fertilizer program the model determined to be profit maximizing (**Figure 3**). The model determined that optimum P fertilization with the build and maintain approach was to apply 279 lb P_2O_5/A the first year followed by 35.7 lb P_2O_5 for each following crop. This resulted in a per-crop average of 60 lb P_2O_5/A. The profit maximizing decision, however, was to apply 423 lb P_2O_5/A the first year, followed by no P_2O_5 for each following crop, for a per-crop average of only 42.3 lb P_2O_5/A. This is due to the responsiveness of yield to soil test P and not to fertilizer P estimated in the model. Although average soil test P over the 10 crops was virtually equal for the two scenarios, the profit maximizing approach was estimated to be $4.77/A per crop more profitable than the steady state approach. Simulations at longer land tenures showed that the advantage to the profit maximizing approach over the steady state approach diminishes, declining to 0 at an infinite number of crops. For example, at 15 crops, the advantage was $3.13/A per crop (**Figure 4**).

Crop production is affected by many biological, chemical, and physical factors. Any effort at predicting yield will have weaknesses because of the diversity and dynamic nature of the system. Nevertheless, some variables are more important in determining yield than others. For years, research has shown that P fertility is one of the important factors affecting yield. The modeling approach used in this research has further demonstrated the importance of soil test P in maximizing profit in wheat production. Although this research showed benefits to very large initial applications of P fertilizer, followed by a period of mining soil P in the last years of a land tenure, the steady state approach is less risky. That is, for farmers who found they incorrectly estimated land tenure on either the short or the long side, the steady state, or build and maintain approach would likely be the most profitable. Regardless, except for very short land tenures, recommendations were to build and maintain soil test P to the high level to maximize profitability and ensure the long-term sustainability of crop production.

This research represents a non-traditional approach to evaluating and predicting influences on yield that uses field level instead of small plot information. This technique of mathematical modeling, not to be confused with crop growth modeling, uses field level crop yield and fertility data to generate response functions that are used to guide fertilizer management decisions. It showed yield benefits to higher levels of soil P than would be expected from previous calibration research. Nevertheless, the production paradigm shift that is being brought about by site-specific management technologies suggests that this approach merits consideration. More investigation in the area of mathematical yield modeling is needed; therefore, this work should be considered exploratory and caution should be exercised in extrapolating from the specific results of this analysis. BC

Dr. Kastens, Dr. Schmidt, and Dr. Dhuyvetter are with Kansas State University, Manhattan; e-mail: agecon.ksu.edu. Dr. Stewart is PPI Great Plains Director, Lubbock, Texas; e-mail: mstewart@ppi-far.org.

Contact PPI/PPIC/FAR on the Internet

You can reach the Potash & Phosphate Institute (PPI), Potash & Phosphate Institute of Canada (PPIC), and Foundation for Agronomic Research (FAR) on-line. Use one of the following as a URL to reach the web site: **www.ppi-ppic.org** or **www.ppi-far.org**.

There is increasing variety and diversity of information now available in electronic form at PPI/PPIC/FAR, with more additions and changes to the website coming soon. Current and back issues of *Better Crops with Plant Food*, *Better Crops International*, *News & Views*, and other publications are available as pdf files.

For further information, contact PPI headquarters by phone at (770) 447-0335 or fax, (770) 448-0439. BC