Kentucky

The Impending "Phosphate Pollution Crisis"... One Man's Opinion

By K.L. Wells

I HAVE BEEN LISTENING and reading for the past couple of years or so about the dire consequences that this nation will face unless we do something about the phosphate contamination of our surface and groundwaters from agricultural practices. I'm led to believe that such contamination is taking place because farmers are: 1) overusing phosphate fertilizers, 2) overloading soils with applications of animal manures, 3) allowing excessive erosion of surface soils, and 4) using conservation tillage practices.

These "concerns" are being manifested in calls for more research on understanding and abating the contamination practices, and for more regulatory measures to enforce or encourage practices designed to control use of animal manures and phosphatic fertilizers and to minimize soil erosion. The USDA's Soil Conservation Service (SCS) has already developed a "phosphorus index" for the nation's soils and is in the process of implementing this index into their Technical Guides. The October 1993, issue of *Water Quality Technology Notes,* a SCS newsletter, states:

> "PHOSPHORUS INDEX: The technology of the Phosphorus Index has been released to the four National Technical Centers for their development of a regional technical note. The technical notes will be the basis for incorporation of the technology into the Field office Technical Guide. The Phosphorus Index is a matrix tool that can be used to assess the potential for phosphorus movement from a landscape or field site. The process uses readily-available field data to rate the site condition for potential phosphorus movement, or loss."

As a person who has lived and worked as an Extension soil scientist in a naturally "high phosphate" environment for the past 25 years, I have been somewhat bemused by all this "concern." I feel this way because of my observations and experience in Kentucky's Inner Bluegrass, a physiographic area in which dominant upland soils have developed in place from phosphatic limestone rocks of the Ordovician period. Indeed, soil tests from such soils show that they commonly contain 100 to 500 parts per million (ppm) of available phosphorus (P), have been in that range since the advent of soil testing, and remain there even without use of commercial phosphatic fertilizers. In fact, the underlying limestone at some sites within this area is high enough in P that it was mined years ago for extraction of phosphate. The Central Basin of Tennessee is a similar area.

In checking research results from studies at the University of Kentucky during the past 10 to 15 years, it appears that the soluble phosphate-P content of groundwater and streams in Kentucky's Inner Bluegrass Area is generally within the range of 0.1 to 0.5 ppm, and commonly may contain 0.3 to 0.4 ppm. These levels, I'm told, can result in eutrophication of surface waters. In fact, eutrophication of many streams and ponds commonly occurs in Kentucky's Bluegrass Regions,

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particularly during the summer. Apart from the unsightliness of scum on a pond or aquatic plant growth in ponds and along the edges of some creeks, it has not been apparent to me that we have a "problem" due to phosphate content of our water in this area. In fact, the Bluegrass area is widely considered to be one of the more picturesque agricultural landscapes in the nation, producing many of the nation's best thoroughbred horses. It is also an important region for production of many breeds of fine beef cattle. I am also unaware that there are either economic or health problems in treatment of streamwaters and municipal reservoir waters in this region due to phosphate content or eutrophication. I pay $2.75 per 1,000 gallons for water taken from the Kentucky River by a commercial water company. The water is treated, and piped into my home, and the price seems to me rather reasonable for high quality water.

In plain words, despite living and working in an area that is contaminated with phosphate by nature, I fail to grasp the urgency and need for such a "national concern" about phosphate content of water. As a matter of fact, I find it somewhat contradictory in that a huge amount of taxpayers' money has been spent by our government to stop erosion, and that the U.S. Farm Bill now requires participants in USDA farm programs who farm "highly erodible" lands to use it according to conservation plans which encourage and often require "residue management" practices. And now, these participants are being told that such practices increase phosphate content of water runoff. This fact has been confirmed by our own research here at the University of Kentucky. However, total volume of surface water runoff is greatly reduced by "residue management" practices. Because of this, the actual amount of phosphate lost in surface runoff from fields in conservation tillage systems, especially no-till, is only a fraction of that lost from clean tilled fields even though the phosphate concentration of that runoff can be much higher. So, why the concern about the high phosphate concentration in surface runoff from fields receiving little or no tillage?

