SIMULATING WEED EMERGENCE UNDER DIFFERENT CROP CANOPIES. Rutendo P. Nyamusamba*, Michael J. Moechnig, Darrell L. Deneke, Graduate Research Assistant, Assistant Professor, Integrated Pest Management Coordinator, Plant Science Department, South Dakota State University, Brookings, SD 57006

Growth chamber and field studies were established to calibrate and validate models to predict emergence of green foxtail (*Setaria viridis*), redroot pigweed (*Amaranthus retroflexus*), and common lambsquarters (*Chenopodium album*) in corn, soybeans, spring wheat, field peas, alfalfa, and fallow. The objectives of this research were to determine if weed emergence rates differed under different crop canopies and, if so, modify hydrothermal-based coefficients to account for crop canopy effects.

To quantify the effects of crop canopies on weed emergence, crop species treatments (corn, soybeans, spring wheat, field peas, alfalfa, and fallow) were arranged in a RCB design with four replications. Plots were 6 m wide and 15 m long. All plots were tilled and planted on May 9, 2007 and May 5, 2008 using local standard agronomic practices for each crop species. In each plot, three 30 cm by 30 cm subplots were permanently marked in which emerged weeds were counted twice a week for the first month and weekly thereafter until August in each year. Emerged green foxtail, redroot pigweed, and common lambsquarters seedlings were removed by hand after each counting. Crop leaf area growth was estimated from weekly measurements of total leaf area (using a LI-COR 3100 area meter) from three randomly selected crop plants from each plot. In each plot, daily soil moisture and temperature were measured approximately 2.5 cm below the soil surface using a gypsum block moisture sensor and thermocouple attached to a data logger In each year, the time required for each weed species to reach 50 or 90% emergence was similar ($P > 0.05$) among crop species. However, leaf area index differed ($P < 0.05$) among crops at 38 days after tillage in each year, which was approximately the time to 90% weed emergence. These results indicated that crop canopies did not affect weed emergence rates. Consequently, it was not necessary to modify our hydrothermal-based models to simulate weed emergence under different crop canopies.

Coefficients for hydrothermal-based weed emergence models were determined from growth chamber experiments where weeds emerged in different soil moisture and temperature environments. Four pots filled with field soil were placed in a growth chamber set at day/night temperatures of 30/20, 20/15, or 15/10ºC. For each day/night temperature, different moisture environments were created by watering the pots daily or every two, four or six days. In each pot, daily soil moisture and temperature were measured approximately 2.5 cm below the soil surface using a gypsum block moisture sensor and thermocouple attached to a data logger. Emerged green foxtail, redroot pigweed, and common lambsquarters were counted and removed daily. Iteration methods were used to identify the base temperature and moisture values that minimized the root mean square error (RMSE) associated with empirical functions of weed emergence among the different temperature and moisture environments. The estimated base temperature (ºC)/moisture (g water/g wet soil) values were 0/0.0001, 0/0.03 and 9/0 for green foxtail, redroot pigweed, and common lambsquarters, respectively.

Hydrothermal coefficients determined from the growth chamber experiments were validated using observed weed emergence values in each crop from the 2007 and 2008 field studies. Among the six crop environments, the RMSE ranged from 0.11 – 0.15, 0.11 – 0.16, and 0.21 – 0.29 for green foxtail, redroot pigweed, and common lambsquarters, respectively in 2007 and ranged from 0.12 – 0.18, 0.20 – 0.27, and 0.06 – 0.17, respectively in 2008. These results indicated that the hydrothermal coefficients determined from the growth chamber experiments were adequate to predict weed emergence in several crop species.

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