Texas

Research Tracks Phosphorus Dissipation Patterns in Rice Production

By Garry N. McCauley

Most Texas rice production is concentrated in areas near the Gulf Coast. It follows, then, that the crop . . . specifically flood water leaving rice fields . . . can impact on surrounding areas, including coastal waters. This study was established to evaluate the environmental impact of nitrogen (N), phosphorus (P) and potassium (K) fertilization of rice grown under flood management. Data presented in this article deal with P fertilization.

A RECENT REPORT published by the U.S. Department of Interior concluded that the Matagorda Bay of Texas is one of the most polluted areas in the U.S. The report was based on a simulated computer model. No sampling, analysis or field trials were done to support assumptions made by project leaders, who had no apparent knowledge of rice irrigation and management.

However, published information such as that included in the report can be successfully refuted only by good scientific data. Earlier small plot research conducted by Texas A&M University scientists showed that with proper pesticide and water management there is little potential for nonpoint source runoff from rice fields. Unfortunately, those studies are 20 years old and did not include P and K.

Extensive research has shown that natural or artificial vegetated wetlands are effective water purification systems. Small, contained vegetative wetlands have proven effective in the decomposition of all agricultural pesticides. A detailed design evaluation reveals that a rice field is a temporary vegetated wetland. One could assume that with sufficient water hold or flow through time, a rice field can purify the inflow water, dissipate all nutrients, and decompose all pesticides. Research is needed to verify these assumptions. This study was designed to define the degradation patterns and estimate nonpoint source runoff of P and K.

Twenty producers in a four-county area (Colorado, Jackson, Matagorda and Wharton) were recruited by county Extension agents to participate in the study. Producers took a water sample at the inlet and outlet of each test field following each rain and flush irrigation. After flood establishment, inlet and outlet samples were taken when the flood reached the bottom of the field and at three day intervals until four samples were taken or at least 12 days after flood establishment. It was assumed that P (and K) would be dissipated from flood water within 12 days after the flood had reached the bottom of the field.

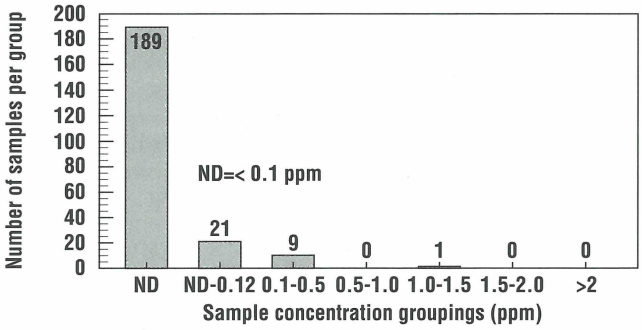

Figure 1. Phosphorus concentration distribution of 220 rice field water quality samples.

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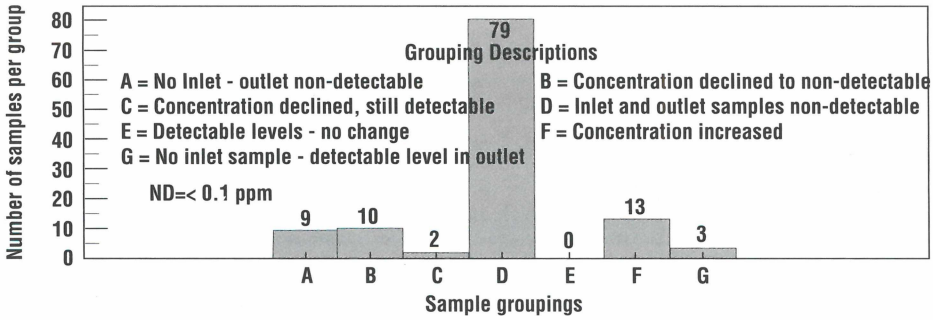

Figure 2. Distribution of inlet-outlet sample change in P concentration for 116 rice field water samples.

The 20 producers took a total of 220 samples at 116 different times. There were 104 matched inlet and outlet samples, with 12 outlet samples being taken when no inlet water was available. Phosphorus concentrations were very low, as shown in **Figure 1**. Only one sample exceeded 0.5 parts per million (ppm) P, while 189 (86 percent of all samples) contained no detectable P. To allow for detailed interpretation, samples were broken into seven groups.

A = No inlet – outlet non-detectable
B = Concentration declined to non-detectable
C = Concentration declined, still detectable
D = Inlet and outlet samples non-detectable
E = Detectable levels – no change
F = Concentration increased
G = No inlet sample – detectable level in outlet

Studying the seven groups reveals that A through E can only be interpreted to have a neutral or positive environmental impact. Group F would be a negative environmental factor, the magnitude depending on the amount of concentration increase. The impact of G group can not be determined because there was only one sample taken, but it is assumed to be negative (conservative interpretation).

Figure 2 shows that there were 13 F samples and 3 G samples (14 percent of the total) that could be considered detrimental to the environment.

Figure 3 illustrates how much those 16 samples increased. Ten samples increased less than 0.1 ppm and 5 samples increased by 0.1 and 0.2 ppm. The remaining sample appears to have increased by 1.1 ppm. In reality this was a single sample where there was no

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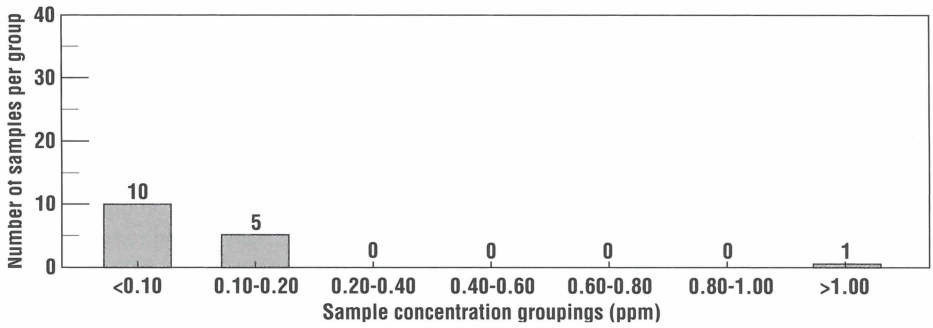

Figure 3. Distribution of P concentration increase from inlet to outlet for 16 rice field water samples that increased.