
<b>30%</b>	<b>59.3 a</b>	<b>11.4</b>	<b>12.9 b</b>	<b>3</b>
<b>20%</b>	<b>61.0 a</b>	<b>12.4</b>	<b>13.6 ab</b>	<b>0</b>
<b>NTC</b>	<b>60.7 a</b>	<b>12.3</b>	<b>13.5 ab</b>	<b>0</b>

**Average seed moisture of 50% represents R6.5 (physiological maturity).**



# Harvest Aid Group V Test - 2006

## Asgrow 5903RR (Planted May 12)

<b>Application timing</b> (Avg. seed moisture)	<b>Yield</b> <b>Bu/A</b>	<b>Moisture at harvest (%)</b>	<b>100-Seed weight (g)</b>	<b>Days harvested before NTC</b>
<b>60%</b>	<b>45.1 d</b>	<b>13.7</b>	<b>10.6 d</b>	<b>18</b>
<b>50%</b>	<b>47.6 cd</b>	<b>13.7</b>	<b>11.6 cd</b>	<b>13</b>
<b>40%</b>	<b>51.3 bc</b>	<b>11.6</b>	<b>12.7 bc</b>	<b>7</b>
<b>30%</b>	<b>52.4 b</b>	<b>13.6</b>	<b>12.8 bc</b>	<b>7</b>
<b>20%</b>	<b>57.1 a</b>	<b>12.4</b>	<b>13.2 ab</b>	<b>0</b>
<b>NTC</b>	<b>52.9 b</b>	<b>13.8</b>	<b>14.4 a</b>	<b>0</b>

**Average seed moisture of 50% represents R6.5 (physiological maturity).**

# Harvest Aids



**Application @ 60% Moisture**

# Harvest Aid Group VI Test - 2006

## Asgrow 6202RR (Planted June 19)

<b>Application timing</b> (Avg. seed moisture)	<b>Yield Bu/A</b>	<b>Moisture at harvest (%)</b>	<b>100-Seed weight (g)</b>	<b>Days harvested before NTC</b>
<b>60%</b>	<b>43.6 c</b>	<b>14.4</b>	<b>10.6 c</b>	<b>21</b>
<b>50%</b>	<b>49.4 b</b>	<b>10.8</b>	<b>12.6 b</b>	<b>20</b>
<b>40%</b>	<b>55.0 a</b>	<b>14.3</b>	<b>13.8 a</b>	<b>14</b>
<b>30%</b>	<b>53.7 a</b>	<b>16.5</b>	<b>14.2 a</b>	<b>0</b>
<b>20%</b>	<b>53.8 a</b>	<b>16.7</b>	<b>14.2 a</b>	<b>0</b>
<b>NTC</b>	<b>53.9 a</b>	<b>16.6</b>	<b>14.8 a</b>	<b>0</b>

