STABILITY OF RADIATION-USE EFFICIENCY FOR ESTIMATING WEED BIOMASS ACCUMULATION IN WEED-CORN COMMUNITIES. Greta G. Gramig, David E. Stoltenberg, and John M. Norman, Graduate Research Assistant, Associate Professor, Department of Agronomy, and Professor, Department of Soil Science, University of Wisconsin, Madison, WI, 53706.

Simplified mechanistic models focusing on critical determinants of competitive outcomes can potentially provide useful descriptions of weed-crop competition with less difficult and cumbersome parameterization than more complex eco-physiological models. Competition for light is often a key determinant of competitive success in highly productive agroecosystems. Plant species convert intercepted radiation into biomass with varying degrees of efficiency. Variation in radiation-use efficiency (RUE) can result from intrinsic physiological differences among plant species and from differences in canopy light environments. Characterizing variation in RUE resulting from crop-weed interactions in complex canopies is necessary for making accurate estimations of weed biomass accumulation.

Field experiments were conducted in 2001 and 2002 to determine the RUE of giant ragweed, velvetleaf, woolly cupgrass, and wild proso millet grown in two competitive environments: weed monoculture or within corn. 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. Early-season weed species RUE values were calculated for each plot as the slope of cumulative intercepted photosynthetically active radiation (IPAR) (MJ $m^{-2}s^{-1}$) vs. cumulative shoot biomass (g m^{-2}) from emergence to V6 corn. IPAR was calculated as a function of leaf area index (LAI) and an estimated light extinction coefficient (K_d), which was based on a spherical leaf angle distribution and LAI. Daily estimates of plant biomass and LAI were interpolated from regression models with growing degree-days as the independent variable. Mean RUE values were tested for significance using the appropriate F-tests.

In 2002, an experiment was conducted to compare the above method of estimating IPAR with direct measurements of IPAR. Radiation sensors were placed above and below the canopy in 24 plots to measure IPAR over a 24-hour period. Paired t-tests comparing measured values of IPAR with estimated values of IPAR indicated no difference between methodologies (p=0.6586). Therefore, estimated values of IPAR were used for calculations of RUE.

F-tests of weed species RUE means indicated significant year by community (p=0.0423) and community by species (p=0.0003) interactions. Consequently, weed species RUE means in corn and in monoculture were compared within year using t-tests. In 2001, RUE of giant ragweed did not differ between communities (p=0.1292), but the RUE of velvetleaf (p=0.0102), woolly cupgrass (p<0.0001), and wild proso millet (p=0.0030) was greater in corn than in monoculture. In 2002, RUE of giant ragweed (p=1.000) and velvetleaf (p=0.0999) did not differ between communities but RUE of woolly cupgrass (p=0.0155) and wild proso millet (p=0.0462) was greater in corn than in monoculture. These results indicate that variation of weed species RUE was associated with the effect of corn on the canopy light environment. Weed species typically had greater RUE in corn than in weed monocultures except when the weed species was highly competitive with corn for light.