

EFFECT OF 1-MCP ON THE GROWTH AND YIELD OF COTTON

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Abstract

High temperatures adversely affect cotton production in the Mid-south by causing excess boll shedding. Extreme year-to-year temperature variability also leads to unpredictable yields. This study investigated the ability of 1-Methylcyclopropene (1-MCP) to ameliorate high temperature stress and enhance cotton yield by blocking the senescence hormone, ethylene. For three consecutive seasons, cotton, cultivar DPL444BR (2006) and ST4554BRF (2007 and 2008), was planted in fields in Marianna and Fayetteville, Arkansas and treated with either no 1-MCP (T1), 1-MCP at the rate of 10 g ai/ha at first flower (FF) (T2), or 1-MCP at 10 g ai/ha at FF and again two weeks later (T3). In 2008 the Fayetteville field had an additional treatment (T4), consisting of 1-MCP applied at the rate of 10 g ai/ha at FF and then again every four days for about two weeks. Although there was no significant effect of 1-MCP treatment on seed cotton production over the three years of the study, in general T3 showed a consistent numerically higher yield. Treatment T4 showed numerically the highest seed cotton yield; however there was no significant difference between T4 and the other treatments. 1-MCP was shown to affect the activity of the enzyme, NADPH oxidase (NOX) which is involved in the regulation of cell expansion, i.e., in fiber elongation). The multiple 1-MCP treatment (T4) also showed a numerically higher level of NOX activity, but not significantly higher than that of the control. Samples for glutathione reductase activity are still being analyzed to document the effect of 1-MCP in reducing plant stress. Two growth chamber studies were conducted at the Altheimer Laboratory in Fayetteville, Arkansas, with the cotton cultivar ST4554BRF grown at normal (30/20 °C day/night) conditions until a week before flowering, at which time the temperature in one growth chamber was raised to 38/20 °C. At FF, half the plants in each chamber were sprayed with 1-MCP at 10 g ai/ha. Flowers were collected from each of the resulting four treatments approximately three times a day at set times. Treatment with 1-MCP significantly enhanced plant height, and numerically increased both leaf area and above ground dry weight, in both temperature regimes. There was a significant increase in NOX activity between the treated and untreated plants in the high temperature regime, and only a numerical increase in NOX activity in the 1-MCP treatment in the normal temperature. Samples for glutathione activity are still being analyzed. We cautiously conclude that 1-MCP has a positive effect on the growth of cotton by preventing high temperature stress from severely impacting the biochemistry of the plant. Additional studies are planned to further investigate the use of 1-MCP on the growth, yield and heat tolerance of cotton.