Experience in Implementing Economic Incentives to Conserve Water and Improve Environmental Quality in the Broadview Water District, California

3. Complementary Economic Incentives

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The increasing block-rate pricing program was the first of several components of the economic incentive program implemented at the Broadview Water District during the 1980s and 1990s, to encourage farm-level improvements in irrigation water management. Other components include: 1) Tiered water pricing for the pre-irrigation of cotton and cantaloupe fields, 2) Farm-level assignment of the District’s annual water allocation to individual farmers, and 3) Low-interest loans for the purchase of mechanical irrigation systems. In addition to these incentives, the manager and staff of the District have worked closely with farmers and their irrigation supervisors to identify farm-specific opportunities for improving water management. Those efforts have been enhanced by collecting and maintaining field-specific irrigation data throughout the District. The data include the crops planted on each field, the volume of water applied during each irrigation event, and the number of irrigation events conducted each year.
Tiered Prices for Pre-Irrigation

The initial increasing block-rate pricing program implemented in Broadview in 1989 included two prices of water and tiering levels that varied by crop. The tiering levels pertained to the total volume of water delivered throughout the season. That program was very successful and it motivated notable improvements in water management in the District. A substantial reduction had been achieved in the amount of deep percolation generated when irrigating during the summer. However, a large amount of deep percolation was still generated during winter months, resulting in excessive volumes of water collected in subsurface drains. The primary cause of the excessive deep percolation was the pre-irrigation of cotton and cantaloupe fields in late fall and early winter, particularly in years when substantial rainfall was received after pre-irrigating the fields.

Discussions involving the District Manager and several Board Members suggested that a new set of tiering levels pertaining specifically to water deliveries for pre-irrigating cotton and cantaloupe fields was needed to encourage farmers to reduce the volume of water applied during those events. The original tiering levels that pertained to annual water deliveries provided some motivation, but the Board of Directors hoped to generate greater focus on pre-irrigation events with a new, supplemental pricing structure. That structure includes the same two water prices, $16 and $40 per acre-foot of water. The higher price becomes effective when pre-irrigation deliveries exceed an average depth of 0.75 feet. As expected, the new program encouraged many Broadview farmers to reduce the length of runs when using siphon tubes or gated pipes, while other farmers began using sprinkler systems for pre-irrigations. Some farmers report that using sprinklers for pre-irrigation enables them to obtain a more uniform leaching of salts than is possible when using surface irrigation methods.
Farm-level Assignment of the Water Allocation

The Broadview Water District was established in the 1950s to obtain a water supply contract with the U.S. Bureau of Reclamation. The contract provides Broadview with 27,000 acre-feet of water each year, provided that water deliveries to Broadview and other districts in the Central Valley Project (CVP) are not reduced for any reason. For most of its history, through the 1980s, Broadview had received a full water supply. The 27,000 acre-feet and the volume of surface water and subsurface drainage water re-circulated in the district were sufficient to meet all farm-level demands. There was no need to allocate the District’s annual water supply among individual farmers because all farmers could obtain as much water as they desired each year.

Broadview’s water supply situation changed markedly in the early 1990s. Persistent drought conditions in California, combined with public concerns regarding the supply of water available for wildlife in major river systems, resulted in sharp reductions in water deliveries to agricultural districts. Broadview’s water supply from the Central Valley Project was reduced by 50% or more from 1990 through 1994. In particular, Broadview received only 50%, 25%, 25%, 50%, and 42% of its annual CVP water supply during 1990 through 1994, respectively. Broadview farmers depend almost entirely on their CVP water supply to support irrigation. Groundwater wells in the District were shut down many years ago when the salinity and boron concentrations in groundwater reached levels that are not suitable for crop production. Broadview farmers can purchase or lease water from farmers in other districts in some years, but that water is scarce and expensive in years when CVP supplies are reduced throughout the region.

The persistent reduction in Broadview’s water supply during the 1990s made it necessary to begin allocating water among individual farmers. Water allotments are determined by dividing the District’s supply by the number of acres in the District, and then allocating water to farmers
according to the size of their farms. Proportional reductions in the District’s annual water supply are reflected in the farm-level water allotments. Farmers wishing to increase the size of their annual water supply may purchase or lease water from farmers in Broadview and other districts. The District manager works closely with farmers to locate affordable, supplemental water supply. Some farmers who are members of more than one water district have been able to move a portion of their water allotment from another district into Broadview, in some years.

Farm-level assignment of Broadview’s water supply has motivated improvements in water management by establishing property rights to each farmer’s allocation of water, and by allowing farmers to sell or lease their allocation to other farmers. In some years, farmers also may carry a portion of their water allotment from one water year to the next. These features of the program encourage farmers to ensure that the incremental gain from irrigation is sufficient to offset both the current cost of water and the opportunity costs of water, both in the present season and in the subsequent year. Most farmers in Broadview have reduced the volume of water applied during irrigation events. The number of events has increased for some crops, but the average irrigation depths and the total water applied have declined substantially. Many farmers also reduce uncertainty regarding next year’s water supply by carrying over a portion of the current year’s water allotment.

**Low-Interest Loans for Irrigation Systems**

In 1992, the Broadview Water District implemented a low-interest loan program to encourage farmers to purchase sprinkler and gated pipe irrigation systems. Funds for the program were provided by the California State Water Resources Control Board. The 3.2% interest rate on the loans was much lower than the prevailing market rates of 8% to 10% for capital improvements. The repayment period on the low-interest loans was 10 years, but many of the participating farmers
repaid the loans within five years. Twelve of the 20 farmers in Broadview participated in the loan program during its initial year (1992), and 4 more farmers joined the program in 1993. By 1994, Broadview farmers had purchased more than 100 km of sprinkler system field pipe, 21 km of sprinkler mainline pipe, and 31 km of gated pipe. Farmers also had purchased 8 booster pumps, 5 power-take-off pump units, and 5 pipe trailers. The total cost of equipment purchased in the program was $1.4 million, or about $142 per acre.

The low-interest loan program enhanced the pace at which farmers switched from using siphon tubes to using gated pipe and sprinkler systems for many irrigation events. The tiered water pricing programs, the reduction in annual water supplies, and public concerns regarding the collection and discharge of subsurface drainage water in the region also contributed to the changes in irrigation practices in Broadview. The improvements in technology enabled many farmers to irrigate a larger portion of their land during the drought-impacted 1990s, than would have been possible with siphon tubes. In addition, crop yields were maintained or enhanced during those years, despite the persistent reductions in the District’s annual water supply.

**Summary**

The Broadview experience demonstrates that farmers will respond in positive ways to economic incentives that encourage improvements in water management. Water prices and allocations that reflect scarcity conditions will motivate farmers to increase the values generated with limited water supplies. Financial incentives will encourage farmers to invest in new equipment that enables them to enhance the uniformity and effectiveness of irrigation events. In addition, the long-term measurement of field-level water deliveries and the collection of data describing field-specific irrigation events greatly enhance the assistance provided by district personnel to farmers and their irrigators, as they seek to implement optimal responses to economic incentive programs.
Additional Reading


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