# HEAT STRESS AND LOW DESERT COTTON – RESULTS OF 2018 EXPERIMENTATION

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## Abstract

Heat stress is known to significantly reduce cotton yields in the low desert, with this reduction thought primarily due to stress related ethylene production. Growers have commented that losses can reach up to two bales per acre in certain years. Large scale, replicated strip trials were designed and conducted in three fields of DPL1549 B2XF cotton in 2018 which evaluated BioHold and Urea Mate for their ability to offset heat-stress, with the former product targeting stress and the latter providing additional nutrition. Two sets of timings were evaluated, each with three applications about 10-14 days apart: prior to expected heat stress, and later in season when heat stress was present. Heat stress arrived much later in 2018 than in previous years, with first night of heat stress (Level 1) not noted until July 7. Early applications of materials beginning in late May near first flower had no effect on yields as stress was lacking. The later set of applications started at various points during the year, resulting in a range of final application dates over the summer and with varying durations of stress periods. Applications applied during stress did result in yield increases, with these increases being from 0.35-0.55 bales (480 lbs.)/acre. The field that had its last application applied prior to heat stress being noted was not noted to have increased yields.

## Introduction

The Palo Verde Valley, located in the southeast corner of Riverside County and northeast corner of Imperial County, has the highest cotton average cotton yields in the United States, with averages for upland cotton exceeding five (5) bales during some years, and long recent averages much above four bales. This area of the US is often beset by high summer temperatures which can provide high levels of heat stress primarily associated with high night-time temperatures.

Heat stress can result in the production of ethylene, which in turn signals for the formation of abscissic acid with the latter causing abortion of developing fruits/flowers. Growers estimated that heat stress in 2017 resulted in lint yield reduction of 2+ bales.

While silver nitrate is known to inhibit ethylene production in plants (Palmer, 1992; Mohiuddin et al. 1997; McDaniel and Binder, 2012), this product is not thought to be economical to use in commercial cotton fields. Cobalt (in the form of cobalt chloride) was also noted to be effective in inhibiting ethylene production (Mohiuddin et al. 1997 and references therein).

These experiments were initiated to determine if a cobalt containing fertilizer product could effectively result in increased cotton lint yields attributed to ethylene production associated with high night temperatures in low desert cotton production.

## Materials and Methods

Several fields of DPL1549 B2XF cotton located in the Palo Verde Valley were utilized for this this experiment. One treatment was a combination of 8 oz./acre of BioHold + 2.5 lbs./acre of Harvest More® Urea Mate, while the second treatment included the addition of 8 oz./acre of Stoller Crop Mix (all products from Stoller USA, Houston, TX).

BioHold consists of 6% nitrogen, 3% soluble $K_20$, 2.5% chelated cobalt, and 0.5% molybdenum in addition to two anti-oxidant compounds.

Harvest More*TM* Urea Mate is a 5-10-27 fertilizer that contains 5% nitrogen (as urea N), 10% available $P_20_5$, and 27% soluble $K_20$. It also contains 4% chelated calcium, 1.5% chelated magnesium, 0.15% boron, 0.0.3# chelated copper, 0.5% chelated magnesium, 0.08% chelated cobalt, 0.08% molybdenum, and 0.5% chelated zinc. It was used in each application all sites at 2.5 lbs./acre (see Bryce exception? On July 7 = 2.1 lbs./acre).

Stoller Crop Mix (hereafter referred to as Crop Mix) is a nutrient fertilizer supplement for foliar and seed application. It contains 8% calcium and 0.5% boron, and weighs 11.0 lbs./gallon.

Treatments were applied three (3) times in each of two windows of cotton development: Early season (beginning shortly after first flower in late May) or late early-season (June-July). Treatments were applied 10-14 days apart during their respective time periods. Plots were field length (varied by field, each plot was minimum of approximately 1 acre in size) and were either 18 or 24 rows wide, with 3-4 replications of treatments using a randomized complete block design in each field. Applications were made early mornings with self-propelled sprayers that delivered 10 gallons/acre of solution.

While two treatments and two periods of develop were targeted in these field experiments, crop damage from herbicide contamination in sprayers was noted at two sites from one application in the early development period. Crop damage was uniform and fairly severe in one field (Site #1) and only somewhat visibly noted in another field (Site #3). This created the opportunity to document and compare potential treatment efficacy using undamaged and herbicide damaged plots.

Plots were harvested December 2018 with 6 row pickers (some equipped with yield monitors to collect harvest data) that created wrapped module bale(s) for each plot. Additional verification following ginning (Modern Gin, Blythe, CA).

