Texas Cooperative EXTENSION
The Texas A&M University System

Result Demonstration/Applied Research Report

2003 Tom Green County
Cotton Harvest Aid Demonstration
Cooperator: Chris Bubenik

Rick Minzenmayer, Extension Agent - IPM for Runnels and Tom Green Counties
and Dr. Billy Warrick, Extension Agronomist (San Angelo, Texas)

Summary

Twenty-four harvest aid treatments were applied to Deltapine 424 BG/RR cotton on October 21, 2003 to prepare the crop for harvest. The plot was established on Chris Bubenik's Farm, seven miles north of Wall, Texas. The chemicals were applied to irrigated cotton that had 80 percent of its bolls open. Leaf shed was less than one percent and the cotton plant leaves were still green in color. All applied treatments resulted in a significant level of leaf defoliation when compared to the untreated checks. New plant growth was minimal for the 21 days the plot was evaluated. The regrowth that was developing should not interfere with harvesting and ginning.

Objective

In the Southern Rolling Plains of Texas, cotton is usually planted starting in mid-May. Because of this late planting date, many producers do not use harvest aids to terminate the cotton. When growing conditions are favorable, most of the cotton in this area is ready for harvest thirty days before the first killing freeze. The delay in harvest reduces the income of farmers due to the loss of lint yield and fiber quality. Even though the cost of several of the harvest aid treatments are expensive, there is usually a product that is economically justified that can be used effectively for crop termination. The intent of this field test is to: 1) determine the effectiveness of harvest aids at defoliating, desiccating, and opening bolls on cotton, 2) provide producers the opportunity of observing how effectively the harvest aid materials work, and 3) determine the economic feasibility of using the harvest aid material.

Materials and Methods

Cooperating Producers: Chris Bubenik
Location: 7 miles north of Wall

Crop Production Information:

Planting Date:	May 14, 2003
Planting Rate:	11.0 pounds per acre
Variety Planted:	Deltapine 424 BG/RR
Planting Pattern:	Solid on 40 inch spacing
Herbicide Applied:	Prowl was applied preplant incorporated in the Fall of 2002 at 3.0 pints per acre, followed by 16 ounces of Direx plus 16 ounces of Caparol applied broadcast at planting.
Number of Irrigations:	4 applications during the growing season (24 acre inches)
Insecticides Applied:	7 ounces of Orthene 90 applied in-furrow at planting
Fertilizer Applied:	Fall 2002, applied 10 tons of cattle manure per acre. Additionally, 100 pounds of 46-0-0 was applied prior to the first irrigation. At planting, 4 ounces of PGR-4 was applied.

Harvest Aid Application Information:

Date Applied: October 21, 2003
Wind Speed: 2 to 5 mph
Wind Direction: Southeast
Water Applied: 16 Gallons Per Acre
Air Temperature: 75 to 86^0 Fahrenheit
Relative Humidity: 23 to 50%
Row Pattern: 40 inch rows planted solid
Irrigation: Yes
Plot Design: 13.33 ft X 60 ft replicated 3 times (randomized)
Boom Height: 40 inches
Pressure: 32 pounds per square inch
Ground Speed: 4 mph
Nozzles: one 11002 Air Induction over the top of row, one 8002 flat fan nozzle on a 9 inch drop on each side of the row.
Time of Day: Bayer test established from 10:30 a.m. to 4:00 p.m.
Test Design: Randomized complete block design replicated 3 times

Harvest Aid Application Information (followup application):

Date Applied:	October 28, 2003
Time of Day:	10:00 a.m. to 1:00 p.m.
Wind Speed:	5 to 7 miles per hour
Wind Direction:	South
Air Temperature:	82 to 84^0 Fahrenheit
Relative Humidity:	55 to 60%
Carrier:	16.0 gallons of water per acre

Pressure, Nozzle Arrangement, Boom Height was the same as shown on October 21.

Plant Information

Date information was collected: September 20, 2003
Average Height: 36 inches
Average number of bolls above top cracked boll: 3
Percent open bolls: 80
Number of plants per acre: 52,000
At the time of application, plant health was excellent. The upper most cotton bolls were cross-sectioned and the seed coats were dark and the cotyledons were well developed.

Weather Information

Rainfall and air temperature information was obtained from the National Weather Service–San Angelo, Texas.

