EVALUATION OF POLLEN CONFINEMENT TECHNIQUES. Raymond W. Arritt, Craig A. Clark, Mark E. Westgate, Eugene S. Takle, Brian Viner and A. Susana Goggi, Department of Agronomy, Iowa State University, Ames, IA 50011.

The expense and time required to perform field studies impose severe limits on the number of pollen confinement approaches that can be tested. We have developed a screening methodology to assess proposed confinement designs so that the most promising designs can then be evaluated in field studies. The screening methodology couples two mathematical models. The first is a hydrodynamic model that predicts airflow and turbulence expected for a hypothetical field design based on the non-hydrostatic, anelastic equations of atmospheric motion. The second is a Lagrangian-stochastic model that predicts the motions of tracer particles in turbulent flow. These tracer particles are interpreted as a sample of the pollen grains that are shed from maize plants in a source plot. The Lagrangian-stochastic model typically employs about 500,000 tracer particles.

We use the screening methodology to study the effect of porous barriers (windbreaks) on the upwind and downwind sides of an isolated maize plot. First, predicted winds and turbulence are obtained from the hydrodynamic model. These wind and turbulence fields are then used in the Lagrangian-stochastic model to track the movement of a sample of pollen grains shed from the maize canopy in the source plot. Pollen deposition is computed as the particles are transported away from their source and fall to a predefined receptor height.

An unexpected result from the coupled models is that a barrier on the downwind side of the source plot has a greater effect than a barrier on the upwind side. Specifically, sedimentation of pollen in the calm zone to the lee of the downwind barrier is more beneficial in terms of restricting fugitive pollen than is the windbreak effect of the upwind barrier. We recently completed a field experiment during the 2005 season to provide observed data for comparison to the screening methodology. If the model results are confirmed by the field results, the tested configuration can be recommended a simple and economical method for decreasing flow of pollen from GM crops to their surroundings. Such confirmation would also give confidence in the utility of the coupled numerical model as a screening tool to evaluate hypothetical pollen confinement techniques.