These data indicate that the first position boll is the most important sink for photosynthates and while the presence of additional bolls does not significantly reduce yields, they do serve to dilute the available photosynthetic material.

Table 1. The effect of selective boll removal on yield of short staple cotton. Tucson, 1980.

Treatment	Seed Cotton Yield lb/plot	Seed Cotton Yield lb/acre
First position boll present	9.1 a*	2384 a
First and second position bolls present	7.6 a	1991 a
Second position boll present	5.1 b	1336 b

*Means followed by the same letter are not significantly different at the 5% level.

Changes in ABA Content and Abscission Rate of Bolls with Water Deficit

Gene Guinn, Linda Parker, Bob McDonald, and Marie Eidenbock
Physiologist and Biological Technicians, respectively,
AR-SEA, USDA
Western Cotton Research Laboratory
Phoenix, AZ 85040

Summary

The concentration of the hormone abscisic acid (ABA) and abscission of bolls both increased with water deficit and decreased when stress was relieved by irrigation. The correlations provide circumstantial evidence that ABA is one plant hormone that regulates boll shedding during drought.

Boll shedding is strongly affected by drought, and tends to increase during the season as boll load increases. Abscisic acid (ABA) is one of two plant hormones that is thought to stimulate boll abscission (shedding). (Ethylene is the other.) Several workers have shown that rapid drying causes a rapid increase in the ABA content of leaves. However, no one has investigated the effects of drought on the ABA content of bolls. We conducted a test during the summer to determine the possible effects of water deficit on ABA content of young bolls, and to correlate ABA content and shedding rate of bolls.

Blooms were tagged during the season for boll shedding determinations and so that bolls of known age could be harvested for ABA analysis. The effects of water deficit were estimated by comparing different irrigation treatments and by following changes in ABA content and boll shedding during irrigation cycles.

ABA content and boll abscission rates were both higher in stressed than in non-stressed plots, and both increased as stress developed during the interval between irrigations (Table 1). Even though one column in Table 1 is labelled "non-stressed," it did become stressed before irrigation on 15 July. Its leaf water potential decreased to -28.6 bars on 14 July compared to -29.7 bars for the "stressed" treatment. The "non-stressed" treatment was irrigated on 30 June and 15 July. Two stressed treatments are included in Table 1; the first three rows of data are for plants that were not irrigated from 28 May until 8 July. The remaining two rows of data (in the "stressed" columns) were obtained from plants that were irrigated on 24 June and 15 July. Both ABA content and abscission rate decreased with irrigation on 15 July. The correlations between ABA contents and abscission rates were high when differences were large, but became small when differences between stressed and non-stressed became small.

Both ABA content and abscission rate of bolls increased as stress developed and decreased when it was relieved by irrigation (Figs. 1 and 2). This was true for 3-day-old bolls through one cycle (Fig. 1) and for 4-day-old bolls through two cycles (Fig. 2).

Our results indicate that ABA content of young bolls increases with water deficit, and the significant correlations provide circumstantial evidence that ABA is a regulator of boll shedding that is caused by drought. (Earlier work at this location indicated that ethylene is also involved.)

Table I. ABA content of 3-day-old bolls and percentage of boll abscission as influenced by water deficit stress.[a]

Date of anthesis	Non-stressed		Stressed		Correlation coefficient[b]
	ABA	Abscission	ABA	Abscission	
Date	ug/g	%	ug/g	%	r
30 June	1.23±0.10	19±3	2.05±0.28	68± 8	0.83**
3 July	1.41±0.15	34±8	3.04±0.22	80± 7	0.74**
7 July	1.87±0.15	69±9	2.46±0.11	75± 8	0.37
11 July	3.02±0.29	89±5	3.76±0.22	92± 3	0.10
15 July	2.04±0.21	59±6	2.23±0.32	51±11	0.51

[a]Data are averages of 6 replications and standard errors of the means are shown.

[b]The correlation coefficient for all data combined was 0.70** (n=57). ** indicates significance at or beyond the 0.01 level.