## Results and Discussion

Initial date of Level 2 heat stress (86.0$^o$ F) was not noted during this experiment until July 7, approximately halfway through the second period for treatments (June-July). Sustained Level 2 heat stress was not noted to begin until July 23. As final treatment varied by field site, this allowed heat stress to be evaluated using heat stress events (Figure 1.)

Difficulties with harvest were encountered at Site #3, at which the yield monitor malfunctioned for many of the plots, resulting in 0-3 data points for this site, including lack of all data for one treatment (late period of combination treatment. There were no missing plots at the other two locations.

Data indicated treatments did effect yields, as well as have interactions associated with herbicide damage. Several early conclusions/trends were noted in this experiment:

# 1. Application of BioHold + Harvest More Urea Mate resulted in increased lint yields when applied during the June-July period, but not during May-June when heat stress was not present. The lack of increase during the non-stress period was noted at all three field locations (Figs. 2-4).

# 2. Largest lint increase (0.55 bales/acre, Site #1) was noted from the last application date (July 26) when more consecutive nights of heat stress levels followed. Application at Site #3 on July 21 resulted in 0.35 bales/acre yield increase.

# 4. Addition of Crop Mix resulted in lower yields in all situations where no herbicide damage was noted (all June-July applications (Figs. 2-4) and both periods (Fig. 3, Site #2) when compared with the BioHold + Harvest More treatment applied on same days.

#5. Lint yield loss due to herbicide contamination ranged from 116 lbs. lint/acre at field with slight injury (Site #3, Fig. 2) to 268 lbs. lint per acre at more severely damaged field (Site #2, Fig. 4) when compared with untreated cotton.

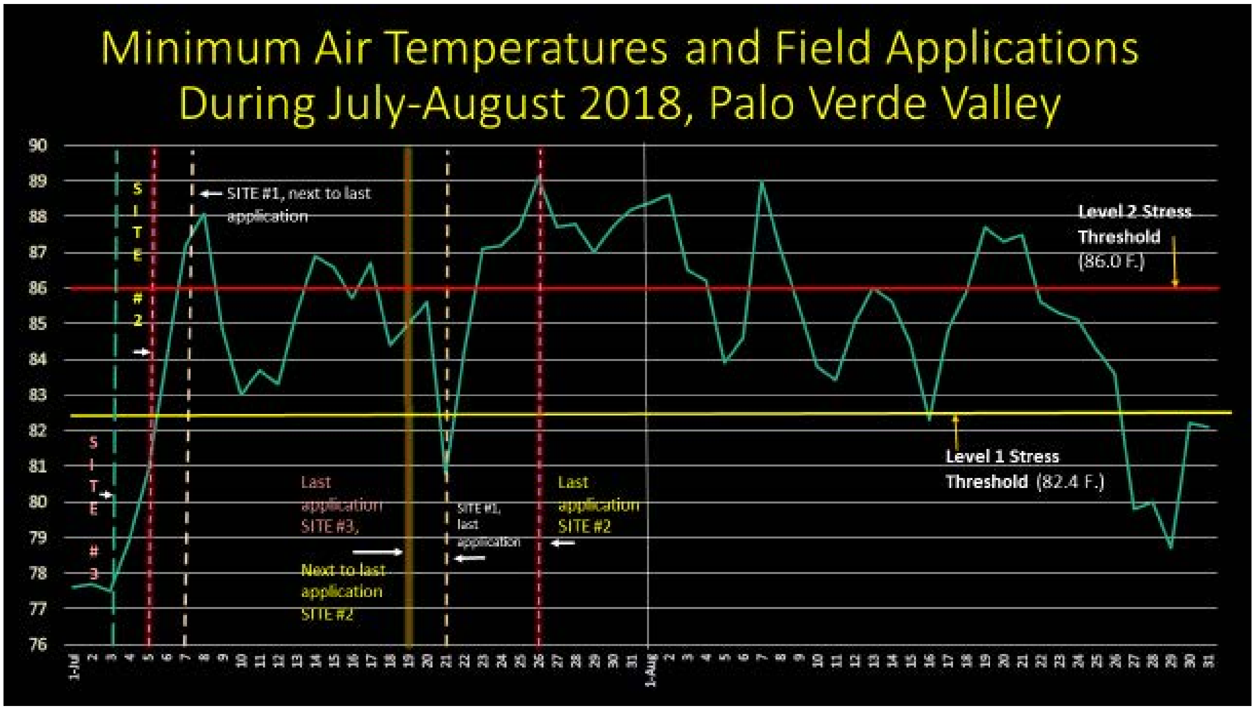


Fig. 1. Relationship of heat stress and final treatment applications.

