



BY JOY BAUM

SOME PEOPLE COLLECT STAMPS OR RARE COINS. KINCHEL DOERNER COLLECTS CHICKEN LITTER.

Dr. Doerner, an associate biology professor at Western Kentucky University, has been working on bacteria associated with the gastrointestinal tracts of animals his entire career. His most recent endeavor is working on a USDA contract to remediate phosphate in chicken litter. This is his first time working with poultry.

"When poultry are fed, their diets are high in calcium phosphate to meet the requirements for rapid bone growth," Dr. Doerner said. "The phosphate comes out of the bird into the litter, which is often used as fertilizer. The problem is, phosphate runs off very quickly into the water. Phosphate causes large algal blooms that prevent photosynthesis from occurring in other organisms. The end result is less oxygen in the water, which in turn kills animal life, such as fish. After this it's just basically polluted water."

Dr. Doerner is trying to come up with a solution for the problems.

"The idea is to figure out how to prevent or delay the phosphate from getting into the water. If you can sequester phosphate on the inside of the bacterial cell, it might delay phosphate runoff," he said. "This is a big problem because Kentucky soil is very different. We live in a karst area, and the topsoil is very thin. Whatever is there, it will potentially pass very quickly through that topsoil into the water system."

The poultry industry in Kentucky is expanding, and Southcentral Kentucky is in a high poultry production area. In order to reduce trucking costs and time for bird transport, chicken growers have to be located in a fifty-mile radius of the

A Whole Lot of Chicken...Whatever



Dr. Kinchel Doerner and his students are trying to “stress” poultry microorganisms in hopes of causing polyphosphate formation, bottling up the phosphate on the inside of the bacterial cell.

slaughterhouses. This means that all the waste is generated in a relatively small area. In addition to the high phosphate content, the litter is low in nitrogen. If the farmer applies the manure at a rate based on nitrogen content, then the phosphate is applied in vast excess, he said. This potentially exacerbates the pollution problem, and could cause the Federal or state government to dictate new manure application rates based on the phosphate concentration in manure. “It wouldn’t be nearly as effective. If the manure application rates are based on phosphate content, then farmers will have manure stores building up without a means to get rid of the manure,” Dr. Doerner said.

One way Dr. Doerner and his students have tried to solve the problem of phosphate runoff is by applying stressful growth conditions to poultry microorganisms in hopes of causing polyphosphate formation.

“What’s stress to a microorganism? The same thing that is stress to you,” he said. “Drinking saltwater, cranking up the heat, changing the pH. Starvation is stressful, like withholding carbohydrates or nitrogen sources. That’s basically what we’ve tested.”

The litter is put through a regular household blender and the microorganisms are knocked off what they are attached to. The freed cells are then collected using centrifugation. Those cells are given carbohydrates or ammonia and then monitored.

“If I withhold food from you, you are stressed from lack of food. That’s what I’m doing to the bacteria. And, in fact, that’s what we have seen. If we withhold a carbon and energy source or a nitrogen source, we see

Poultry litter is often used as fertilizer. The phosphate runs off very quickly into the water, causing large algal blooms that prevent photosynthesis from occurring in other organisms. The result is less oxygen in the water, which in turn kills animal life, such as fish.

increases in the polyphosphate inside the bacterial cell. Also, we know the phosphate is coming from the litter, because phosphate levels outside the cell decrease.”

Dr. Doerner has one graduate student, Yoga Vadari, working with him and together they travel out to the poultry farms and collect samples of the litter. Vadari, an international student, started in September 2001.

“The research is challenging,” Vadari said, “but we have produced promising results at the USDA conference twice.”

After the samples are collected, they are brought back to the lab for examination under a microscope by Bryan Mason, the lab assistant.

Mason has worked on the project since August of 2002, and said he really enjoys working with Dr. Doerner.

“It’s refreshing to be able to work on a project where there is a correlation in which one can see that the amount of quality of scientific effort directly corresponds to the scientific project,” Mason said.

This project lets students get out of the classroom and get their hands dirty, understand scientific design, and develop critical thinking, Dr. Doerner said.

An important aspect of the research for the students is that this is cross-disciplinary. Biology students are working on the phosphate project along with agriculture students.

Dr. Doerner has a doctorate in microbiology from the University of Illinois, Urbana-Champaign. He plans to continue work on this project in hopes of generating a practical, low-cost solution for local producers and also protecting Kentucky’s water supply.