

# **Agronomic Comparison of Transgenic Varieties with their Parent Lines, Safford Agricultural Center, 1998**

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## **Abstract**

*As more transgenic varieties become available, grower's interests intensify and more information is needed to satisfy the inquiries. Agronomic comparisons of six lines (transgenic varieties and their recurrent parents) from three companies are represented in this high desert study. Results show some subtle differences between the transgenic lines and their recurrent parents. Under the high Pink Bollworm pressure observed in the trial, yield increases were uniformly seen when the Bt gene was present, even though all plots were sprayed to control insect pests. Yields tended to be lower when herbicide resistance was introduced into the plants (even though not statistically significant), except when placed in a stacked array. Several agronomic values and HVI lint quality values are reported in this report.*

## **Introduction**

Agronomic studies were performed on a limited number of transgenic varieties in 1997 in other parts of the state (1, 2). These studies concluded that the transgenic lines performed very close to the recurrent parent. This study was instituted to see how the transgenic lines and their recurrent parents compared at the higher elevations.

## **Materials and Methods**

This trial was designed as a replicated small plot trial with four replications. In-as-much-as the strongest comparisons to be made were between transgenic varieties and their recurrent parent, the replications were divided into sub-blocks so the varieties from common lines were always grouped together, even though in a random order. Plots were planted using cone-type hoppers which distributes a given weight of seed uniformly over the length of the plot. The Crop History that follows provides the information on how the study was administered:

### Crop History:

Previous crop: cotton

Soil type: Grabe clay loam

Planting date: 30 April 1998

Rate: 25 pounds per acre

Herbicide: 1.5 pints per acre Treflan pre-plant (3/10), 3 pints per acre Prometryne at layby (7/27)

Fertilizer: 100 pounds per acre urea sidedressed two times (6/2 and 7/8)

Insecticide: Six applications between 6 August and 15 September to control aphid, pink bollworm and white fly

Pix/Prep: None

Defoliation: 9 ounces per acre of Ginstar applied on 8 October

Irrigation: Furrow irrigation; watered up and 10 irrigations (ca. 33.0 inches + 3.2 inches of rain)

Harvest dates: First Pick - 3 November

Heat units (86/55°F) per growing season (3/30 - 10/8): 3257

In early October, 25-boll samples were taken to determine boll weights. At harvest grab samples were taken which

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were used to determine percent lint turnout, a sub-sample was taken from which HVI analyses were run. Stand counts, plant height measurements, node counts, first fruiting branches (FFB) and insect damaged bolls were determined just prior to or just after harvest. Plots were harvested with an IH 782 cotton picker modified for small plot use.

## Results and Discussion

Bt varieties had been tested at the Safford Agricultural Center in 1996 (3) and 1997 (4) with results indicating that they typically yielded higher than their recurrent parents, even when the entire experimental plot was sprayed to protected from insect damage. In 1998, none of the previously tested transgenic lines were available for commercial plantings, but many others became available, especially from Deltapine Seed.

Yields and other agronomic data are available in Table 1. The table is broken into six parts, one for each recurrent parent and its transgenic progeny. Letters indicating significant differences between measured values were only placed in the column of lint yields to make it easier to see the differences. They were omitted from the remaining columns to reduce the cluttered appearance. Differences between values on these remaining columns can be noted if differences between two values are greater than the LSD(05) (least significant differences at the 95% level of confidence) values shown toward the bottom of the table. The 'ns' notation in the LSD row means that no significant differences were seen between any of the values in that column. Detailed comparisons will not be given in the text, but readers are encouraged to make their own in depth studies of the varieties from the data in the tables.

Significant differences in yield were seen in the three Deltapine lines between the varieties containing Bt and those not containing it. The differences were typically in the range of 300 pounds of lint with a market value around \$165 per acre. This difference is much greater than described by Silvertooth, et.al. and Knowles, et.al. in the lower desert regions of the state. Part of the explanation might be in the intense pink bollworm pressure to which our plots were subjected.

Caution must be exercised in the third Deltapine comparison. Even though DP 5409 and DP 5415 (the recurrent parent of DP 33B) are selections from the same cross, they are not equivalent. Therefore, comparisons between DP 5409 and DP 33B are not the same as the two lines shown above.

In the Paymaster 1560 line, lint yield differences were not significantly different, but still large enough to encourage speculation.

There were significant differences within parent lines on % lint turnout and Plant Populations. These could relate to true differences in seed size and/or seedling vigor. In the last column, % Dmgd Frt, the CV(%) (coefficient of variability) is quite high casting some doubt on our measuring techniques. It is likely that many bolls that were visibly damaged were still picked by the picker and then, too, maybe our number of observations wasn't adequate to describe the situation. There were no significant differences seen between any of the plant heights, first fruiting branches nor height to node ratios. Numerical differences in some of these values, however, makes one wonder if there aren't subtle differences between some of the varieties with common genetics.

Table 2 provides the HVI data from all of the compared varieties. Detailed study shows some subtle differences between varieties, few of them statistically significant. Critical analysis is left to the reader.