**Average seed moisture of 50% represents R6.5 (physiological maturity).**

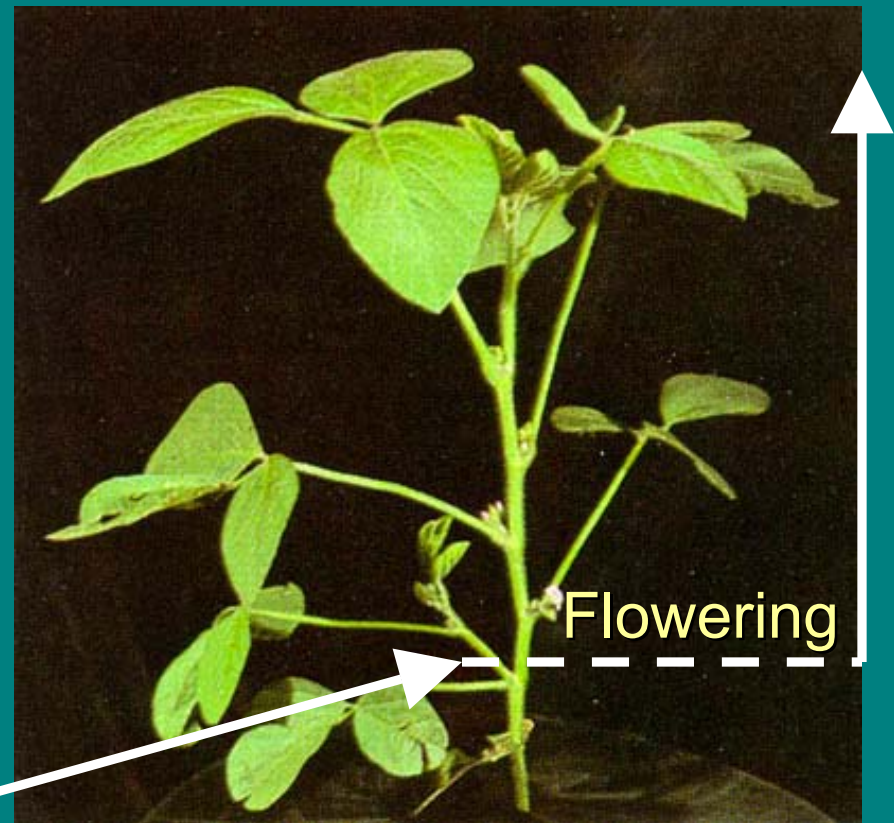
# Observations

- Harvest aid application timing was more flexible for the indeterminate (Group IV) variety than for the determinate (Group V and VI) varieties.
- Determinate varieties were more sensitive to early harvest aid application (before physiological maturity) than indeterminate varieties.
- Differences in response to timing of defoliation for indeterminate and determinate varieties were related to differences in growth habit and the effect on flowering and seed development.

# Differences in Floral Initiation

## Indeterminate Varieties

- Flowering begins at the lower nodes of the plant and progresses toward the top of the plant.
- Pod growth and seed fill follow in a similar pattern.
- The most immature seed are in the top of the plant.

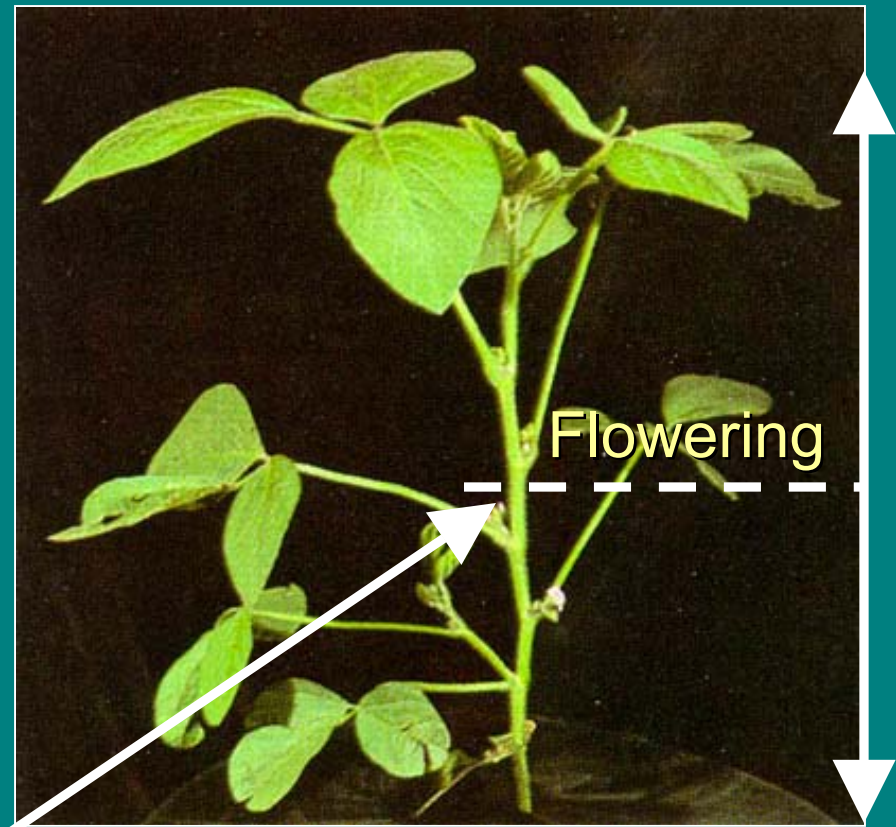


Floral Initiation

# Differences in Floral Initiation

## Determinate Varieties

- Flowering begins at the middle 3 to 6 nodes of the plant and progresses toward the top and bottom of the plant.
- Pod growth and seed fill follow in a similar pattern.
- The most immature seed are in the top and bottom of the plant.



