WEED MANAGEMENT AFFECTS THE MAXIMUM RETURN TO NITROGEN IN FIELD CORN.
Timothy L. Trower, Chris M. Boerboom, Carrie A. M. Laboski and Todd W. Andraski, Senior Outreach Specialist, Professor, Assistant Professor and Researcher, University of Wisconsin, Madison, WI 53706.

Many corn growers are interested in adopting new nitrogen application rate guidelines to improve profitability. However, the potential exists that weeds may compete and limit the nitrogen available for the corn. Field studies were conducted at Arlington, WI in 2006 and 2007 to determine the economic optimum nitrogen rate (EONR) at two postemergence weed removal timings compared to weed-free and weedy controls. Nitrogen was applied pre-plant as 28% UAN at 0, 45, 90, 135, 180, and 225 kg ha^{-1} and incorporated prior to planting glyphosate-resistant corn. The previous crop was soybean. Mesotrione plus s-metolachlor plus atrazine at 0.22 plus 2.2 plus 0.8 kg ai ha^{-1} was applied preemergence in 2006 while mesotrione plus s-metolachlor at 0.22 plus 2.2 kg ha^{-1} tank mixed with simazine at 1.1 kg ai ha^{-1} was used in 2007. Glyphosate was applied postemergence at 0.84 kg ae ha^{-1} following the 2007 preemergence treatment due to poor activation caused by low rainfall. These preemergence treatments provided the weed-free control. Weeds were removed when they reached 10- and 30-cm heights by applying glyphosate at 0.84 kg ae ha^{-1}. Weed biomass was collected from 0.25 m^2 quadrats at the weed removal timings. Corn and weed biomass collected in 2006 was analyzed for nitrogen concentration. Corn was harvested for yield and grain was adjusted to 15.5% moisture. The study had a randomized complete block design with four replications.

Giant foxtail and common lambsquarters were the predominant weed species in both years. Weed densities averaged 890 and 390 plants m^{-2} in 2006 and 2007, respectively, at the 10-cm weed removal timing and 1090 and 660 plants m^{-2} in 2006 and 2007, respectively, at the 30-cm weed removal timing. Weed biomass at the 10-cm weed removal timing averaged 52 and 67 g m^{-2} in 2006 and 2007 and 96 and 183 g m^{-2} at the 30-cm weed removal timing in 2006 and 2007. Weeds accumulated an averaged of 13 kg ha^{-1} of nitrogen at the 10-cm removal timing compared to 28 kg ha^{-1} at the 30-cm weed removal timing. Corn biomass was sampled at tassel and nitrogen accumulation averaged 95 kg ha^{-1} for the weed-free control, 92 kg ha^{-1} for the 10-cm weed removal timing, and 78 kg ha^{-1} for the 30-cm weed removal timing. Grain yields did not differ between the weed-free control and the 10-cm weed removal timing. Yields were reduced 7 and 11% with the 30-cm weed removal timing compared to the weed-free control in 2006 and 2007, respectively. The yield of the weedy control was reduced an average of 37 and 56% in 2006 and 2007, respectively, compared to the weed-free control. The EONR was determined using a nitrogen fertilizer to corn price ratio of 0.15. In 2006, the EONR was 108 and 109 kg N ha^{-1} for the weed-free control and 10-cm weed removal timing, respectively, and 225 kg N ha^{-1} for the 30-cm weed removal timing. In 2007, the EONR was 44 kg N ha^{-1} for the weed-free control, 88 kg N ha^{-1} for the 10-cm weed removal timing, and 246 kg N ha^{-1} for the 30-cm weed removal timing. Corn yields were similar among the weed-free control, 10-cm and 30-cm weed removal timings when 225 kg N ha^{-1} was applied, which suggests that high nitrogen rates may compensate for greater weed competition. These results document that early season weed competition for nitrogen contributes to corn yield loss when postemergence herbicide applications are delayed and may increase the EONR. Weed management programs that limit early season weed competition will optimize nitrogen use.