Introduction

Equilibrium displacement (ED) models, or their forerunners, have been part of the agricultural economics literature since 1958 (Buse, 1958) and have had recent applications (Piggott et al., 1995, and Sumner, 2005). One reason for their popularity is ease of computation with today's spreadsheet technology. Some researchers have noted their restrictive assumptions as limitations.

Mathematical programming (MP) models have been relatively neglected in the theoretical literature of agricultural economics in recent years, while still being used in applications such as computable general equilibrium models, the ERS Regional Environment and Agriculture Programming (REAP) Model (formerly the USMP Model) and Howitt's positive MP method (Howitt, 1995). Both the equilibrium displacement and MP approaches, individually, have fallen short of adequately addressing some emerging issues. To address the types of adjustments to the agricultural sector currently being raised requires models that:

- Assure feasibility and efficiency of solutions with respect to the underlying physical production and demand functions.
- Simultaneously and gradually adjust to changes in technology, organizational structure, and/or policy without imposing artificial constraints or mechanisms not supported by theory.
- Portray progressive investment in emerging technologies and disinvestment in superseded technologies.
- Allow analysis of large displacement scenarios, often without historical precedent.
- Allow portrayal of pure competition, monopoly/monopsony, or mixed-competition, as the issues and markets may require.
- Can model the simultaneous interaction of detailed Government policies affecting the farm sector.
- Incorporate economic structures synthesized from known physical and economic relationships, such as process technology, production alternatives, demand substitutions, and market linkages.
- Allow calibration to base situations, such as forecasts, baselines, and coordinated studies.
- Allow the user to control which activity levels are predetermined and which are endogenous to the analysis.

This bulletin describes the methodology, structure, and supply-response characteristics of such a model for the U.S. agricultural sector. We have cast the discussion in simple, conceptual terms rather than detailed, technical terms in order to demystify the methodology for researchers not specifically trained in MP. Equilibrium Displacement Mathematical Programming Models (EDMP) combine the equilibrium displacement modeling approach with the positive MP technique, an asset-fixity conceptualization of supply response, and consistent specification of demand relationships for subaggregates such as regions or types of farms (see fig. 1 in box on page 7).