

## ABSTRACT OF THE THESIS

### Insecticide Contamination and Trophic Relationships in a First-Year, Old-Field Ecosystem

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Studies were conducted on the impact of a high soil residue of diazinon, an organophosphate insecticide, on ecological succession in a 3-acre old field on the Piedmont of New Jersey. The insecticide was applied in May 1967 and 1968 at a rate of 12 pounds of active ingredient per acre each summer. A latin square experimental design was used to analyze the effects of the insecticide on the density, diversity, and production of vegetation; the density and diversity of herb-stratum arthropods; and the trophic relationships that developed on treated and untreated areas.

In 1967 the short-lived insecticide induced a greater density, diversity, biomass, and rate of succession of herbaceous vegetation. Plant differences were believed due to phytotoxic effects of diazinon on an inhibitory plant dominant with a subsequent flourishing of other normally inhibited species on treated areas. Differences failed to develop in the herb-stratum arthropod populations. Radionuclide tracer studies attributed the lack of arthropod differences to similar availability of ragweed (Ambrosia artemisiifolia) biomass on treated and untreated areas. Ragweed was the major food web base of resident

consumers in the old-field community. Vegetation differences were absent in 1968 following the second diazinon treatment. High rainfall during the early portion of the 1968 growing season apparently played a major role in offsetting the influence of insecticide contamination.

Radionuclide tracer techniques were utilized in 1968 to study the temporal dynamics in trophic relationships during the first year of old-field succession. Wild radish (Raphanus raphanistrum) and ragweed, the early and late summer plant dominants, respectively, served as food web bases for most consumers. Aphids and a plant bug species (Miridae) were the chief herbivores on wild radish in early summer, while crickets later consumed the seed crop of this plant species. Grasshoppers and plant bug species were the major ragweed consumers as the species became the dominant producer late in the growing season. Spiders, ladybird beetles, and damsel bugs were the main arthropod predators in the old-field community. Most trophic transfer during the growing season was by sucking insects (i.e., hemipterans, homopterans) which consumed nutrient-rich internal fluids from the reproductive structures of wild radish and ragweed. Most consumer species peaked in abundance when their specific food source became available, with rapid changes in producer-consumer relationships resulting. The dynamic changes in specific feeding relationships permitted further

insight into the methodology of radiotracer techniques for trophic transfer analysis.