## Literature Cited

1. Silvertooth, J.C. and E.R. Norton. 1998. Agronomic evaluations of transgenic cotton varieties. Cotton, A College of Agriculture Report, The University of Arizona, Tucson, AZ. Series P-112, pp. 148-186.
2. Knowles, T.C., Del Wakimoto, Greg Sprawls and Greg Hurtado. 1998. Agronomic evaluations of new transgenic and non transgenic cotton varieties in La Paz and Mohave counties. Cotton, A College of Agriculture Report, The University of Arizona, Tucson, AZ. Series P-112, pp. 187-194.
3. Clark, L.J. Unreported research done on Hartz transgenic and recurrent parent lines, 1996.
4. Clark, L.J., E.W. Carpenter, G.L. Hart and J.M. Nelson. 1998. Short staple cotton advanced strains trial, Safford Agricultural Center, 1997. Cotton, A College of Agriculture Report, The University of Arizona, Tucson, AZ. Series P-112, pp. 134-138.

**Table 1. Yields and other agronomic data from the transgenic comparison study grown on the Safford Agricultural Center, 1998.**

Variety	Lint Yield	% Lint	Plant Ht	First Frt Br	Plants/Acre	HNR	% Dmgd Frt
DP 90 lines							
DP 90B	1560 a <sup>1</sup>	35.05	36.75	5.5	63979	2.02	18.9
DP 90	1240 bcd	36.24	37.50	6.5	64886	1.75	25.2
DP 90RR	1210 bcd	36.29	36.75	6.0	63071	1.91	17.7
DP 5690 lines							
DP 55BRR	1525 a	34.88	37.50	5.8	67155	1.91	23.4
DP 35B	1479 ab	34.40	35.75	5.5	69878	1.77	17.9
DP 5690	1216 bcd	36.85	34.00	5.5	72146	1.87	23.0
DP5690RR	1190 cd	36.80	35.00	5.8	60349	1.87	24.3
DP 54XX lines							
DP 33B	1447 abc	35.30	37.00	6.3	60803	1.89	23.0
DP 5409	1033 de	35.37	36.25	6.3	55811	1.90	20.0
Paymaster 1560 lines							
PM 1560BGRR	1254 bcd	36.28	34.25	6.0	66248	1.97	22.9
PM1560BG	1187 cd	35.59	35.75	6.8	61256	1.81	30.5
PM 1560	1068 de	36.25	35.00	5.5	52181	1.80	20.8
Paymaster 1580 lines							
PM 886-104	886 ef	36.00	35.50	5.75	61710	1.90	14.8
PM1580RR	756 f	34.84	33.75	6.5	64886	1.86	23.4
Stoneville 474 lines							
STV 474	1142 de	36.97	34.50	5.5	65340	1.71	19.2
BXN 47	1100 de	36.30	36.50	6.0	60349	1.85	18.5
Average	1205.8	35.8	35.7	5.9	63128.0	1.86	21.5
LSD(05)	246.2	1.3	4.9 ns	1.5 ns	13286.0	0.27 ns	10.9
CV(%)	14.3	2.6	9.6	17.7	14.8	10.3	35.7

1. Numbers within a given column followed by the same letter are not significantly different at the 95% level of confidence using the Duncan Multiple Range Test.

**Table 2. HVI data from the transgenic comparison study on the Safford Agricultural Center, 1998.**

Variety	C Grade	LF Grade	Mike	Length	Strength	Uniformity	HVI Trash	Color	
								RD	+B
DP 90 lines									
DP 90B	21	3.0	45.5	113.3	31.5	82.0	3.3	80.8	80.8
DP 90	31/21	4.0	46.3	114.3	30.9	82.3	3.3	79.5	81.0
DP 90RR	31/21	3.3	47.8	113.3	31.0	82.8	3.8	80.0	76.8
DP 5690 lines									
DP 655BRR	21	3.3	47.3	112.3	30.7	82.3	3.3	81.8	79.5
DP 35B	21	5.5	48.0	114.3	31.1	82.3	2.8	81.3	78.3
DP 5690	31	4.5	48.0	112.0	29.8	82.8	4.3	80.3	77.8
DP5690RR	31/21	3.5	47.8	112.3	30.7	82.3	3.8	80.0	78.0
DP 54XX lines									
DP 33B	21	5.0	47.8	114.0	30.3	82.3	3.5	82.3	76.8
DP 5409	21	5.0	48.0	113.5	28.9	82.3	5.0	80.5	78.5
Paymaster 1560 lines									
PM 1560BGRR	31	4.3	47.3	115.3	29.8	83.3	5.0	80.0	78.3
PM1560BG	21/31	3.5	49.3	113.8	30.8	83.3	4.3	80.8	80.3
PM 1560	32	4.5	48.0	114.8	29.8	82.8	3.8	78.3	85.3
Paymaster 1580 lines									
PM 886-104	31/22	3.3	46.0	110.5	28.1	81.5	3.8	79.5	80.5
PM1580RR	31/21	3.0	49.0	112.5	29.0	82.5	3.5	80.8	82.3
Stoneville 474 lines									
STV 474	31	6.3	52.3	110.0	27.6	82.8	7.0	77.0	81.0
BXN 47	31	4.5	50.0	112.8	28.4	83.3	4.8	77.8	85.0
Average	--	4.1	48.0	113.0	29.9	82.5	4.0	80.0	80.0
LSD(05)	--	1.2	3.3	3.0	1.8	1.2	1.7	1.3	2.9
CV(%)	--	20.7	4.9	1.8	4.1	1.0	29.2	1.1	2.5