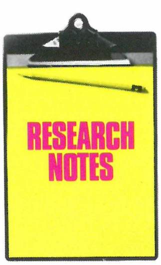
As to whether farmers are overusing commercial phosphatic fertilizers, tonnage figures show that such use has peaked and is declining in the U.S. Based on soil test summaries, it is apparent that some farmers have used commercial P fertilizers during past 40 years to enrich the plow layer of many fields from low to high levels of available P. However, since inorganic phosphates have very low solubilities, their loss from dissolution in surface runoff or leaching of water has never been considered to be of concern except for that contained in the sediment load during soil erosion.

Phosphorus in animal manures is another story. It has long been recognized that the use of animal manures adds to and enhances the availability of residual soil P due to phosphorus being retained in organic molecules which are more water soluble than inorganic phosphates. The concentration of large numbers of animals in some localities has generated large amounts of manure which are stored and spread locally. This sometimes results in overloading of manure on nearby fields, and sometimes results in storage facilities washing or overflowing directly into streams and ponds. It is not unreasonable to expect that phosphate content of surface runoff and groundwaters would be increased by the presence of large volumes of organic P in manure. While this represents a pervasive problem to individual operations or localities where concentrations of such operations exist, it by no means represents U.S. animal production systems in general. For this reason, it would seem appropriate to me that plans for regulation of manure storage and disposal be directed to such operations and localities rather than a state or the nation as a whole. Rumors about this situation abound, but one I've heard being considered in a nearby state would prohibit spreading of manure on any soil testing higher than 30 ppm available P. Such a regulation here in Kentucky's naturally highly phosphatic Inner Bluegrass would decimate animal production in the region.

The main idea I've tried to present here is that, in my opinion, non-point source phosphate contamination of groundwater and surface water deserves a much lower priority for national concern about the environment than it is receiving. Surely there are environmental concerns about water quality that deserve more national concern. For those who feel that a "high phosphate" environment is of paramount concern, I would invite you to visit Kentucky's Bluegrass or Tennessee's Central Basin regions and see for yourself what existence is like in a naturally high phosphate environment.

As an epilogue, I would point out that I do not advocate overuse of fertilizer, point-source disposal of manure, or soil erosion. What I'm really suggesting is use of some common sense in development of national issues to which regulatory responses can often unduly affect our nation's agricultural system.

I'll close with two challenges: 1) If there is a great nationwide concern about this situation by the scientific community, the Council on Agricultural Science and Technology (CAST) should be asked to develop a white paper assessing the situation to ascertain its importance. 2) Before implementing a "Phosphorus Index" for soils into its Technical Guides in the U.S., the SCS should widely field test this index and obtain "ground truth" of its validity and effects it may have on prevalent and recommended agricultural practices. ■



Oklahoma

Ammonium and Nitrate Nitrogen in Soil Profiles of Long-Term Winter Wheat Fertilization Experiments

OBJECTIVES OF THIS STUDY were to evaluate the long-term response of winter wheat to nitrogen (N) fertilization and to determine the accumulation of ammonium-N (NH_4-N) and nitrate-N (NO_3-N) in the soil profile.

Four long-term experiments (greater than 18 years) on soils that had received selected annual N fertilization were sampled. Soils were either silt loam or clay loam in texture. At each location, one soil core 1.75 inches in diameter and to a depth of 8 feet was taken from plots receiving variable N rates. Each core was segmented into 12-inch increments and analyzed for NH_4-N and NO_3-N. Results were as follows:

- At all locations, NH_4-N levels were not significantly different from the zero N treatment when N was applied at or below yield goal requirements (80 to 40 lb/A N). Similar results were obtained for NO_3-N.
- When N rates exceeded 80 lb/A, NH_4-N levels in the upper 6 inches increased above the zero N treatment, while there were no differences in subsurface layers. At the excessive N rate, NO_3-N did accumulate at depths greater than 12 inches.

In summary, researchers found that N accumulation . . . either as NH_4-N or NO_3-N . . . is not a problem in soils where recommended N fertilizer rates are applied. ■

Source: Westerman, R.L., R.K. Boman, W.R. Raun and G.V. Johnson. 1994. Agron. J. 86:94-99.