

**TRANSGENIC BT® AND ROUNDUP READY™  
COTTON VERSUS NON TRANSGENIC  
COTTON IN NORTHERN MEXICO**

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**Abstract**

A study comparing non transgenic and transgenic cotton varieties having the Roundup Ready™ gene was conducted in 1998 in Delicias, Chihuahua, Mex. Results showed that Roundup resistant genotypes of cotton had higher yield. These results might be due to the more efficient weed control during crop development.

**Introduction**

Weed control is one of the main problems faced by cotton growers in Northern Mexico. Although currently there are many commercial herbicides that can be used for weed control in cotton crops, those that are recommended for broad leaf weeds, have a negative effect on cotton. Using Genetic Engineering, human been has been able to get transgenic cotton genotypes that can be used to face some of the common problems, such as pests and weeds. Some examples of transgenic cotton genotypes are those which have Bollgard® gene and Roundup Ready™ gene. Monsanto has developed some cotton varieties resistant to the application of the herbicide Roundup (*glyphosate*). Although Roundup has proved to be an excellent herbicide for weed control in cotton (Mascarenhas and Griffin, 1997; Murdock *et al.*, 1996; Elkins *et al.*, 1996; Vencill, 1996), one of the problems is how to prevent crop injury. The development of Roundup Ready™ cotton might provide growers with a cost effective, broad spectrum weed control alternative (Vidrine *et al.*, 1996). The objective of this study was to evaluate the biological effectiveness of the cotton varieties DP-5690BR, DP-5690RR and PM-1220RR for resisting the application of Roundup.

**Materials and Methods**

The study was conducted in the Facultad de Ciencias Agrícolas y Forestales of the Universidad Autonoma de Chihuahua, located in Delicias, Chihuahua, Mex. Five cotton varieties were established in April 1998, using a Complete Randomized Design with four replications. Three of the varieties are transgenic, having the Roundup Ready™ gene (DP-5690BR, which has Bollgard® gene too; DP-5690RR, and PM-1220RR, having Roundup Ready™ only)

and the rest are conventional varieties (DP-5690 and PM-1220). The herbicide treatments consisted in: **A**, 1 application of Roundup directed to the weed and to cotton plants having four leaves; **B**, 1 application of Roundup directed to the weed and to cotton plants having four leaves + 1 application of Roundup directed to the base of the plants, over the rows; **C**, 1 application of Roundup directed to the weed and to cotton plants having four leaves + 2 applications of Roundup directed to the base of the plants, over the rows; and **D**, a control with zero applications of Roundup. Through the crop development, six samplings of cotton plant height and number of extended leaves were conducted, approximately every two or three Weeks. Samplings included five plants per treatment.

**Results and Discussion**

Tables 1 and 2 show that height of plant and number of extended leaves increase with time and number of Roundup applications. It is possible to see that DP-5690BR was higher than DP-5690 and DP-5690RR. This result might be due basically to the effect of the Bollgard® gene. Additionally, DP-5690BR got also the highest number of extended leaves most of the sampling dates. About PM varieties, although at the beginning of the season PM-1220RR was taller and had higher number of extended leaves than PM-1220, both varieties showed the same values at the end of the crop. In general, the number of Roundup applications had no statistical effect on height of the plant; however, there is a numerical tendency indicating that plants of the treatment without Roundup were smaller. On the other hand, treatments without Roundup also had less extended leaves than those plots treated with 1, 2 and 3 applications of the herbicide. Table 3 shows that yield increased as the number of Roundup applications was increased. At the same time, it is shown that in both groups of varieties, genotypes having Roundup Ready™ gene had higher yield than non transgenic genotypes.

**Conclusions**

The application of the broad spectrum herbicide Roundup, apparently does not affect the behavior of the transgenic cotton varieties DP-5690BR, DP-5690RR and PM-1220RR. Under the study conditions, the use two and three applications of Roundup for weed control in cotton, showed the best yield. However, further research under bigger land areas is recommended before definitive conclusions can be made.

**References**

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Table 1. Mean plant height (cm) and number of extended leaves of five cotton genotypes treated with Roundup. Delicias, Chihuahua, Mex. 1998.

Trait	Genotype	Date of sampling			
		Jun 22	Jul 04	Aug 08	Sep 21
Height	DP-5690	5.74 bc	14.06 c	72.53 b	87.56 b
	DP-5690BR	13.00 a	32.42 a	114.63 a	127.16 a
	DP-5690RR	7.88 b	16.00 c	70.00 b	95.27 b
	PM-1220RR	18.85 a	39.85 a	108.21 a	125.74 a
	PM-1220	8.95 b	27.26 b	111.16 a	128.11 a
No. of extended leaves	DP-5690	5.47 c	17.61 c	113.18 b	43.94 a
	DP-5690BR	13.89 a	37.49 a	135.53 a	43.68 a
	DP-5690RR	5.76 c	20.75 c	90.00 c	25.73 c
	PM-1220RR	15.25 a	38.80 a	117.79 b	37.68 b
	PM-1220	10.16 b	29.05 ab	45.53 d	39.95 b

Note: means within a column followed by the same letter are not significantly different at the 0.05 level. Means were separated by Tukey's studentized range test.

Table 2. Mean height (cm) and number of extended leaves by treatment and date of application of Roundup. Delicias, Chihuahua, Mex. 1998.

Trait	Treatment	Date of sampling			
		Jun 22	Jul 04	Aug 08	Sep 21
Height	A	13.17 a	29.65 a	99.55 a	118.86 a
	B	11.60 a	28.16 a	96.92 a	119.92 a
	C	10.26 ab	24.26 b	98.00 a	127.22 a
	D	9.04 b	23.62 b	91.60 a	86.86 a
No. of extended leaves	A	13.43 a	32.00 a	121.27 a	37.24 b
	B	11.52 a	33.24 a	126.20 a	44.44 ab
	C	8.26 b	23.83 b	111.78 a	47.04 a
	D	7.69 b	24.90 b	99.85 a	24.14 c

Note: means within a column followed by the same letter are not significantly different at the 0.05 level. Means were separated by Tukey's studentized range test.

A, B, C, and D = 1, 2, 3, and 0 Roundup applications respectively.

Table 3. Mean yield (kg/ha) of five cotton varieties treated with Roundup herbicide. Delicias, Chihuahua, Mex. 1998.

Genotype	Three	Two	One	Zero
	Applications	Applications	Application	Applications
DP-5690	777.78	680.54		
DP-5690BR	3,791.69	2333.31	1,069.46	777.78
DP-5690RR	4,763.85	3986.08	2,138.92	1,166.69
PM-1220RR	6,319.46	6027.77	4,666.69	1,944.46
PM-1220	2,138.92	1944.46	1,166.69	972.22