Cooperative Extension

No. 2 (rev 6/97)

BT Cotton In Arizona: '94 Variety Results

The University of Arizona • College of Agriculture

November 8, 1995

Until 1994, testing of 'Bt' cotton varieties was confined to the variety, Coker 312. This variety is not particularly suitable for low desert cotton production. Over the past 4 years, we have demonstrated the performance of the 'Bt' gene (i.e., Bollgard™ gene by Monsanto) in this cotton variety under Arizona conditions. Recommendations on how to scout and manage our pests in Bt cotton are outlined in another UA Extension fact sheet, "*BT Cotton in Arizona: What will change?*". The initial conversion of cotton into a "transgenic" variety required inserting the gene from the *Bacillus thuringiensis* (Bt) microbe into the Coker 312 variety. Transformation of our more popular varieties into transgenics was accomplished through more conventional methods of plant breeding including backcrossing. These methods involved parent varieties common to Arizona production. Ideally, these transformed varieties carry with them the most favorable agronomic characteristics of their related parent line (e.g., DP 5415) combined with the worm-killing gene (e.g., Bollgard) present in the transgenic Coker 312 line. These varieties carry new names or designations like the NuCOTN™ series by DeltaPine. Now with the creation of new varieties, whole suites of agronomic and entomologic factors must be evaluated.

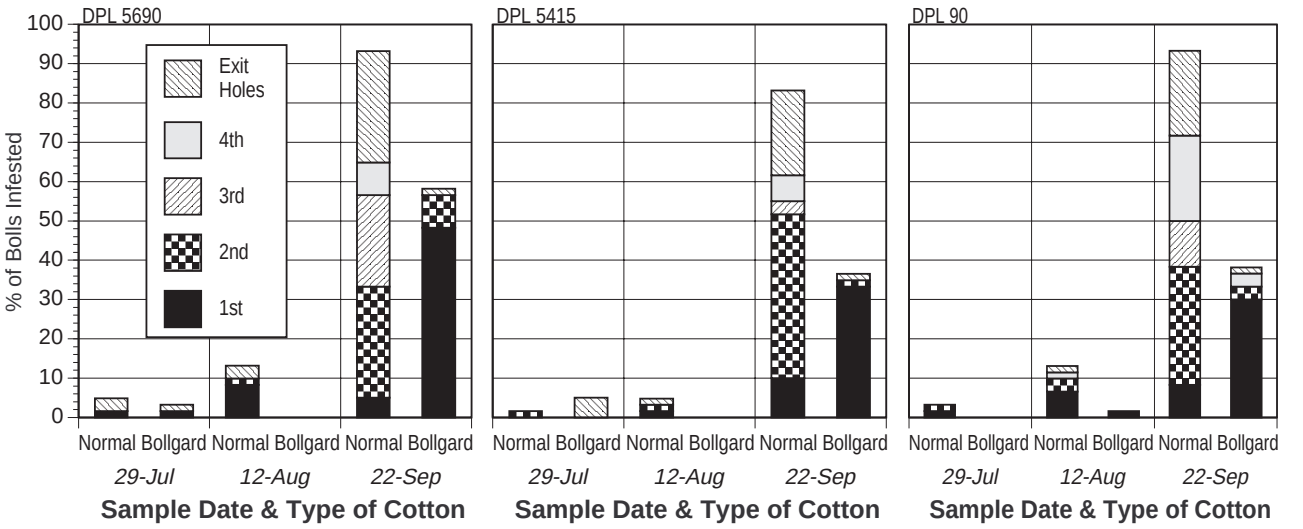
University of Arizona Trials

In 1994 in cooperation with Delta & Pine Land Company, Dr. Jeff Silvertooth and Dr. Peter Ellsworth began a test of these new transgenic Bt varieties, side-by-side with their most closely related, commercial parent lines. These tests were carried out at the UA Maricopa Agricultural Center under field conditions and exposed to natural insect infestations. The varieties contrasted included the Bollgard and "normal" variants of Coker 312, DP 5415, DP 5690, and DP 90. They were dry-planted and watered up on April 9. No insecticides active against PBW were sprayed. Final irrigation was made on August 17, defoliants were applied on September 16, and cotton was harvested on November 8 with a mechanical picker. The questions tested were: ***do these varieties control the pink bollworm,*** and ***are these new varieties agronomically equal to or better than our current varieties?***

