Nitrogen Management

Specialist Studies Fine Details For Growing Center Pivot Rice

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PORTAGEVILLE, MO

Nitrogen management in center pivot rice was discussed recently by Dr. Gene Stevens of the University of Missouri Delta Center in Portageville.

"We're looking at the amount of water and nitrogen it takes to produce high rice yields with center pivot irrigation systems" he said. Rice fields are normally flood irrigated but Stevens is finding ways to expand rice production to fields that can't be flooded.

Stevens explained that careful management is needed to head off problems with pivot rice. Yield losses from blast disease can be greater in sprinkler irrigated rice because of the wetness of the foliage after watering.

"In the 1980s, several researchers studied pivot irrigated rice but gave up on the concept because of low yields resulting from blast," he said. "Back then they did not have effective fungicides and Blast resistant varieties that we have now.

"At Portageville, we did not find any blast in 2008. But, in 2009, plots were decimated in non-resistant varieties such as Wells and Francis with no fungicides. In plots planted with the blast-resistant 'Templeton' variety or a resistant hybrid, rice yield ranged from 160 to over 200 bushels per acre. Yields were even high in blast susceptible varieties when fungicides were applied by chemigation."

The amount of water and nitrogen it takes to produce high rice yields with center pivot irrigation systems is being presented by Dr. Gene Stevens, Crop Production Specialist, University of Missouri Delta Center. Photo by John LaRose, Jr.

An injection pump was used at early boot stage to deliver Quadris fungicide in irrigation water through the pivot.

"Since center pivot rice fields are not flooded, we don't really have to be concerned about sheath blight spores floating up and infecting the rice stems," he explained. "The breeders can get sheath blight resistance or blast resistance in a variety, but they have a hard time getting both in the same variety. So, if you can get sheath blight resistance O.K., but for this technology focus on the blast."

The research project was begun at Portageville in 2007 using an 18-acre center pivot donated by Mid-Valley Irrigation. Stevens is cooperating with Jim Heiser, a weed scientist at the Delta Center, and Dr. Earl Vories, USDA-ARS irrigation engineer. The team had a steep learning curve at the beginning.

"Our first challenge was weed control, in particular palmer amaranth," Stevens added. "We assumed that the Clearfield technology using Beyond or Newpath herbicides would give good broadleaf control. We quickly discovered that the pigweeds in our field were ALS herbicide resistant. We might as well have been spraying water on the pigweeds. Fortunately, Jim Heiser was able to salvage the study by using a different chemical.

"In 2009, our main program was Command pre-emergence followed by applications of Stam and Facet when the pigweeds were in the 2- to 4-leaf stage. Jim scouted the field closely and had the sprayer ready to go."

The criticalness of spray timing can't be overemphasized. Sometimes when farmers spray weeds in traditional rice fields they make them sick early, and then finish them off by flooding; whereas with pivot rice you have to get them graveyard dead or they will come back.

Dr. Stevens' main focus is evaluating nitrogen fertilizer programs using dry urea and weekly fertigation applications with 32 percent UAN through the center pivot. He learned that splitting N with fertigations produced more uniform plant height and green color rice across the field than a 2-way split with urea alone. The best yielding nit fertility program was a dry urea application at first tiller growth stage followed by five small fertigations spaced in one week intervals.

Irrigation has also been a learning process.

"In 2007, basically we went out there and tried to kick the dirt and if it was muddy we thought we had enough water," he explained. "In 2009, I worked closely with Dr. Vories who modified the Arkansas Irrigation Scheduling Program. The program wasn't originally designed for center pivot rice but he cooperated with scientists at University of Arkansas to come up with crop coefficients for us, which gave me more confidence that we were doing it right."

To double-check the program, Stevens installed soil moisture sensors in the ground that were wired back to the internet. Dr. John Travlos at MU-Columbia set an electronic system to call my cell phone if the soil got too dry.

The center pivot rice project will continue through 2010. The labor and the supplies for the project are being provided from a grant by the Missouri Department of Natural Resources from parks, soil and water sales tax.

"DNR is interested in ways to reduce fertilizer use and conserve water and energy," Stevens said. "I think we're showing that we can conserve nutrients and water by using a center pivot."

A major benefit of growing center pivot rice is that it can be grown in fields that are not graded or can't hold water.

"Missouri has a lot of fields where we could increase our rice acreage with this type of technology and we couldn't before," he said. "Dr. Kelly Nelson at the MU Greenley Research Center at Novelty, Mo., showed that rice can be grown successfully almost to the Iowa border. Right now we're limited by the soils in flood irrigated rice. The field where our Portageville pivot test is located is silt loam soil intermingled with large sandy areas. Several years ago we had a drip irrigation rice test right next to the pivot field. We tried to have control plots which were flooded for comparison. Each morning we pumped water to flood the field, then by lunch time it was dry again. Water is plentiful in the Bootheel but flood irrigation was not feasible in this field."

Stevens concluded, "So between the weed, nitrogen, water, and blast experiences of 2008 and 2009, we have learned a lot about growing rice with a center pivot." Δ

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