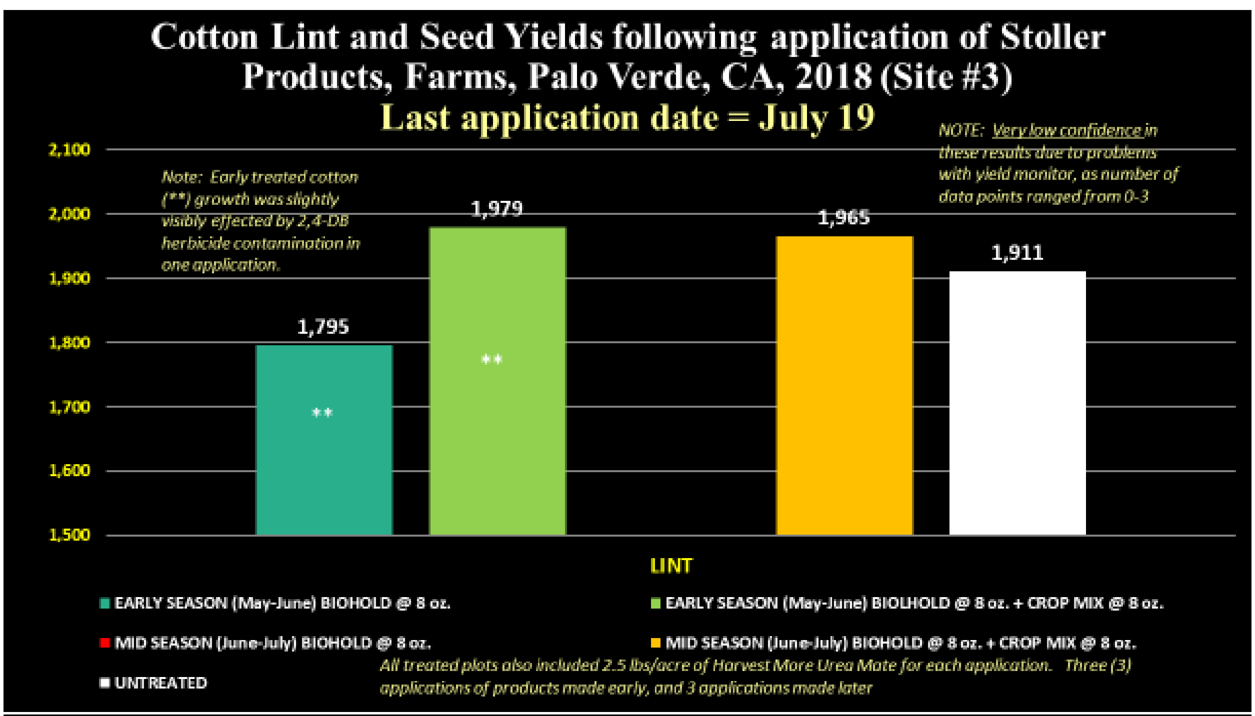


Fig. 2. Yield responses noted from Site 3, which had the earliest last application and some herbicide damage

