RETROSPECTIVE PERTURBATION ANALYSIS OF CROPPING SYSTEM EFFECTS ON GIANT FOXTAIL DEMOGRAPHY. Adam S. Davis, Philip M. Dixon and Matt Liebman, Graduate Research Assistant, Department of Agronomy, Professor, Department of Statistics, and Professor, Department of Agronomy, Iowa State University, Ames, IA 50011.

Most agricultural systems are designed without regard to their intrinsic effects upon weed populations. Yet cropping system characteristics may affect weed population dynamics by altering key demographic rates of weeds. We examined the effects of legume green manure and tillage timing upon giant foxtail (*Setaria faberi*) demography using retrospective perturbation analysis of a periodic matrix population model. Retrospective perturbation analysis is used to estimate the contribution of treatment effects on a given demographic rate to overall treatment differences in population growth rate ($\lambda$). In this method, observed variation in a given demographic rate is weighted by the sensitivity of $\lambda$ to changes in that demographic rate. Demographic data were collected for giant foxtail grown in a wheat-corn-soybean crop sequence in the central USA in 2000 and 2001, with either a wheat sole-crop ('W') or wheat/red clover crop mixture ('R') in the wheat phase. Residues from the wheat phase were incorporated either in fall ('FT') or spring ('ST') for a factorial of four cropping system treatments: FT/W, FT/R, ST/W, and ST/R. Demographic rates estimated from the field data included seed survival from October to March ($\sigma_{s(w)}$) and March to October ($\sigma_{s(s)}$), seedling recruitment ($\gamma$), plant survival ($\sigma_p$), fecundity ($\phi$) and proportion of newly dispersed seeds not consumed by seed predators ($\sigma_{s(pred)}$). Deterministic simulations of giant foxtail population growth indicated that there were both interannual and management-induced variations in $\lambda$. The FT/R treatment had consistently low values of $\lambda$ compared to the other cropping system treatments. Retrospective perturbation analysis suggested that $\sigma_{s(w)}$, $\phi$, and $\sigma_{s(pred)}$ were important driving variables for this system. There was more variation in $\phi$ and $\sigma_{s(pred)}$ in response to changing management treatments than for $\sigma_{s(w)}$, leading to greater contributions from $\phi$ and $\sigma_{s(pred)}$ to differences in $\lambda$ between the various management treatments than from $\sigma_{s(w)}$. Retrospective perturbation analysis of matrix population models has the potential to aid the design of integrated weed management systems by elucidating cropping system effects upon weed demography.

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