200 bushels of corn with only 12 inches of irrigation a 'no-go' in the High Plains, three-year-study finds

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A Texas A&M AgriLife Research study determined on a multiple year basis, the High Plains region doesn't receive enough rain to reduce irrigation on corn to only 12 inches and still produce 200 bushels per acre. Credit: Texas A&M AgriLife Research photo by Kay Ledbetter

Three years of a research study to determine if 200 bushels of corn can be produced with a maximum of 12 inches of added irrigation water has one conclusion – not in normal or lower-than-average rainfall years.

Texas A&M AgriLife Research has completed a limited-irrigation 12-200 corn production assessment study at the North Plains Research Field near Etter in conjunction with the North Plains Groundwater Conservation District in Dumas.

The study's purpose was to evaluate the field-based potential of producing 200 bushels of grain corn using only 12 pumped inches of irrigation water per acre, said Thomas Marek of Amarillo, AgriLife Research irrigation engineer and North Plains Research Field superintendent.

"We used the best management techniques we knew at the time to try to accomplish the targeted production goal," Marek said.

The multi-year effort was a team approach involving support from AgriLife Research, the North Plains water district, U.S. Department of Agriculture-Agricultural Research Service water management unit at Bushland, the Ogallala Aquifer Program and the Texas Corn Producers Board.

"We determined the probability of receiving the 10.5 inches of rainfall during the growing season needed to combine with the 12 inches of irrigation water to meet the crop's needs for a 200-bushel per acre production is unlikely," Marek said.

Implementing a rigid water reduction measure to only 12 inches could have significant economic impact to producers, he said. The probability of receiving the necessary rainfall to supplement that irrigation and stored soil-profile water is less than 50 percent.

"We wanted to collect this data so we could evaluate the feasibility of sustainable production and to address the economics of the production practice for producers, in case this effort was put into regulation,"

Marek said.

A partial budget analysis showed that on a 125-acre corn field, the estimated loss in net returns would be $2,390 in the best-case scenario. That is when only the 25 bushels per acre reduction is considered from full irrigation yields of 225 bushels per acre to the limited 200 bushels per acre.

But if the producer applied the typical 22 inches of irrigation water and received the normal rainfall, production would be 250 bushels per acre. This would mean the potential loss could be as much as $21,450 for a 125-acre circle.

If the rain doesn't materialize, as in two of the past three years, yields are significantly reduced by the limit of 12 inches of irrigation water, and the economic loss could be tremendous for the corn producer, Marek said.

While yields improved somewhat in 2012 over the 2011 season, he said, the three commercially available corn hybrids thought to be top producers only averaged 100 bushels an acre in 2012. The primary reason was the expected seasonal rainfall of 10.5 inches didn't materialize – less than 6 inches fell during the growing season, Marek said.

In spite of the results, the study was a success, Marek said. Not only did it disprove the capability of being able to sustainably produce 200 bushels per acre on such a limited-irrigation basis, it provided valuable data on limited irrigation water management and characteristic traits of the corn hybrids.

"We think this three-year 12-200 study gained us extremely valuable data regarding previously unknown data portions of the corn production

function for the region," Marek said. "Much of the characterization information regarding the specific varieties can potentially be related to other 'families of corn hybrids' and to those being developed."

For instance, he said, the data gathered indicated that one of the varieties had a tendency to be a better forage variety than a grain-producing variety.

Several production management practices were determined as being key factors during the course of the study also, Marek said. They include:

- Irrigation depth per application generally should be increased to the point that application runoff either does not occur or is minimal to reduce soil evaporation losses, but should be limited to depleted water within the soil root zone profile.
- Upper soil profile cracking should be managed to the degree possible with irrigation applications and allow for maximum opportunity regarding rapid infiltration potential should a large rainfall event occur.
- Delayed corn planting should be implemented to shift the peak corn evapotranspiration requirement and to take advantage of reduced evapotranspiration requirements typical in the early fall period.

Marek said this study showed the potential range of climatic conditions that can and do occur in this region and how they can impact production.

"The policy and regulatory insight towards both the cost to producers and benefit to water conservation cannot be overstated," he said. "The data derived from this and other similar research and demonstration efforts strongly support sensible groundwater regulations and rules of

water conservation management, not only for the region but throughout the western U.S."

Marek said more limited irrigation research is needed "as we utilize the Ogallala Aquifer to support our regional economy. Next, we should further study rainfall probabilities needed for sustained limited-irrigation corn production, since corn accounts for over 60 percent of the agricultural water used within the region."

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