Rainfall Information (Date and Amount)

October 6	0.42 inch	November 2	0.01 inch
October 8	0.53 inch	November 5	0.24 inch
October 9	1.32 inches	November 6	0.09 inch
October 11	0.96 inch	November 7	0.09 inch
October 12	0.09 inch	November 8	0.30 inch
October 26	0.06 inch		
	---		---
Total October Rainfall	3.38 inches	November Rainfall	0.73 inch

Maximum and Minimum Air Temperatures for October 21 - November 10, 2003

Date	Max Air	Min Air	Date	Max Air	Min Air	Date	Max Air	Min Air
21	85	49	28	79	44	4	82	65
22	89	51	29	82	46	5	65	49
23	88	51	30	81	58	6	49	40
24	85	49	31	81	57	7	43	38
25	68	48	1	79	65	8	47	41
26	54	43	2	82	67	9	54	46
27	73	41	3	81	66	10	70	54

Data Collection:

An area in each treatment was marked to make ratings on the percent open bolls, percent defoliation, percent desiccation, and regrowth in the top and bottom portion of the plants. A rating system was used to reflect the growth of new leaves in the top and bottom portion of the plants within each marked area. A copy of the regrowth rating system used is attached. The information collected on October 27, November 3 and November 10 are reported in Tables 1, 2 and 3, respectively.

Results and Discussion

The First Seven Days

During the first two weeks of October, 3.32 inches of rain was received on the plot. No rain was received seven days prior to the establishment of the test plot.

On the previous page is a table that indicates the maximum and minimum air temperature during the 21 days these products were evaluated. From October 21 to October 27, daytime air temperatures ranged from 54 to 89 degrees Fahrenheit and the night temperatures ranged from 41 to 51 degrees. On October 26, 0.06 inch of rain fell on the plot. When the plots were evaluated on October 27, there was a significant difference in the percent defoliation and percent desiccation. The data collected is summarized in Table 1.

The percent of open bolls increased by 5 to 8 percent in the first week but no significant difference was determined between treatments. All treatments had significantly more leaf defoliation than the check.

The Second Week (October 28 - November 3, 2003)

Hourly daytime air temperature ranged from 79 to 82 degrees Fahrenheit. The nighttime temperatures ranged from 44 to 67 degrees. Only 0.01 inch of rain was recorded during the week and it fell on November 2. The followup applications were applied on September 28. On November 3 when the plots were evaluated, there was a significant difference in the percent defoliation and percent desiccation. The data collected is summarized in Table 2.

The amount of boll opening ranged from 85 to 88.33 percent, which is an increase of 0 to 1.67 percent from the seven day evaluation.

In the treated areas, defoliation ranged from 51.67 to 83.33 percent, which is an increase of 13 to 43 percent from the evaluation conducted on October 27. At the time of this evaluation, enough leaves had been lost by the plant to keep the leaf rating of ginned cotton in the range of 1 to 3.

Table 1. Chris Bubenik's 2003 Bayer Cotton Harvest Aid Test (Tom Green County)
October 27, 2003 (6 days after initial treatments were applied)

Harvest Aids Applied	Rate Applied Per Acre	% Open Bolls (6 DAT)	% Defoliation (6 DAT)	% Desiccation (6 DAT)	Regrowth Rating Top (6 DAT)	Regrowth Rating Bottom (6 DAT)
Ginstar + Aim	12.8 oz. + 1.0 oz	88.33	50.00 ab	23.33 bcd	0	0
Finish 6 Pro	21.3 oz.	86.67	58.33 a	6.67 d	0	0
Finish 6 Pro + Ginstar	21.3 oz. + 4.0 oz.	86.67	61.67 a	10.00 cd	0	0
Finish 6 Pro + Aim	21.3 oz. + 1.6 oz.	86.67	48.33 ab	11.67 cd	0	0
Finish 6 Pro + Aim	21.3 oz. + 1.0 oz.	85.00	50.00 ab	15.00 cd	0	0
Finish 6 Pro + Aim	21.3 oz. + 0.8 oz.	88.33	58.33 a	13.33 cd	0	0
Check	--	85.00	13.33 cd	0.00 d	0	0
Ginstar + Aim	8.8 oz. + 1.6 oz.	85.00	33.33 abcd	41.67 ab	0	0
Prep + Aim followed by Aim + C.O.C.	32.0 oz. + 1.6 oz. followed by 1.6 oz. + 1% v/v	86.67	56.67 a	18.33 cd	0	0
Ginstar	6.0 oz.	86.67	38.33 abc	10.00 cd	0	0
Ginstar + Aim	6.4 oz. + 1.0 oz.	86.67	40.00 abc	33.33 abc	0	0
Ginstar + Aim	3.0 oz. + 0.8 oz.	85.00	41.67 abc	16.67 cd	0	0
Prep + Aim	32.0 oz. + 1.6 oz.	85.00	40.00 abc	31.67 abc	0	0
Prep + Ginstar	21.3 oz. + 4.0 oz.	86.67	55.00 a	10.00 cd	0	0
ET + Gramoxone Max + C.O.C.	2.0 oz. + 10.67 oz. + 1% v/v	86.67	33.33 abcd	41.67 ab	0	0
Ginstar	5.0 oz.	86.67	45.00 abc	10.00 cd	0	0
Ginstar	7.0 oz.	85.00	31.67 abcd	11.67 cd	0	0

