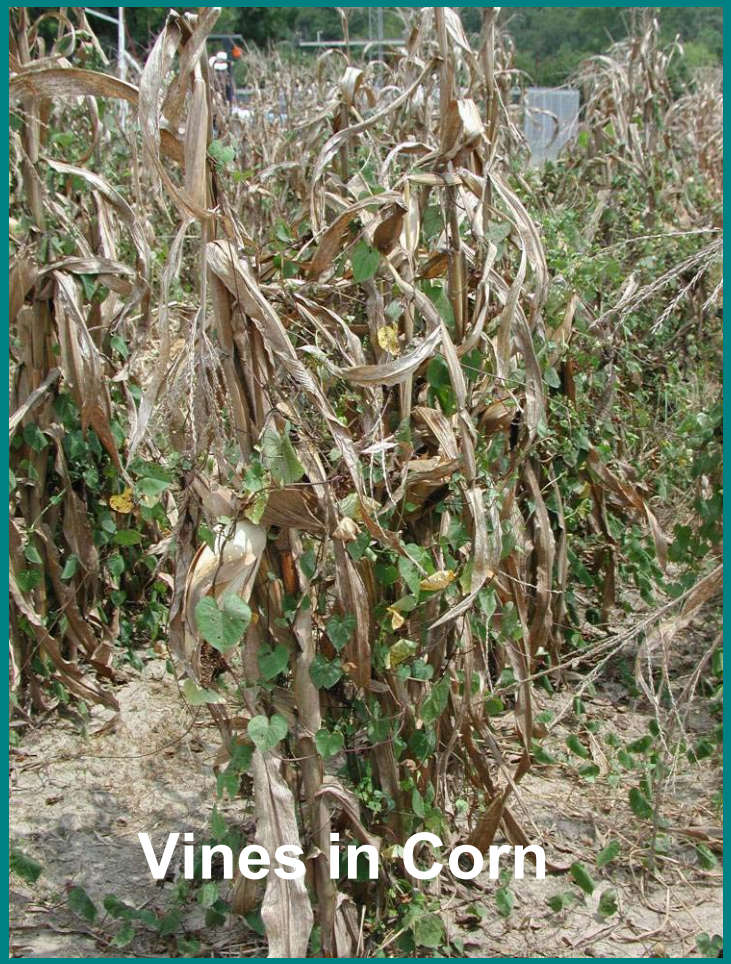
Harvest Aids in Soybeans - Application Timing and Value

J.L. Griffin, C.A. Jones,
L.M. Etheredge, Jr., J. Boudreaux,
and D.Y. Lanclos

Need For Harvest Aids?

Vines in Sugarcane



Vines in Corn

Desiccation of Weeds

Mississippi State University Research

- R.M. Griffin, D.H. Poston, D.R. Shaw, and M.C. Smith. Economics of Preharvest Desiccants in Maturity Group III Soybean (SWSS Proceedings)

Results from 2000 and 2001:

- Preharvest desiccant (paraquat + sodium chlorate applied 5 to 7 days prior to harvest) generally increased harvestability but did not consistently increase yield
- The decrease in cost associated with machinery wear and labor may warrant use of a harvest aid

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 beans 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

- 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
- 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
- Differences in growth habit between determinate and indeterminate soybeans can affect the need for harvest aids/defoliants.

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.

Harvest Aids Can Promote 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, ½ 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 3/16 inch long at one of the four uppermost nodes on main stem
- R4 Full Pod
  - Pod is ¾ inch long at one of the four uppermost nodes on main stem
- R5 Beginning Seed
  - Seed is 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. Leaf senescence begins. Seed at 50% dry matter accumulated.
- R7 Beginning Maturity
  - One normal pod on main stem has reached mature color. Seeds at 100% dry matter accumulated. Physiological maturity (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