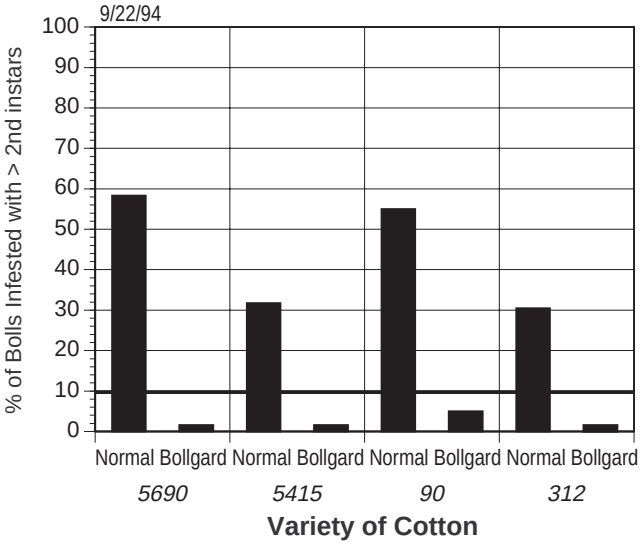
Pink Bollworm

Pink bollworm (PBW) is our key lepidopteran (worm) pest in Arizona. Our past studies of the Coker 312 line have shown levels of control of PBW superior to any chemical alternative. This test confirms our past findings; PBW is effectively controlled by these transformed varieties. The figures below detail the progress and age distribution of the PBW infestation through time for the three commercial variety pairs. The "normal" varieties (**not** treated for worm pests) sustained heavy damage by older larvae by the last sample date (9/22). The Bollgard varieties also had large numbers of PBW in the last sample, but nearly all of the larvae were in the first or second instar. Remember, young larvae must feed on the plant in order to be killed. Only rarely did a PBW larva grow beyond the second instar on Bt cotton.

The late infestation was characterized by extremely high



PBW moth populations concentrated on a relatively small number of egg-laying sites. This worst case scenario is useful for determining if high levels of large PBWs in the bolls are possible. A tentative threshold for treatment decisions against PBW is 10% of the bolls infested with live larvae that are larger than second instar (i.e., infested with "pink" PBW larvae). In the figure below, the 9/22 infestation shows how the Bollgard-possessing lines stay well below the 10% level, while the normal varieties reach levels in excess of 30 and 40%.

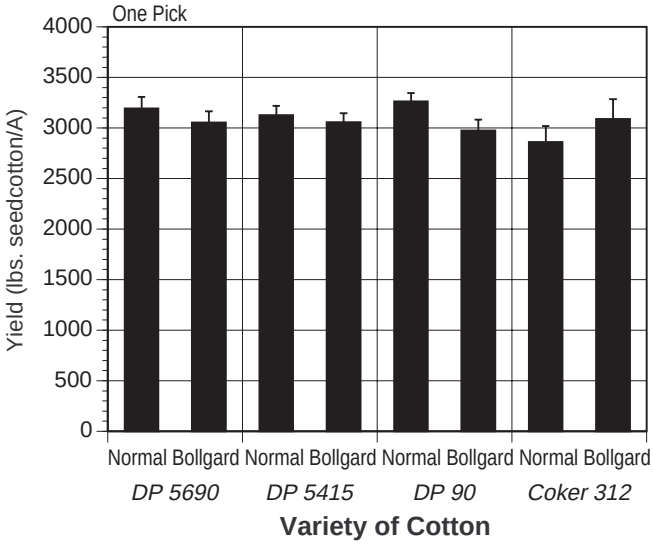


The Bottom Line

Many growers might consider the acid-test for any new variety to be its yield potential. In a competitive world economic climate, growers look at the bottom line—how does the use of this new variety "pay out." Insect control savings will be a major factor in making this determination. An objective evaluation of yield parameters must consider all of the factors that lead to the final yield.

This test experienced some difficulties which limited complete agronomic evaluations to some extent. Plots with the Bt lines had noticeably lower seedling vigor that resulted in stand problems. The source of seed for this project included Bollgard lines that were produced under winter nursery conditions and then rushed to this country for our use. Under these conditions, it is not uncommon to find latent dormancy, "hard" seed, immature seed or other problems associated with a suboptimal seed increase. The normal lines were commercially prepared and produced out of normal seed supplies. The result was that soon after emergence, two distinctly different plant populations were present with the Bt varieties at lower densities. All stands were thinned down to around 30,000 ppa in order to standardize our evaluations.

The yields are presented below for each of the eight varieties. Analyses of these results showed no significant differences among all of the varieties. Lepidopteran insect pressure was late this year and probably did not influence production enough in the remaining foliage and bolls to show "enhancement" in the Bollgard lines over the normal lines. At the same time, stand establishment and resulting poor plant vigor conditions, which persisted through the fruiting cycle, may have also compromised yields. All other agronomic variables measured indicated that there were no significant differences among the varieties tested.



Summary

Growers should approach this technology with a great deal of optimism tempered with measured doses of healthy skepticism. Optimism is called for because of the great promise Bt and transgenic cottons hold for our future. We can look forward to new, innovative products which will reward the producer when used properly. Skepticism is needed when making the decision to adopt this technology in your own system. Do you have the kind of lepidopteran pressure that would warrant the investment? Are the current suite of varieties offered consistent with your yield and other production goals?

These studies help answer some of the above questions. PBW (and other worm pests) are readily, effectively, and safely controlled by Bt cotton. To date, even a conservative threshold has not been reached during the normal fruiting period. In terms of some general agronomic measurements, these varieties perform and look much like their parent lineages. At the same time, however, **further work under a broader set of conditions in Arizona is needed to properly "benchmark" and place these new transgenic varieties among our current seed choices.**

Peter Ellsworth, IPM Specialist[1]
Jeff Silvertooth, Cotton Agronomist[2]
Jon Diehl, Assistant in Extension, IPM[1]

[1]*Department of Entomology, Maricopa Agricultural Center, Maricopa, AZ*
[2]*Department of Plant Sciences, Tucson, AZ*