LIGHT QUALITY EFFECTS ON CORN GROWTH, DEVELOPMENT, AND YIELD. Melinda K. Markham and David E. Stoltenberg, Graduate Research Assistant and Professor, Department of Agronomy, University of Wisconsin, Madison, WI 53706.

Recent research results have suggested that early-season detection of neighboring plants via light quality signals may be an important mechanism affecting crop-weed interactions. The increased reflection of far-red light among higher densities of green plants can lower the red:far-red ratio (R:FR) of horizontally propagated light before there is a significant degree of mutual plant shading. In turn, this modifies the light environment of stem tissue, and elicits changes in stem elongation rate. Consequently, carbon allocation patterns can be altered before photosynthesis is reduced by shading. Typical effects of reduced R:FR are enhanced axis (stem or shoot) elongation, reduced branching of broadleaves, and reduced tillering of grasses. Numerous studies conducted in controlled environments, and to a lesser extent in the field, have shown plant morphological changes associated with altered R:FR light environments. However, little research has been conducted to investigate the possible effects of R:FR-mediated alterations in weed and crop morphology on competitive outcomes under field conditions. Limited evidence suggests that altered light quality can influence early growth and development of corn, but it is not understood how responses to early-season low R:FR (associated with higher total plant densities in corn-weed communities than in weed-free corn) affect season-long growth and productivity of corn. Therefore, field experiments were conducted in 2005 and 2006 to determine the effect of low R:FR on early-season corn growth and morphology, and late-season outcomes such as corn plant biomass and grain yield. Corn 'DKC50-20RR/YGCB' was planted at medium and high densities (53,800 and 107,600 plants ha^{-1}, respectively) to establish medium and low early-season R:FR environments, respectively. The medium density treatment represented a typical weed-free corn environment, whereas the high density treatment simulated a competitive corn-weed community. The high density treatment was thinned to the medium plant density at the time of mutual shading (V6-7 corn) which simulated total weed removal. Spectral light quality (R:FR, 645:735 nm) was measured at least twice weekly from corn emergence to the time of mutual shading among plants in each treatment. Photosynthetically active radiation was measured daily to determine the time of mutual shading. The R:FR was nearly 50% less at the time of mutual shading in the high density corn treatment (0.24) than the medium density treatment (0.43). Measurements of soil moisture availability, soil nutrient availability, and corn leaf tissue nutrient status indicated that soil moisture and nutrient availability were not limiting and did not differ among light quality environments. In 2005, early-season low R:FR had little effect on corn plant morphology at the time of mutual shading. In contrast, low R:FR was associated with taller plants, longer leaves, and less tiller mass than corn plants in medium R:FR in 2006. The root:shoot ratio did not differ between light quality environments at the time of mutual shading in either year. At physiological maturity, above-ground plant biomass and corn grain yield did not differ between early-season light quality environments ($p > 0.05$). These results suggest that early-season light quality effects on corn morphology, if any, were transitory and did not affect corn yield. We conclude that early-season low R:FR typically associated with corn-weed communities was not a key determinant of corn yield in the field environment when water and nutrients were not limiting factors.

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