RADIATION-USE EFFICIENCY OF BROADLEAF AND GRASS WEED SPECIES IN MONOCULTURE AND IN CORN. Greta G. Gramig and David E. Stoltenberg, Graduate Research Assistant and Associate Professor, Department of Agronomy, University of Wisconsin, Madison, WI, 53706.

Empirical crop-yield loss models based on weed density are typically unstable both spatially and temporally, because such models lack physiologically-based parameters that respond to environmental stochasticity. Mechanistic, physiologically-based models of crop-weed interactions offer the potential to increase accuracy and stability of crop-yield loss predictions, but these models can be inaccurate due to additive errors associated with large numbers of parameters. These problems may be addressed by focusing on physiologically-based parameters that are critical in determining outcomes of crop-weed competition. Photosynthesis is a major determinant of plant biomass production. As such, the quantity of radiation intercepted, and its utilization, may be one of these critical parameters. Therefore, our objective was to determine the radiation-use efficiency (RUE) of six weed species as an initial step toward characterizing crop-weed competition for light.

A field experiment was conducted in 2001 at the University of Wisconsin–Arlington Agricultural Research Station. Experimental design was a split-plot randomized complete block with three replications in 4- by 4-m plots. Community type (weed grown in monoculture or in corn) was the main plot factor and weed species was the subplot factor. Corn was planted at 79,000 seeds ha^{-1} in 76–cm wide rows on May 14 and weed seeds (giant ragweed, pigweed species, velvetleaf, large crabgrass, wild proso millet, and woolly cupgrass) were planted by hand on May 15. Target weed densities were established shortly after emergence by culling and transplanting seedlings. Water and nutrients were applied for optimal plant growth.

One corn plant and one to three weed plants per plot were randomly selected at regular intervals during the growing season, cut at the soil surface, divided into 30-cm height intervals, and measured to determine leaf area index (LAI) and shoot dry biomass. Measurements of daily mean air temperature and daily total solar radiation were obtained from a nearby weather station. Daily total shoot biomass accumulation based on growing degree days (GDD) was estimated from regression analysis. Intercepted photosynthetically active radiation (IPAR) was calculated using a Beer's Law relationship that describes IPAR in terms of LAI, and an extinction coefficient that measures the attenuation of light through a plant canopy as a function of leaf angle distribution. Daily IPAR was determined using linear and non-linear regression of GDD versus IPAR. The change in IPAR (MJ m^{-2}s^{-1}) was regressed against change in accumulated plant biomass (g m^{-2}) to determine RUE. Mean RUE values were tested for significance using the appropriate F-tests. Preliminary analysis suggests that RUE values for broadleaf weeds grown in monoculture were greater than those for grass weed species. This analysis also suggests that RUE values for weeds were less in corn than in monoculture; however, additional analysis is required to elucidate treatment effects.