MORPHOLOGICAL VARIATION OF COMMON LAMBSQUARTERS AND GIANT FOXTAIL ASSOCIATED WITH CROP-MEDIATED CHANGES IN LIGHT QUALITY. Greta G. Gramig and David E. Stoltenberg, Graduate Research Assistant and Professor, Department of Agronomy, University of Wisconsin, Madison, WI 53706.

Plants use an array of physiological mechanisms to sense resource availability; such mechanisms may trigger adjustments in biomass allocation patterns to maximize access to key limiting resources, thus increasing competitive ability. Numerous studies conducted in controlled environments have demonstrated altered biomass allocation patterns in response to decreased red/far-red (R/FR) ratios. Previous results suggest that some plant species respond to changes in R/FR ratios in the absence of mutual shading; it has been hypothesized that this may be a critical mechanism for early neighbor detection and avoidance. Few studies have investigated the effects of decreased R/FR ratios on competitive interactions among plants in the field, where light intensities far exceed those in controlled environments, and where other important environmental factors fluctuate both spatially and temporally. Our objectives were to determine if crop-mediated changes in light quality are associated with early changes in weed morphology in the field and also if residual effects of the early R:FR environment were expressed later in the season, after mutual shading has occurred.

Two field experiments were conducted in 2004 at the University of Wisconsin-Arlington Agricultural Research Station to investigate the responses of common lambsquarters (CHEAL) and giant foxtail (SETFA) to altered R:FR ratios mediated by neighboring corn plants. Corn was planted in rows 0.76-m apart over one-half the study area; bare soil was maintained in the other one-half of the field. Standard agronomic practices were used for seed bed preparation, fertilization, and crop planting. At V5 corn, weed seeds were sown in 11.4-L pots containing 50:50 sand:silt loam; pots were placed 1.8-m apart in either the open area or between corn rows. Pots were watered and fertilized regularly; after emergence, weed seedlings were thinned to one per pot. Each experiment consisted of 156 weed plants (either CHEAL or SEFTA) subjected to one of four treatments: 1) early-season low R:FR, late-season shade, 2) early-season low R:FR, late-season no shade, 3) early-season high R:FR, late-season shade, and 4) early-season high R:FR, late-season no shade. Low R:FR ratios were mediated by corn rows, which were trimmed to maintain low R:FR ratios and to prevent shading of target weed plants. Late-season shade was provided by placing target weed plants (in pots) between corn plants in rows spaced 1.52-m apart. In the non-crop area, high R:FR ratios were maintained by controlling non-target weeds and by maximizing the space between target plants. Several times during the season, a spectroradiometer was used to measure the R:FR (645:735 nm) composition of horizontally propagated radiation at the apex of target weed plants in each treatment. Target weed plants were harvested at several times during the season to determine biomass allocation to leaves, stems, and roots. Analysis of variance and specific paired comparisons were used to assess the treatment effects on specific leaf area, specific main stem length, leaf to stem ratio, branch or tiller number, vertical leaf area distribution (CHEAL only), branch/tiller to main stem ratio, and root to shoot ratio.

For CHEAL, early-season low R:FR was associated with a vertical shift in leaf area, thinner leaves, less biomass allocated to branches than to stems, and lower mass per unit stem length when compared to plants exposed to early-season high R:FR. CHEAL plants subjected to late-season shade also exhibited vertical shifts in leaf area, thinner leaves, less biomass allocated to branches than to stems, and lower mass per unit stem length when compared to non-shaded plants; late-season shade was also associated with less biomass allocation to roots than to shoots. Additionally, shaded CHEAL plant responses did not differ with early R:FR exposure; likewise, non-shaded CHEAL plant responses did not differ with early R:FR exposure. For SETFA, early-season low R:FR was not associated with changes in biomass allocation, except leaves were slightly thinner than those of plants exposed to high R:FR. Late-season shaded SETFA plants had thinner leaves and less biomass per unit stem length than

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non-shaded plants; these responses did not differ with early R:FR exposure. Also, for shaded plants, less biomass was allocated to SETFA roots and tillers than to leaves when compared to non-shaded plants, but these responses differed with early-season R:FR exposure. These results indicate that CHEAL responds rapidly to altered R:FR, but that these early-season responses have little effect on late-season CHEAL morphology. In contrast, most SETFA responses to early-season R:FR exposure were apparent only after exposure to late-season shade and also differed with R:FR treatment. These results indicate that monocot and dicot plants may not only respond differently to early changes in R:FR ratios but also that the residual effects of early R:FR environment on late-season morphology (and thus competitive ability) may differ between monocots and dicots.