INTRODUCTION

Cogongrass (Imperata cylindrica (L.) Beauv.) is a troublesome perennial grass that is among the most troublesome weeds worldwide (Holm et al. 1977). It grows in tropical, subtropical, and some temperate regions of the world (Bryan and Carter 1993). Following introduction into the southern U.S., cogongrass has spread at an alarming rate and is now an invasive weed in many states of the Coastal Plain Region of the southeastern U.S. (Byrd and Bryson 1999; Dickens 1974). Cogongrass spreads mainly by seed and rhizomes (Dorier et al. 1998). Its extensive rhizome, creeping, and suck rhizome promote survival during periods of stress. Once established, cogongrass is extremely competitive with neighboring plant communities and thrives in infrequently cultivated areas, utility right-of-ways, roadsides, forests, pastures, mining areas, pine plantations, parks, and other natural and recreational areas (Colie and Shilling 1993; Dorier et al. 1998; Willard et al. 1996).

The objectives of this research were to determine the effectiveness of heat for killing cogongrass rhizomes and evaluate survival and mortality with tetrazolium chloride test rather than a greenhouse bioassay. Because tetrazolium chloride (ISTA 1985) has been used to determine seed viability, we hypothesized that it might provide a chemical test to determine cogongrass rhizome viability.

MATERIALS AND METHODS

Rhizomes were harvested from a patch of cogongrass maintained for 6 years in a containment area at Stoneville, MS, and grown on a Dundee sift loam (fine-silty, mixed, thermic Aeric Ochraqualf) with pH 6.3; 1% organic matter; soil textural fractions of 26% sand, 56% silt, and 18% clay; and a cation exchange capacity of 15 cmol/kg. Rhizomes of 0.6 to 0.7 cm diam were cut into 10-cm-long segments and subjected to temperatures of 52, 65, 79, 93, 107, 121, 149, 177, and 187°C for 0.5, 1, 1.5, 2, 2.5, 5, 10, 15, 20, 25, and 30 min. Following heat treatment, five rhizome segments were cut in half and placed in a vial with 5 ml 1% tetrazolium chloride (ISTA 1985), and five rhizomes were placed in 8 by 15 cm trays in a basket sandy loam soil (Mollisch Rapadulfo) and Jiffy Mix Plus at 50:50 v/v, covered lightly with the soil-Jiffy Mix mixture, and allowed to sprout in the greenhouse at Stoneville, MS. Soil was watered lightly as needed. The greenhouse was maintained at temperatures of 26°C at night/day with no supplemental lighting. Fresh and dry weight of rhizomes and leaves were recorded at 6 wk. Cogongrass rhizomes treated with tetrazolium chloride in vials were placed in the dark for 24 h, then removed, placed in the light, and visually determined to be pink or not, with pink representing viable tissue. The experiment was conducted as a factorial design with four replications and repeated. All data were analyzed according to analysis of variance.

RESULTS

Cogongrass rhizome mortality increased with increasing temperature and longer duration of heat exposure (Table 1). Cogongrass rhizome mortality was 100% at 65, 79, 93, 107, 121, 149, 177, and 187°C at time periods ≥2.5, 2.5, 2.5, 2.5, 2, 1, and 1 min, respectively. Cogongrass rhizome mortality (control) was ≥97% at 65 C and exposures times ≥10 min. Cogongrass control was 99% at 149 and 177°C at heat treatments of 1.5 min. Temperatures of 79, 107, 121, 149, and 177°C provided 50, 66, 13, and 42% control at 2.5, 2, 1.5, 1, and 1°C.

The tetrazolium chloride was ineffective in predicting viability of cogongrass rhizomes following heat treatments (Table 2). Of the 99 treatment combinations of temperature and duration of temperature, the tetrazolium chloride test predicted 100% mortality correctly 5 times and correctly determined 100% survival of cogongrass rhizomes 22 times when compared to the standard greenhouse bioassay (Table 1 and 2). The tetrazolium chloride test provided a false positive or negative 69 times for 100% cogongrass rhizome survival or mortality, therefore, the tetrazolium chloride test was not a useful tool in determining the effectiveness of heat to kill cogongrass rhizomes.

CONCLUSIONS

Based on these data, cogongrass rhizomes were effectively killed with heat treatments. The duration of heat required for cogongrass mortality was less as temperature increased. A standard greenhouse bioassay for cogongrass rhizome mortality was more accurate than a chemical test using tetrazolium chloride. Additional research may yield an effective chemical test to determine cogongrass rhizome mortality.

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LITERATURE