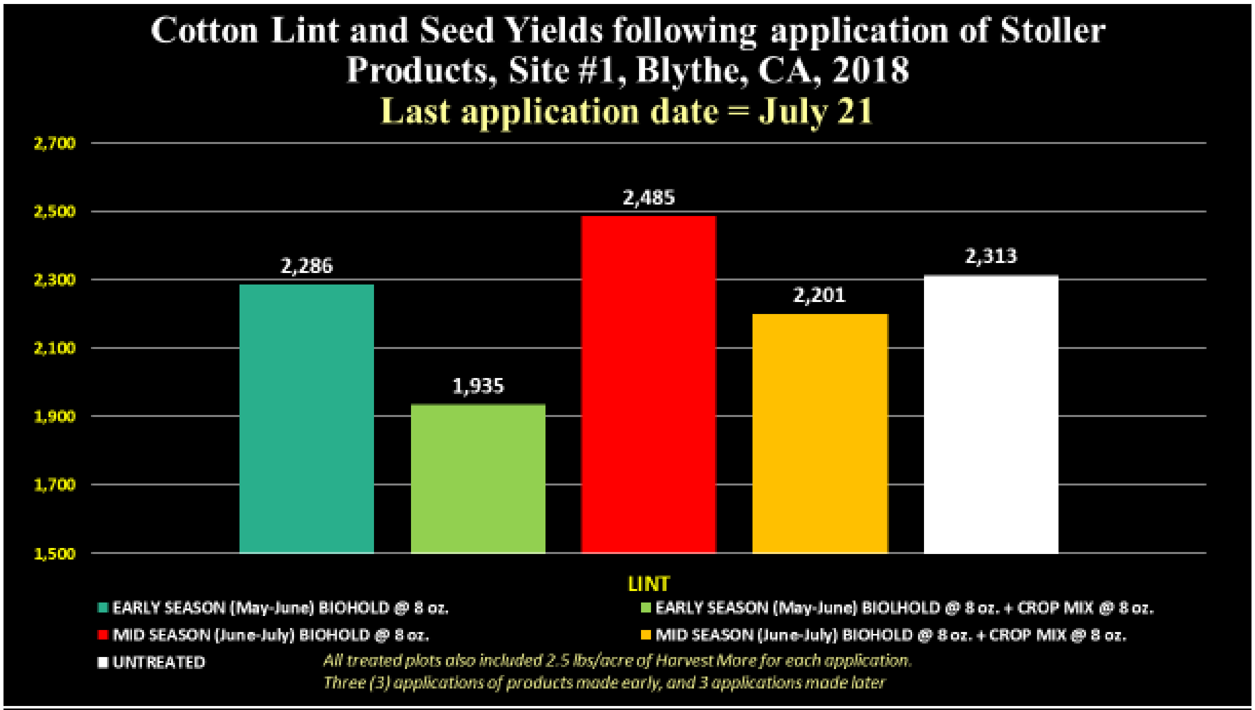


Fig. 3. Cotton lint yields from field that had no herbicide damage.

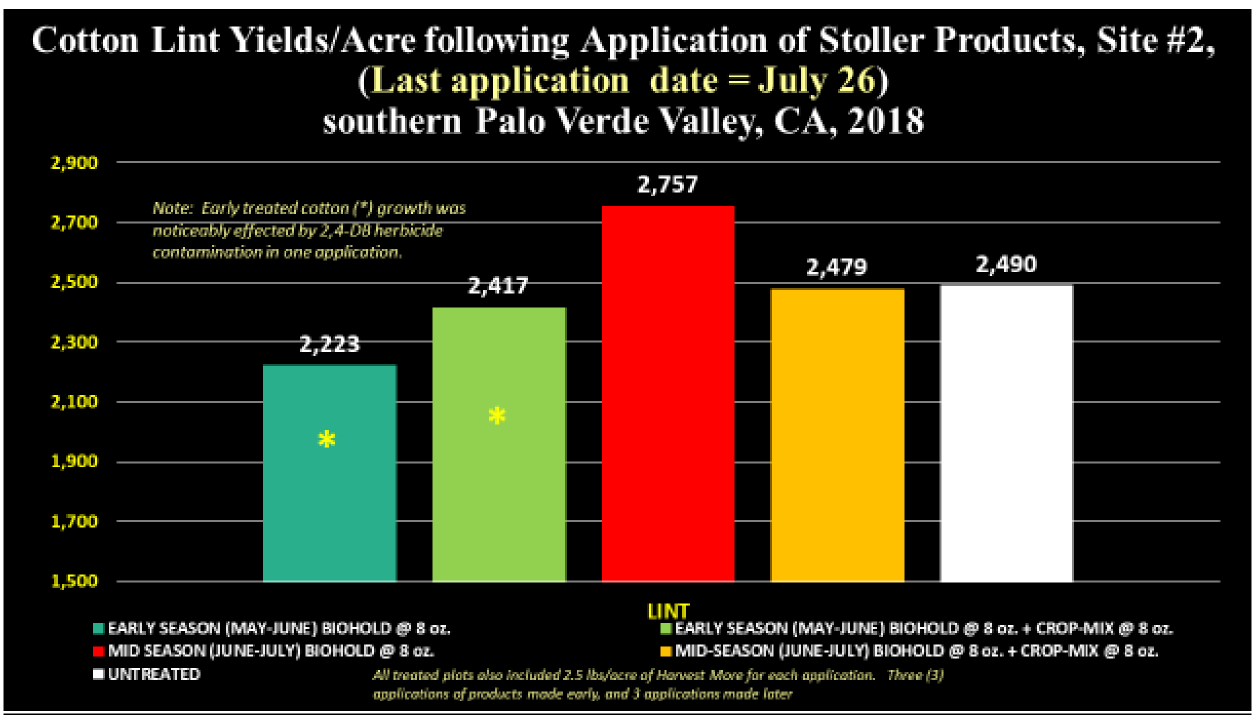


Fig. 4. Cotton lint yields noted from field that had latest applications but also herbicide injury in an early application.

# 3. Addition of Crop Mix resulted in higher yields when compared with the BioHold + Harvest More treatment in fields that experienced herbicide damage (Sites 2 and 3) in an early application, indicating that Crop Mix has potential to offset herbicide damage in cotton.

**Acknowledgements**

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**References**

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