Bacteria Break Kidney Stone-Oxalate Link

Oxalate is a substance that can lead to the formation of kidney stones if absorbed from the diet too quickly.

At the National Animal Disease Center in Ames, Iowa, ARS microbiologist Milton J. Allison and chemist Albert L. Baetz have helped lay the groundwork for medical research that may offer some relief to people who suffer from kidney stones.

Some 20 years ago, Allison was one of the first researchers to study bacteria that can break down oxalates in livestock forages. Now, the two researchers are concentrating on an oxalate-degrading bacterium called *Oxalobacter formigenes* that lives in the digestive tracts of cattle, sheep, and humans.

"This bacterium consumes only oxalate for its energy and growth. It is able to live in the large intestine of humans—but not in the small—because it can't tolerate any amount of air," says Allison.

He and Baetz have isolated two oxalate-busting enzymes from the bacterium. Their collaborative research with Peter Maloney, a microbiologist at Johns Hopkins University in Baltimore, Maryland, provided an understanding of how the bacterium gets its energy and grows in the anaerobic environment of the rumen of cattle and the large intestine of humans.

Studies on the oxalate-degrading bacterium at ARS' Poisonous Plant Research Laboratory in Logan, Utah, helped solve a mystery for western cattle ranchers who have lost livestock to the lethal halogeton plant, also loaded with oxalate.

Halogeton infests rangeland in seven western states. Cattle and sheep grazing freely on the weed become severely ill and die. But researchers at Logan showed that sheep could safely graze small amounts of this toxic plant because bacteria in their stomachs break down the oxalate, making it harmless. (See "Grazing Poisonous Plants," *Agricultural Research,* May 1986, pp. 6-10.)

Medical researchers suspect some humans may ward off formation of kidney stones because their intestines contain high numbers of oxalate-degrading bacteria. But like the cattle which consumed and absorbed too much oxalate at once, other people may have difficulty when too many oxalate-containing foods are eaten.

"Several other researchers have published data supporting the concept that oxalate use by these intestinal bacteria may protect people against kidney stone disease. But further medical studies to examine this relationship are needed," says Allison.—By **Linda Cooke,** ARS.

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Nitrogen Needs Assessed More Accurately

Farmers routinely use soil-testing laboratories to help determine how much nitrogen, phosphorous, and potassium fertilizers their farms need.

Apply too little and crop yields are limited, reducing income. Apply too much and risk polluting the environment, particularly with nitrogen fertilizer.

But soil labs that farmers contract with do not always give accurate nitrogen fertilizer recommendations; they generally measure only the amount of inorganic nitrogen in the soil samples that farmers provide. There isn't a good mechanism for the labs to use to factor in the amount of nitrogen that is released naturally by microbial degradation—nitrogen mineralization—when soilborne bacteria chew up organic matter such as residues left from the previous crop.

But that may change, now that Agricultural Research Service scientists have found a way to more accurately assess microbial breakdown of straw and stalks. The new method cuts in half the error between measured and predicted nitrogen mineralization rates.

"Using more accurate nitrogen fertilization recommendations will help farmers nationwide, and it could reduce nitrogen fertilizer costs by $10 to $30 per acre," says Merle F. Vigil, an ARS soil scientist at the Central Great Plains Research Station in Akron, Colorado. "And more accurate rates will help reduce the environmental threat of excess nitrogen seeping downward toward water supplies."

The new technique uses computers to predict the effect of temperature on mineralization rates in soils.

The scientists collected data from soils mixed with different crop residues. They took measurements for up to 160 days at four temperatures ranging from 40°F to 90°F.

They plugged that data into a computer model called MINIMO—for Mineralization and Immobilization—that was originally developed by scientists in Israel, The Netherlands, and the United States. It is a subroutine of CERES-Maize, developed by ARS, Texas A&M, and Michigan State University scientists.

"The technique will be of more benefit to farmers in the East and Midwest—where soils contain more native organic matter—than in the more arid areas of the western United States," says Vigil.

Vigil is now working on ways to help soil-testing labs give more accurate assessments of how much cattle and swine manure, plowed-under green crops like rye and alfalfa, or sewage sludge help meet crop fertilizer requirements and reduce the need for commercial sources.—By **Dennis Senft,** ARS.

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