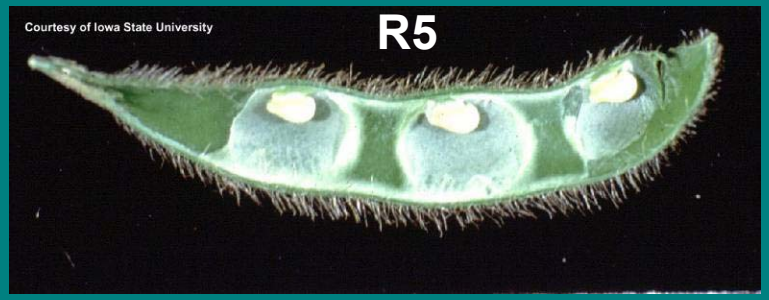
Harvest Aids Application Timing

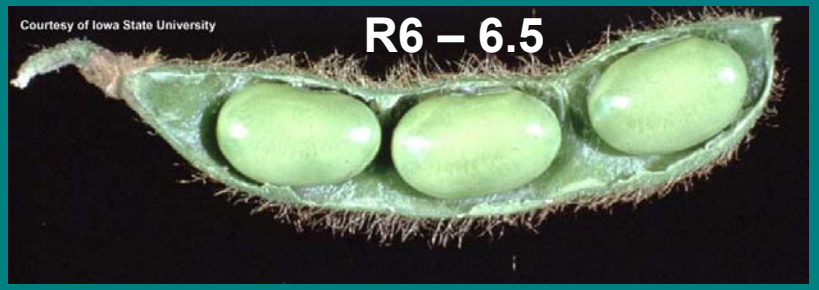
Assessing Frost Damage in Soybeans (North Dakota State University www.ag.ndsu.edu)

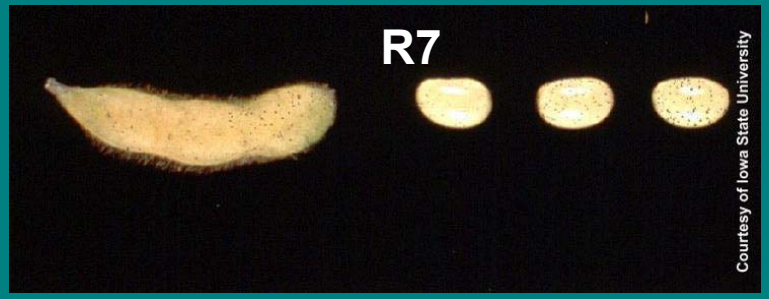
- A killing frost before soybeans reach “physiological maturity” can result in significant yield loss.
- At physiological maturity (R6.5):
  - Seeds have reached maximum dry weight and will lose moisture (dry down) from that point on
  - Pods are yellow sprinkled with brown
  - Beans in the pods are separating from the white membrane inside the pod
- Soybean yield was reduced if frost occurred at or before R6.
- Frost injury to soybeans reduced number of beans per plant and bean size.

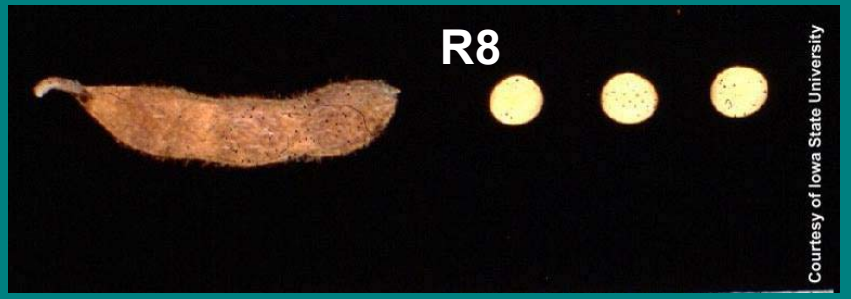
Applying a desiccant/harvest aid that kills green soybean foliage would be comparable to a killing frost.

Soybean Reproductive Growth Stages









Soybean Harvest Aid Research Methods

- Research conducted in Group IV indeterminate soybeans and Group V and Group VII determinate soybeans
- Harvest Aids:
  - Gramoxone Inteon 1pt/A + 0.25% NIS
  - Gramoxone Inteon 1 pt/A + Aim 1.4 oz/A + 0.25% NIS
  - Sodium chlorate 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%
  - Based on application at approximately weekly intervals

Soybean Harvest Aid Research Methods

- Application Timing:
  - Initiated at 60% moisture
  - Group IV on August 4
  - Group V on September 20
  - Group on October 10
- At each application, pods from uppermost 4 nodes were collected and shelled. Seeds were weighed and dried to determine percent moisture.
- Our estimates are:
  - R6 ~ 60% moisture
  - R6.5 ~ 50% moisture (physiological maturity); all pods on the top 4 nodes easily shelled
  - R7 ~ 40% moisture
  - R8 ~ 20-30% moisture

Soybean Seed For Group IV Application at 60% moisture R6

Too Early?

