APPLICATION TEMPERATURE INFLUENCES PYRITHIOBAC (STAPLE®) EFFICACY IN A SEMI-ARID ENVIRONMENT

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Abstract

Weed control by Staple® has been inconsistent since its commercial introduction in 1996. The influence of temperature at the time of post-emergence Staple® applications was investigated as a source of the variability in field activity. Over two growing seasons, sixteen independent and random applications of Staple® were made to 2-4 inch Palmer amaranth (*Amaranthus palmeri* S. Wats). The herbicide was applied at a rate of 0.063 lbs. a.i./A in a carrier volume of 15 GPA with 1% crop oil concentrate using a backpack sprayer. Plant/soil scene temperature was monitored with an infrared thermometer and air temperature was monitored with a thermocouple. These temperatures were recorded at 15-minute intervals from mid-June to late September of both years. Field activity, expressed as a percentage of the non-treated dry weight, was quantified as the dry weight accumulated by treated plants for a 14 day period following herbicide application. Accumulated dry weight ranged from 0.1% to 71.5% when compared to non-treated Palmer amaranth. Field activity differences were correlated with plant/soil scene temperature at herbicide application. Applications at temperatures above 93° F resulted in poor activity.

To determine the source of the thermal limitations on Staple® efficacy, thermal dependence of the inhibition of the target enzyme, acetolactate synthase (ALS), was examined. A crude extract of acetolactate synthase was obtained from Palmer amaranth and utilized in microtiter assays. The herbicide concentrations where the enzyme was inhibited by 50% (I_{50} values) were obtained from 50 to 122° F in 9° increments. The lowest I_{50} value occurred at 86° F, indicating the most efficient inhibition of the enzyme. At temperatures below and above this optimal temperature, the enzyme inhibition was less efficient. Comparison of field activity against I_{50} values showed that both accumulated dry weight and I_{50} values increase rapidly above 93° F. Therefore, the thermal dependence of the ALS-Staple® interaction may contribute to inconsistent field activity.

Field activity was correlated with plant/soil scene temperature, a parameter not readily available to producers. However, analysis of temperature data showed that below 93° F, air temperature adequately represented plant/soil scene temperature. Based on this study, air temperatures of 68 to 93° F optimize Staple® activity. Applications made outside this range may provide inconsistent weed control.

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