The Power of Polyacrylamides

Futurists often pinpoint three frontiers for scientific discovery—information technology, bioengineering, and materials science. Information technology harnesses computer power to analyze data faster than ever. Bioengineering uses renewable biological substances in place of nonrenewable ones in products for business, agriculture, and health care. Materials science leads to new uses of such compounds as ceramics, plastics, and polymers.

All three affect ARS research on management of Earth's soil and water. An article in this issue describes a materials science technology that is keeping water cleaner, saving soils from eroding, and forestalling unwanted spread of certain nutrients and microbes from fields and feedlots. (See story on page 4.)

These remarkable accomplishments stem from ARS research on optimum use of environmentally safe, food-grade compounds known as polyacrylamides, or PAMs. Importantly, these studies—from ARS scientists based at Kimberly, Idaho—prove that growers need use only a few pounds an acre of this polymer to achieve impressive benefits. PAM, easily added as a powder to irrigation water, does all of this at an annual cost of only $10 to $20 an acre. Even better, PAM applications don't disrupt routine farming operations.

Interest in polymers and other chemical soil stabilizers has come and gone before. This time around, however, our scientists have a better choice of polyacrylamides. When applied according to ARS-developed strategies, these new-generation chemicals are 10 times more effective than earlier compounds—at only a hundredth the cost. That has made mainstream use on America's irrigated farmlands a reality.

Though early ARS studies in the United States focused primarily on furrow irrigation, our ongoing research is also providing practical, effective guidelines for growers who use sprinkler or surge irrigation. And this is only the beginning. Imagine being able to use these polymers to make it easier for water to enter soil. Conversely, imagine using PAM and a surfactant to prevent unwanted seepage.

Preliminary results from continuing experiments suggest that ARS scientists will succeed in developing each of these new roles for PAM. For example, their work indicates that PAM easily, rapidly, and cheaply helps seal leaky, unlined irrigation ditches and canals. PAM might thus greatly reduce water loss while providing an exciting new alternative to today's more expensive and difficult-to-install concrete or plastic canal-lining systems.

This application was demonstrated on an irrigation canal upslope of the historic Hagerman Fossil Beds National Monument in Idaho. There, seepage could erode and slough away prized fossil-bearing formations.

Today, the raw material used to produce most PAM is natural gas. It has usually been cheap and abundant. However, that may not always be the case. So the polymer industry and ARS scientists are working to ensure that the important role of these and related polymers can continue, even if natural gas and other fossil hydrocarbon sources become unavailable or too expensive.

The polymer industry already knows how to produce PAM and other polymers from vegetable oils, for instance. In another approach, ARS scientists at Kimberly and at Albany, California, are investigating polymers produced from crop residues and food-processing wastes. These PAMs would create new markets for those agricultural leftovers.

The effort is part of the Natural Resources and Sustainable Agricultural Systems research programs. Conducted at a cost to each U.S. citizen of only about a penny a week, this ARS research yields benefits for everyone. Among them: cleaner air, because well-managed soil doesn't become airborne dust; cleaner water, because pollution from soil, nutrients, and microbes is diminished; and affordably priced food for your shopping cart, because growers don't face costly loss of fertile topsoil.

Of course, the discoveries are applicable not only in the United States, but in many other parts of the globe, as well. Natural resource managers everywhere are continually on the lookout for new developments in information technology, bioengineering, and materials science to meet the increased demands on agriculture. These technologies may prove especially critical for countries where populations are burgeoning, living standards are rising, and pressure on limited natural resources is likely to increase. In those countries, ingenuity and innovative application of these technologies to agriculture may be key to prosperity and to protecting the environment.

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