

# Ohio Water Development Authority

## Research and Development Grant Program

### Livestock Projects

#### **The Ohio State University**

##### *Effect of Ground Zebra Mussel Shells as a Calcium Source for Poultry and Dairy Cow (1993, Grant Award - \$55,000)*

The goal of the study was to evaluate the use of harvested zebra mussel shells (ZMS) as a calcium source for poultry and dairy cows. The study conducted diet experiments with turkeys, Leghorn hens and Holstein cows.

For dairy cows, those taking ZMS consumed less feed resulting in lower milk production. The reasons could not be fully determined, however, lower milk production is not a desirable outcome. The substitution of ZMS for calcium did not seem to otherwise affect the control group. Digestibility of ZMS was higher than the calcium supplement. Also, cows taking calcium absorbed a lower percent than those taking ZMS.

##### Final Report

#### **Logan Soil and Water Conservation District**

##### *Constructed Wetlands for Livestock Waste Management (1996, Grant Award - \$17,000)*

Logan Soil and Water Conservation District (LSWCD) evaluated the feasibility of using constructed wetlands to remove excess nutrients and organic solids from feedlot and milk house runoff waters. The LSWCD completed a manure management plan, engineering design of the wetlands, construction of the wetlands. After construction they collected monthly samples to monitor the operation of the wetlands. LSWCD has conducted several workshops and field days to demonstrate the system. Teachers and students were among those who attended these workshops.

#### **The Ohio State University**

##### *Development of Composting Based Manure Utilization Systems for Dairy Farms that Improve Water and Air Quality - Part 1, 2 and 3 (2000, 2001, and 2002; Grant Awards - \$250,000, \$248,605, and \$249,524)*

Based on research completed as of April 30, 2003, five objectives are being met. OSU is summarizing the results of these objectives by writing and presenting technical papers. OSU will present papers at the 2003 Annual ASAE International Meeting and the Animal, Agricultural and Food Processing Wastes, Proceedings of the Ninth International Symposium. OSU has made

presentations to Ohio farmers at the Ohio Composting and Manure Management Spring Program and at the Auglaize County Fairgrounds. OSU has also prepared articles for the peer review journal of "Compost Science & Utilization".

1. Quantify and develop strategies that minimize *water usage* and maximize the retention of manure in solid form thus minimizing the generation, storage, and transport of liquid manure.
2. Develop strategies that improve the economics of *manure management* by reducing costs associated with bedding through recycling of bedding material and *composting manure*.
3. Develop guidelines for *management of odors* generated during manure handling through implementation of new treatment systems.
4. Determine standards for *stability of composted dairy and swine manures* based on plant growth bioassays to allow production of value-added disease suppressive products.
5. Perform *greenhouse and nursery demonstrations trials with the composted manures* to determine optimum *amendment and loading rates*.

### Final Report

## **The Ohio State University**

### ***Testing and Demonstration of Full Scale Systems for Sand Bedded Dairy Manure (2003; Grant Award - \$150,000)***

The OWDA funded a multidisciplinary research team at OSU/OARDC, Wooster during 2001-2003 to develop guidelines for composting and value-added marketing of all or part of the manure stream on farms to abate these problems. A survey of Ohio's dairy farms and the research established that 8% of Ohio's dairy farmers already have begun to compost part or all of the manure. Furthermore, 75% of Ohio's dairy farms use bedding for cows that would allow diversion of much of the manure to a composting process if value-added markets were available to offset additional costs. A composting engineering model was developed, based on pilot- and full-scale studies, which showed that a large number of farmers will be able to adopt composting as a way to divert excessive manure nutrients away from farms to horticultural industries. Standards were developed for testing composts for nutrient availability, stability and plant growth response potential and thus value-added benefits. Demonstration trials were performed in nurseries with composted swine and dairy manures, which established that these composts increased plant growth and health in a manner comparable to composted biosolids, a product that is imported into Ohio to meet market demands. Since this research was funded, several Ohio companies have begun to divert composted manures into the ornamental plant and vegetable producing industries.

Two aspects of manure management on dairy farms not foreseen before the completion of the previous studies require a fourth year of research. The first relates to water management in Ohio's wet winter months. Unless composts are cured and stored at a moisture content <50%, value-added marketing is not feasible. One of the goals of this research is to develop the technology for full-scale curing and storage of composted manure on an Ohio dairy farm. Our second goal is to assist this farm in the design construction and operation of the composting facility so that it can serve as a model for others. A finding made during the survey was the rapid expansion of the use of sand as bedding under dairy cows in Ohio. Manure-laden sand (MLS), a by-product from this

process, cannot be hauled onto farmland during inclement weather conditions due to its high density. Large quantities accumulate on farms during the winter and spring. It is a major environmental issue facing large dairy farms in particular. Currently available mechanical sand separation systems require excessive quantities of “clean water” to wash the sand and remove the manure. During the third year of this research, progress was made with a new process for low temperature composting of MLS which yielded dried, decomposed MLS but the fate of pathogens in the process remains unknown. Additional goals of this research, therefore, will be to develop operational guidelines for a full-scale MLS “composting” / sand separation system and to test the sanitary aspects of the two by products from this process, namely, compost and sand to be recycled as bedding for cows.

The objectives designed to achieve these goals are to: 1) Develop guidelines for the design and operation of dairy manure composting, curing, and storage facilities while minimizing costs and develop marketing strategies for the value-added product, 2) Develop a low temperature composting process for treatment of manure laden sand (MLS) from dairy farms that minimizes leachate production and odor generation and, 3) Determine the fate of key indicator pathogens such as *Escherichia coli*, *Salmonella enterica* and *Cryptosporidium parvum* during this novel low temperature composting, curing and drying process for MLS. Results of the research should be applicable to all sizes of dairies in Ohio. The anticipated benefits are less environmental pollution associated with manure utilization, improved manure nutrient management practices and a significant decrease in traffic and road overloading issues associated with management of dairy manures and high density MLS.

*The final report has not been completed*