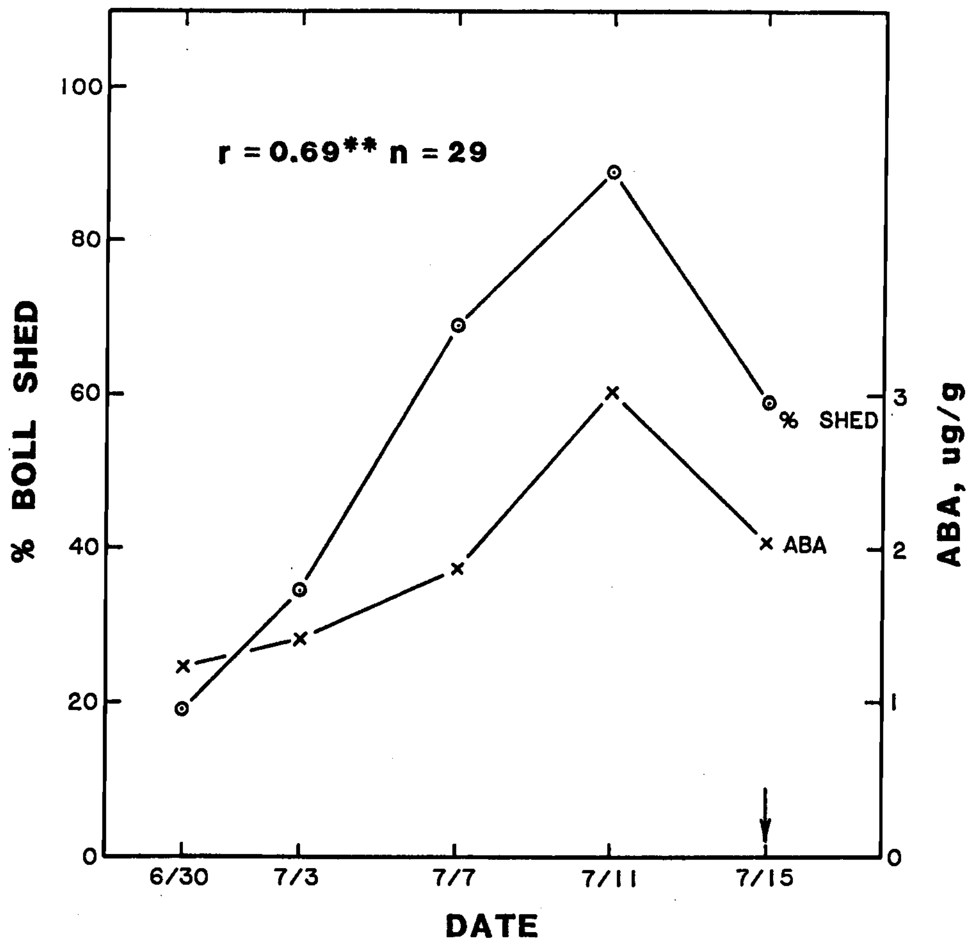

Fig. 1. Changes in ABA content and shedding rate of 3-day-old bolls during an irrigation cycle.

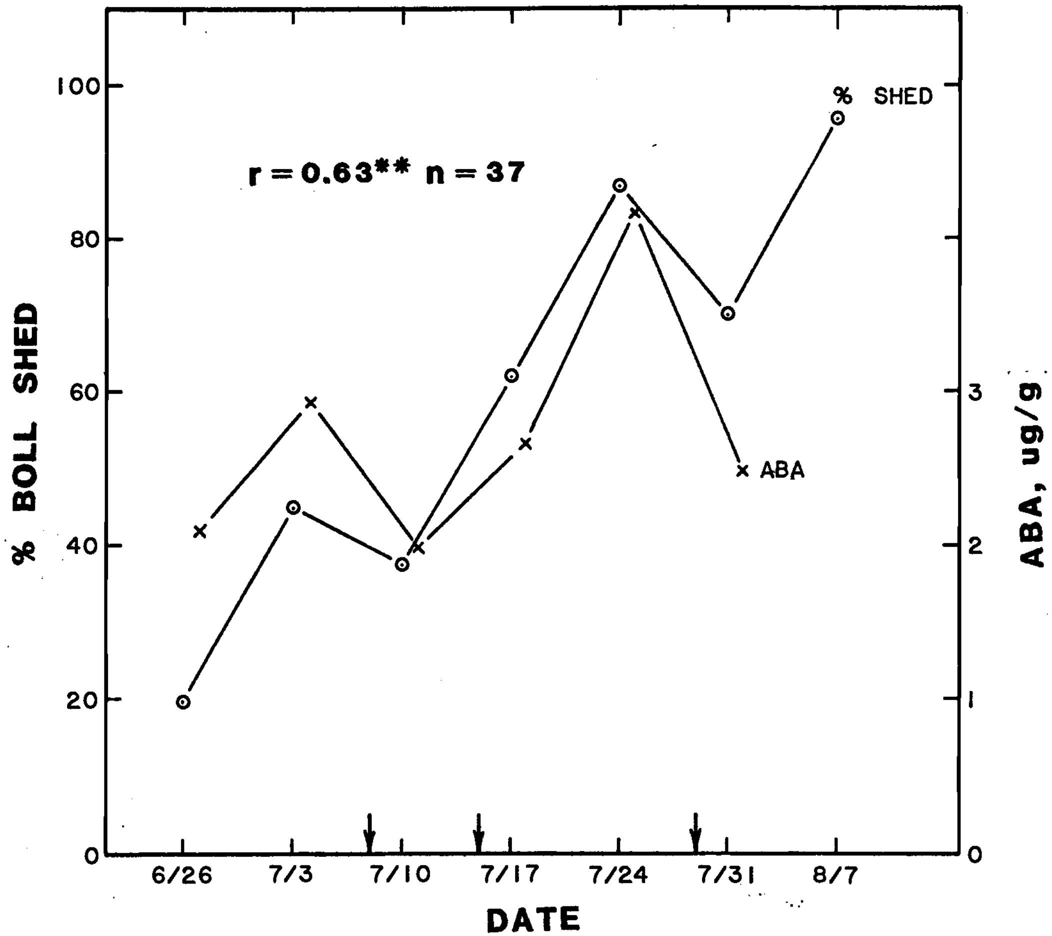

Fig. 2. Changes in ABA content and shedding rate of 4-day-old bolls during three irrigation cycles.