

**YIELD AND PHYSIOLOGICAL RESPONSE OF NON-TRANSGENIC  
COTTON TO ROUNDUP ULTRAMAX DRIFT**

**Walter E. Thomas, Bridget Robinson, Ian C. Burke, Wendy A. Pline,  
John W. Wilcut, Keith L. Edminsten and Randy Wells  
North Carolina State University  
Raleigh, NC**

**Abstract**

Roundup Ready crops have been increasingly popular among growers yet many growers still use nontransgenic varieties. Herbicide tolerant soybeans and upland cotton acreage for 2001 is estimated at 51.27 (68% of total) and 5.12 million acres (32% of total), respectively. Large acreage of nontransgenic cotton could be susceptible to Roundup UltraMax (glyphosate) drift from other transgenic crops such as corn and soybean. The problems could be amplified since no visible distinction can be made between transgenic and nontransgenic cotton. Therefore, non-transgenic cotton was subjected to various rates of Roundup UltraMax to evaluate yield, shikimic acid accumulation, cotton height, and percent injury, discoloration, and stunting in a weed free environment. Fibermax 989 in the 4 L growth stage was treated early postemergence (EPOST) with Roundup UltraMax at 0.2, 0.41, 0.81, 1.625, 3.25, 6.5, 13, and 26 fluid ounces product / ac. These rates correspond to 0.0078, 0.0156, 0.03125, 0.0625, 0.125, 0.25, 0.5, and 1.0 ae / ac, respectively. Shikimic acid accumulation was determined by the methods developed by Singh and Shaner (1998). Accumulation of shikimic acid in nontransgenic crops may be used to determine glyphosate drift. Samples for shikimic acid accumulation were taken 7, 14, 21, and 28 d after EPOST Roundup UltraMax treatments. Cotton heights were measured at 68 days after planting or 35 days after EPOST treatments. Percent injury, discoloration, and stunting were visually rated 7 d after the EPOST treatment.

Untreated plot yields were significantly lower than 0.2, 0.41, and 0.81 oz ae / ac Roundup UltraMax. Cotton treated with Roundup UltraMax at 3.25 oz ae / ac yielded similarly to untreated weed free cotton. As Roundup UltraMax rates increased above the 3.25 oz rate, cotton yield decreased. Cotton treated with Roundup UltraMax at 6.5, 13, and 26 oz ae / ac yielded less at 400, 75, and 0 lbs / ac of lint. Shikimic acid accumulation was not significantly different at 14, 22, or 31 d after EPOST treatment (DAT). At 7 DAT, accumulation of shikimic acid began at the 3.25 oz rate of Roundup UltraMax and increased with increasing rates of Roundup UltraMax treatment. Due to the underestimation of shikimic acid by the spectrophotometric method, accumulation was not significant between the 13 and 26 oz rates (Pline et al. 2001). Cotton height at 68 DAT was not influenced by Roundup UltraMax treatment at rates up to 1.625 oz / ac. Cotton heights were reduced by Roundup UltraMax rates of 3.25 oz / ac or higher. Injury, stunting, and plant discoloration values also increased as Roundup UltraMax rates of 3.25 oz / ac or higher. Fibermax 989 treated at the 4 L stage was tolerant to Roundup UltraMax at rates of 1.625 oz / ac or less. At these rates visual cotton injury and cotton height were not negatively influenced. Additionally lint yields were higher than untreated weed free cotton. Shikimic acid accumulation was an effective diagnostic tool at 7 DAT but not at 14 DAT or later. Accumulation of shikimic acid was related to visual injury, cotton stunting, and yield reductions.