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Impact of Alternative Energy Prices, Tenure Arrangements and Irrigation Technologies on a Typical Texas High Plains Farm

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- Full Text

Irrigation is a major contributing factor in crop production on the Texas High Plains. It is responsible for greatly increasing crop production and farm income for the region. Two factors, a declining groundwater supply and increasing production costs, are of primary concern because they impact on farm operations and producer economic viability.

A recursive linear programming model for a typical Texas High Plains irrigated farm was developed to evaluate expected impact of price changes, tenure and new technology. The model includes a Fortran sub-routine that adjusts irrigation factors each year based on the linear programming solution of the previous year. After calculating new pumping energy requirements, well yield, and pumping lift, the Fortran component updates the linear programming model. This procedure continues automatically to the end of a specified planning period or to economic exhaustion of the groundwater, whichever occurs first.

Static applications of the model, in a deep water situation, showed that a natural gas price increase from $1.50 to $2.20 per thousand cubic feet (mcf) would result in reductions in irrigation levels. Irrigation was terminated when the price of natural gas reached about $7.00 per mcf. In a shallow water situation, much higher natural gas prices were reached ($3.60 per mcf) before short-run adjustments in farm organization began to occur. Under furrow irrigation, irrigation was terminated when the natural gas price reached $7.00 per mcf. Increased natural gas prices impact heavily on returns above variable costs (up to 15 percent reductions) for a 60 percent natural gas price increase. The effects of rising natural gas prices over a longer period of time were more significant. Annual returns (above variable and fixed costs) were reduced by as much as 30 percent, and the present value of returns to water was reduced by as much as 80 percent as the natural gas price was increased annually by $0.25 per mcf (from $1.50 per

mcf). The economic life of deep groundwater was shortened by as much as 18 years.

Renter-operators are even more vulnerable to rising natural gas prices than are owner-operators. With rising natural gas prices, profitability over time for the renter is low. As natural gas prices continue to increase, the greater will be the incentives for renter-operators to seek more favorable rental terms such as a sharing of irrigation costs.

With the problem of a declining groundwater supply and rising natural gas prices, an economic incentive exists for producers to find new technologies that will enable them to make more efficient use of remaining groundwater and of natural gas. Substantial economic gains appear feasible through improved pump efficiency. Increasing pump efficiency from 50 to 75 percent will not increase the economic life of the water supply, but can improve farm profits over time; e.g., the present value of groundwater was increased 33 percent for a typical farm with an aquifer containing 250 feet of saturated thickness and 15 percent for 75 feet of saturated thickness.

Improved irrigation distribution systems can help conserve water and reduce irrigation costs. Results indicate that irrigation can be extended by 11 or more years with 50 percent improved distribution efficiency. In addition, the increase in present value of groundwater on the 1.69 million irrigated acres of the Texas High Plains was estimated to be $995 million with 50 percent improved efficiency.

Limitations in borrowing can substantially reduce annual net returns. This analysis suggests that the farmer can economically justify very high costs of borrowing rather than a limitation of funds available for operating expenses.

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