Check	--	85.00	5.00 d	0.00 d	0	0
Aim + Gramoxone Max + C.O.C.	1.0 oz. + 10.67 oz. + 1% v/v	86.67	50.00 ab	33.33 abc	0	0
ET + Prep + C.O.C.	1.4 oz. + 21.0 oz. + 1% v/v	86.67	51.67 a	10.00 cd	0	0
Ginstar + Prep + N.I.S.	7.0 oz. + 16.0 oz. + 0.25% v/v	85.00	41.67 abc	18.33 cd	0	0
Def + Prep + N.I.S.	16.0 oz. + 21.3 oz. + 0.25% v/v	85.00	40.00 abc	5.67 d	0	0
Ginstar + C.O.C.	5.0 oz. + 16.0 oz.	85.00	18.33 bcd	16.67 cd	0	0
Ginstar + Finish 6 Pro + N.I.S.	7.0 oz. + 16.0 oz. + 0.25% v/v	85.00	51.67 a	18.33 cd	0	0
Ginstar + Gramoxone Max	3.0 oz. + 20.0 oz.	86.67	31.67 abcd	51.67 a	0	0
Def + Finish 6 Pro + N.I.S.	8.0 oz. + 21.0 oz. + 0.25% v/v	86.67	43.33 abc	10.00 cd	0	0

NOTE: In Table 1 the individual or combination of letter a, b, c, or d shown below the number are to indicate statistical significance. There is no statistical difference between numbers that have the same letter (even when there appears to be a large difference in results between the materials applied).

Table 2. Chris Bubenik's 2003 Bayer Cotton Harvest Aid Test (Tom Green County)
November 3, 2003 (13 days after initial treatments were applied / 6 days after followup treatments)

Harvest Aids Applied	Rate Applied Per Acre	% Open Bolls (13 DAT)	% Defoliation (13 DAT)	% Desiccation (13 DAT)	Regrowth Rating Top (13 DAT)	Regrowth Rating Bottom (13 DAT)
Ginstar + Aim	12.8 oz. + 1.0 oz	88.33	65.00 abcd	20.00 bcdef	0	0
Finish 6 Pro	21.3 oz.	86.67	81.67 a	5.67 fg	0	0
Finish 6 Pro + Ginstar	21.3 oz. + 4.0 oz.	88.33	78.33 a	10.00 defg	0	0
Finish 6 Pro + Aim	21.3 oz. + 1.6 oz.	86.67	80.00 a	11.67 defg	0	0
Finish 6 Pro + Aim	21.3 oz. + 1.0 oz.	85.00	73.33 abc	13.33 cdefg	0	0
Finish 6 Pro + Aim	21.3 oz. + 0.8 oz.	88.33	76.67 ab	13.33 cdefg	0	0
Check	--	85.00	26.67 e	0.00 g	0	0
Ginstar + Aim	8.8 oz. + 1.6 oz.	85.00	51.67 d	41.67 a	0	0
Prep + Aim followed by Aim + C.O.C.	32.0 oz. + 1.6 oz. followed by 1.6 oz. + 1% v/v	86.67	80.00 a	13.33 cdefg	0	0
Ginstar	6.0 oz.	86.67	81.67 a	10.00 defg	0	0
Ginstar + Aim	6.4 oz. + 1.0 oz.	86.67	66.67 abcd	25.00 abcde	0	0
Ginstar + Aim	3.0 oz. + 0.8 oz.	85.00	70.00 abcd	16.67 cdefg	0	0
Prep + Aim	32.0 oz. + 1.6 oz.	85.00	56.67 bcd	30.00 abc	0	0
Prep + Ginstar	21.3 oz. + 4.0 oz.	86.67	83.33 a	8.33 efg	0	0
ET + Gramoxone Max + C.O.C.	2.0 oz. + 10.67 oz. + 1% v/v	86.67	55.00 cd	35.00 ab	0	0
Ginstar	5.0 oz.	86.67	81.67 a	10.00 defg	0	0
Ginstar	7.0 oz.	85.00	78.33 a	11.67 defg	0	0