Floral Initiation

# Harvest Aid Research Findings

- Soybean seed lost around 10% moisture every 7 to 10 days.
- Gramoxone Inteon at 16 oz/A plus NIS and sodium chlorate at 4/qt/A were equally effective in desiccating soybean foliage.
- Harvest aids applied at 40 to 50% moisture (average for seed from uppermost 4 nodes of plants) did not reduce soybean yield.
- Soybeans were harvested 14 to 20 days earlier compared with the nontreated when harvest aid was applied at 50% moisture; 7 to 14 days earlier at 40% moisture.

# Harvest Aid Research Findings

- Application of harvest aid at 60% moisture compared with 40% did not reduce yield of the Group IV variety, but yield was reduced 6.2 Bu/A for the Group V variety and 11.4 Bu/A for the Group VI variety.
- Gramoxone label is unclear as to application timing and is probably too conservative (current label 30% seed moisture and 1/2 leaves dropped).
- Aim can be applied with Gramoxone if vines are present.



# Soybean Research Harvest Aids



**Group IV -  
With and Without  
Harvest Aid**

# Is Application of Harvest Aid at 60% Seed Moisture too Early? Yes

Before Drying

After Drying



# Recommendations For Timing of Harvest Aid Application in Soybeans



Collect pods from the top third of plants at random across the field. Open pods and look for separation of beans from the white membrane inside the pod. If this is observed for all pods collected then seed are at physiological maturity and have reached their maximum dry weight. It is safe then to remove leaves without affecting seed weight.



# Recommendations For Timing of Harvest Aid Application in Soybeans



If after opening the pods not all seed are at physiological maturity then application of harvest aid will result in some yield loss due to lower seed weight. The grower will need to decide if the yield loss can be offset by earlier harvest.



**Questions?**

# Wide Beds / Row Configurations



**Soybeans can be grown during the sugarcane fallow period utilizing traditional sugarcane beds without delaying the planting of sugarcane or negatively affecting the planting operation or plant cane yield.**

**Weed control was not sacrificed when RR soybeans were grown in fallow compared with a conventional non-crop system.**

# Wide Beds / Row Configurations

## Why the Interest in wide beds?

- Ridge roller implements – put up a bed and make furrows for irrigation (and improved drainage)
  - Bed width is adjustable up to 72 inches

## Why the interest in row configurations?

- Twin-row research in Mississippi
  - 40 inch center beds – single row vs. two 10 inch rows
  - Twin rows produced five more pods per plant and yield 8.5% greater (7 bushel increase) than single row
- Explanation - Plants in the twin-row system intercepted twice as much light as plants in the single-row system.

# Wide Beds / Row Configurations



2 Rows @ 18 inches

Date of canopy closure  
on the bed



2 Rows @ 30 inches

Date of canopy closure  
in the row middle



3 Rows @ 15 inches



# Wide Beds / Row Configurations

Row Configuration per 72 inch bed	Date of canopy closure on the bed	Date of canopy closure in the row middle	Yield Bu/A
2 rows @ 18 inch spacing	6/28-7/5 21 d earlier vs. 7/26	8/10 22 d later vs. 7/26	59.1 bc (-5.4)
2 rows @ 24 inch spacing	7/5-7/12 14 d earlier vs. 7/26	7/26 7 d later vs. 7/26	62.2 ab (-2.3)
2 rows @ 30 inch spacing	7/19-7/26	7/19	56.6 c (-7.9)
3 rows @ 15 inch spacing	6/28-7/5 21 d earlier vs. 7/26	7/19	64.5 a

# Wide Beds / Row Configurations

- Soybean height across the growing season did not differ for the various row configurations.
- To maximize yield, canopy closure on wide beds is more important than row middle canopy closure.
- All of row configurations were conducive to glyphosate and fungicide/insecticide deposition around time of flowering and pod set.
- For all row configurations seeding rate per acre was the same.
- Yield was 7.9 Bu/A greater when 3 rows at 15 inch spacing were planted per wide bed compared with 2 rows at 30 inches.

# Questions?