Soybean Seed For Group IV Application at 40% moisture R6.5 - R7

Safe Stage?

Soybean Yield (Bu/A)
Timing of Harvest Aid Application
Maturity Group IV

Harvest Aid	8/04 60% seed moisture	8/09 50% seed moisture	8/14 40% seed moisture	8/18 30% seed moisture	8/24 20% seed moisture
Gramoxone Inteon 1 pt/A + NIS	**63***	**67**	**74**	**72**	**77**
Sodium Chlorate 4 qt/A	**64***	**71**	**72**	**73**	**75**
None	**72**				

Desiccation of soybean foliage was greater than 90% 10 days after application of both Gramoxone Inteon and Sodium Chlorate.
Soybean seed moisture at harvest on September 1 was 13% where Gramoxone Inteon was applied August 18 and 17% where harvest aid was not used.

Soybean Yield (Bu/A)
Timing of Harvest Aid Application
Maturity Group V

Harvest Aid	9/20 60% seed moisture	9/29 50% seed moisture	10/05 40% seed moisture	10/10 30% seed moisture	10/14 20% seed moisture
Gramoxone Inteon 1 pt/A + NIS	**40***	**49**	**46**	**47**	**49**
Sodium Chlorate 4 qt/A	**38***	**47**	**39**	**50**	**41**
None	**43**				

Desiccation of soybean foliage was greater than 90% 15 days after application of both Gramoxone Inteon and Sodium Chlorate.
Soybean was harvested on October 28.

Soybean Yield (Bu/A)
Timing of Harvest Aid Application
Maturity Group VII

Harvest Aid	10/10 60% seed moisture	10/14 50% seed moisture	10/19 40% seed moisture	10/24 30% seed moisture	10/28 20% seed moisture
Gramoxone Inteon 1 pt/A + NIS	**52**	**52**	**54**	**55**	**63**
Sodium Chlorate 4 qt/A	**55**	**56**	**57**	**57**	**58**
None	**63**				

Desiccation of soybean foliage was greater than 90% 14 days after application of both Gramoxone Inteon and Sodium Chlorate.
Soybean was harvested November 11.

Soybean Research
Harvest Aids

Group IV -
With and Without
Harvest Aid

Soybean Harvest Aid Research Results

- Seed moisture at harvest was reduced when harvest aid was applied compared to the nontreated.
- Gramoxone Inteon at 16 oz/A plus NIS and sodium chlorate at 4/qt/A were equally effective in desiccating soybean foliage.
- Desiccation was at least 90% in 10 days when applied to Group IV and in 14 days for Group V and VII soybeans.

Soybean Harvest Aid Research Results

- Group IV variety - application of Gramoxone or sodium chlorate at 60% moisture (R6) reduced yield around 12% when compared with application at 30% moisture (label recommendation for Gramoxone).
- Group V variety - application at 60% moisture (R6) reduced yield around 15% for Gramoxone and 24% for sodium chlorate when compared with application at 30% moisture (label recommendation for Gramoxone).
- Group VII variety - application of Gramoxone or sodium chlorate at 60% moisture (R6) did not reduce yield when compared with application at 30% moisture (label recommendation for Gramoxone).
- All Soybean varieties - Yield was not affected by application of Gramoxone or sodium chlorate at 50 or 40% moisture (physiological maturity or later).

Recommendations For Harvest Aids in Soybean

- Gramoxone label is unclear as to application timing and is probably too conservative.
- Gramoxone and sodium chlorate can be applied earlier than 30% moisture without reducing yield.
- Sodium chlorate is more environmentally sensitive than is Gramoxone, i.e. temperature, humidity, soil moisture. Sodium chlorate performed equal to Gramoxone in our tests.
- Allow 10 to 14 days between harvest aid application and harvest.
- Aim should be included with Gramoxone if vines are present.

Recommendations For Timing of Harvest Aid Application in Soybean

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 Soybean

If after opening the pods <u>not all</u> 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?