Check	--	85.00	20.00 e	0.00 g	0	0
Aim + Gramoxone Max + C.O.C.	1.0 oz. + 10.67 oz. + 1% v/v	86.67	65.00 abcd	28.33 abcd	0	0
ET + Prep + C.O.C.	1.4 oz. + 21.0 oz. + 1% v/v	86.67	78.33 a	10.00 defg	0	0
Ginstar + Prep + N.I.S.	7.0 oz. + 16.0 oz. + 0.25% v/v	85.00	73.33 abc	18.33 bcdefg	0	0
Def + Prep + N.I.S.	16.0 oz. + 21.3 oz. + 0.25% v/v	85.00	73.33 abc	5.67 fg	0	0
Ginstar + C.O.C.	5.0 oz. + 16.0 oz.	85.00	73.33 abc	16.67 cdefg	0	0
Ginstar + Finish 6 Pro + N.I.S.	7.0 oz. + 16.0 oz. + 0.25% v/v	85.00	66.67 abcd	18.33 bcdefg	0	0
Ginstar + Gramoxone Max	3.0 oz. + 20.0 oz.	86.67	53.33 cd	40.0 a	0	0
Def + Finish 6 Pro + N.I.S.	8.0 oz. + 21.0 oz. + 0.25% v/v	86.67	76.67 ab	10.00 defg	0	0

NOTE: In Table 2 the individual or combination of letter a, b, c, d, e, f, or g shown below the number are to indicate statistical significance. There is no statistical difference between numbers that have the same letter (even when there appears to be a large difference in results between the materials applied).

The Third Week (November 4 - November 10, 2003)

Hourly daytime air temperature ranged from 43 to 82 degrees Fahrenheit. The nighttime temperatures ranged from 38 to 65 degrees. The cooler temperatures through most the week slowed the plants response to harvest aids. During the week, 0.72 inch of rain was received. Total cloud cover occurred for four of the seven days. The followup applications had been applied for 13 days. On November 10 when the plots were evaluated, there was a significant difference in the percent open bolls, percent defoliation, percent desiccation, and the amount of regrowth in the top and bottom portion of the cotton plant. The data collected is summarized in Table 3.

The amount of boll opening ranged from 85 to 93.33 percent, which is an increase of 0 to 6 percent from the 14 day evaluation. All treatments had significantly more boll opening than the check.

Leaf defoliation increased from 3.3 to 29 percent and all treatments had significantly more leaf defoliation than the check. Several of the treatments that had Gramoxone Max as a tank mix partner had less defoliation than the other treatments in this test.

In this test, the Prep at 32 ounces plus Aim at 1.6 ounces was an aggressive treatment that had significantly more desiccation than the other treatments except for the Ginstar at 3 ounces combined with Gramoxone Max at 20 ounces. If the same results are obtained from other tests conducted, then these treatments should not be used as tank mixes for harvest aid purposes. Most of the Finish 6 Pro treatments had significantly less desiccation than the other treatments.

Even though there was significant differences between the treatments in the amount of regrowth developing in the top and bottom portion of the cotton plants, none of the regrowth was at a level that would impact harvest efficiency at the time of the 21 day evaluation. None of the treatments had enough regrowth to cause a problem during the ginning process.

The remaining area of the field that had not had harvest aids applied was ready to be sprayed. Several of the treatments used in this test could be selected and used successfully to prepare the crop for harvest. It was impressive to see the level of defoliation and regrowth suppression provided by many of the harvest aids in this test. I look forward to having these products available in the future for use as harvest aids in our region.

Economics

For 2003, we had a wet September and most of 100,000 acres of cotton needs to have a harvest aid applied by mid-November. During October most acreage received over 3 inches of rain and it has kept producers from harvesting cotton in a timely manner. A loss of lint yield is obvious on most cotton acreage that was planted in May and lint quality has been effected. A loss of 4 to 7 cents per pound could occur because of the weather related delay. It is important to remember that a higher lint yield is not the only way of increasing profit from the use of a harvest aid. Other factors include: timely harvest, improved fiber quality, improved harvesting efficiency, and higher percent lint turnout at the gin.

