

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

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

Abstract

Roundup Ready crops have become increasingly popular among growers, yet many growers still plant nontransgenic varieties. Herbicide-tolerant soybeans and upland cotton acreage for 2002 is estimated at 54.67 (75% of total) and 8.18 million acres (58% 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 exacerbated 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, 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 ai / 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 were taken 7 d after EPOST Roundup UltraMax treatments in 2001 and 2002. Samples taken at 14, 21, and 28 d in 2001 field trials could not be used, as shikimic acid accumulation was not different from the untreated check. Percent injury, discoloration, and stunting were visually rated 7 d after the EPOST treatment.

Nontransgenic cotton treated with 0.2, 0.41, and 0.81 oz / ac Roundup UltraMax in 2001 yielded higher than the untreated weed-free check. Cotton treated with Roundup UltraMax up to 3.25 oz / ac yielded similarly to untreated weed free cotton at all locations in 2002. As Roundup UltraMax rates increased above the 3.25 oz rate, cotton yield decreased. Cotton treated with Roundup UltraMax at 26 oz / ac reduced lint yield by 100, 76, and 70% at Lewiston 2001, Clayton 2002, and Lewiston 2002, respectively. At 7 days after treatment (DAT), accumulation of shikimic acid began at the 3.25 oz rate of Roundup UltraMax and increased with increasing rates of Roundup UltraMax treatment at all locations. 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). Injury, stunting, and plant discoloration values also increased as Roundup UltraMax rates of 3.25 oz / ac or higher at all locations. 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 lint yield were not negatively influenced. Shikimic acid accumulation was an effective diagnostic tool at 7 DAT but not at 14 DAT or later. The Clayton 2002 location had extremely low shikimic acid accumulation possible due to the extreme drought conditions throughout much of the cotton growing season in North Carolina. Accumulation of shikimic acid was related to visual injury, cotton stunting, and yield reductions. However, shikimic acid accumulation appears to be influenced by environmental growing conditions.