Table 3. Chris Bubenik's 2003 Bayer Cotton Harvest Aid Test (Tom Green County)
November 10, 2003 (20 days after initial treatments were applied / 13 days after followup treatments)

Harvest Aids Applied	Rate Applied Per Acre	% Open Bolls (13 DAT)	% Defoliation (13 DAT)	% Desiccation (13 DAT)	Regrowth Rating Top (13 DAT)	Regrowth Rating Bottom (13 DAT)
Ginstar + Aim	12.8 oz. + 1.0 oz	91.67 a	77.33 abc	10.67 cde	0.33 ab	1 a
Finish 6 Pro	21.3 oz.	93.33 a	87.67 ab	3.67 de	0.33 ab	1 a
Finish 6 Pro + Ginstar	21.3 oz. + 4.0 oz.	93.33 a	89.67 a	4.33 de	0.33 ab	1 a
Finish 6 Pro + Aim	21.3 oz. + 1.6 oz.	90.00 a	88.00 ab	7.67 cde	0.33 ab	1 a
Finish 6 Pro + Aim	21.3 oz. + 1.0 oz.	91.67 a	87.33 ab	6.67 cde	0.33 ab	1 a
Finish 6 Pro + Aim	21.3 oz. + 0.8 oz.	91.67 a	86.67 ab	5.00 cde	0.33 ab	1 a
Check	--	85.00 b	40.00 e	0.00 e	0 b	0 b
Ginstar + Aim	8.8 oz. + 1.6 oz.	90.00 a	81.33 ab	12.67 cd	0.33 ab	1 a
Prep + Aim followed by Aim + C.O.C.	32.0 oz. + 1.6 oz. followed by 1.6 oz. + 1% v/v	93.33 a	87.33 ab	8.33 cde	0 b	1 a
Ginstar	6.0 oz.	93.33 a	85.00 ab	6.67 cde	0.67 ab	1 a
Ginstar + Aim	6.4 oz. + 1.0 oz.	91.67 a	85.00 ab	8.33 cde	0.67 ab	1 a
Ginstar + Aim	3.0 oz. + 0.8 oz.	91.67 a	84.00 ab	8.33 cde	0.67 ab	1 a
Prep + Aim	32.0 oz. + 1.6 oz.	91.67 a	64.67 d	28.33 a	0.33 ab	1 a
Prep + Ginstar	21.3 oz. + 4.0 oz.	90.00 a	88.67 ab	4.67 de	0 b	1 a
ET + Gramoxone Max + C.O.C.	2.0 oz. + 10.67 oz. + 1% v/v	90.00 a	75.00 bcd	16.67 bc	0.33 ab	1 a
Ginstar	5.0 oz.	90.00 a	86.67 ab	6.00 cde	0 b	1 a
Ginstar	7.0 oz.	90.00 a	89.00 a	6.67 cde	0 b	1 a
Check	--	85.00 b	40.00 e	0.00 e	0 b	0 b

Aim + Gramoxone Max + C.O.C.	1.0 oz. + 10.67 oz. + 1% v/v	91.67 a	77.33 abc	16.67 bc	0.33 ab	1 a
ET + Prep + C.O.C.	1.4 oz. + 21.0 oz. + 1% v/v	90.00 a	84.33 ab	8.67 cde	0.67 ab	1 a
Ginstar + Prep + N.I.S.	7.0 oz. + 16.0 oz. + 0.25% v/v	90.00 a	80.67 ab	9.33 cde	0 b	1 a
Def + Prep + N.I.S.	16.0 oz. + 21.3 oz. + 0.25% v/v	91.67 a	84.33 ab	3.67 de	1	1 a
Ginstar + C.O.C.	5.0 oz. + 16.0 oz.	90.00 a	83.67 ab	10.00 cde	0 b	1 a
Ginstar + Finish 6 Pro + N.I.S.	7.0 oz. + 16.0 oz. + 0.25% v/v	90.00 a	83.33 ab	9.33 cde	0.33 ab	1 a
Ginstar + Gramoxone Max	3.0 oz. + 20.0 oz.	93.33 a	66.67 cd	26.67 ab	0.33 ab	1 a
Def + Finish 6 Pro + N.I.S.	8.0 oz. + 21.0 oz. + 0.25% v/v	91.67 a	87.33 ab	6.67 cde	0.67 ab	1 a

NOTE: In Table 3 the individual or combination of letter a, b, c, d, or e shown below the number are to indicate statistical significance. There is no statistical difference between numbers that have the same letter (even when there appears to be a large difference in results between the materials applied).

Acknowledgments

I want to take this opportunity to thank:

- Chris Bubenik for his help in plot establishment and management.
- Bayer Crop Science for supporting harvest aid research conducted in the Trans-Pecos and Southern Rolling Plains areas of Texas.

I would also like to thank the companies that provided the chemicals for this harvest aid test, these included:

- Bayer CropScience who provided the Def, Finish 6 Pro, Ginstar, and Prep
- FMC Corporation who provided the Aim
- Nichino America Incorporated who provided the ET
- Syngenta Crop Protection, Inc. who provided the Gramoxone Max
- UAP Southwest who provided the Activator 90 (non-ionic surfactant) and Herbimax (crop oil concentrate)