n the late 1700s, Benjamin Franklin, whose interest in scientific experiments is now legend, demonstrated the value of a natural geological substance called gypsum, used in making plaster, as a soil amendment.

On a prominent hillside, Franklin applied gypsum in a word pattern that read, “This land has been plastered.” The increased grass growth in the area on which the gypsum had been applied served as an effective demonstration of its value as a fertilizer.

Two hundred years later, gypsum is again being studied—this time as a way of controlling erosion by increasing water infiltration.

“We suspected that gypsum could reduce surface sealing and improve water entry and reduce erosion,” says Norton. “In lab studies, we found the powdered waste product releases electrolytes that keep clay particles clumped together, reducing crusting.”

About the same time, Shainberg became interested in another white powder—PAM, short for polyacrylamide—a material used in water treatment plants as a flocculent to clean up the water by precipitating small particles.

“According to the literature, you could stabilize a soil with PAM, but it was very expensive for practical use when mixed in the entire plowed layer,” says Norton. A series of lab studies conducted by Shainberg and ARS scientists on some small flumes confirmed that as little as 5 to 10 parts per million of PAM mixed with water almost eliminated rill erosion—the tiny gullies caused by water moving over the soil.

At the NSERL, Norton and Shainberg, working with three ARS colleagues—soil microbiologist Diane E. Stott, agricultural engineer John M. Laflen, and soil scientist Joe M. Bradford—studied how adding PAM both to simulated rainfall water and to the soil surface affected erosion. They soon came to recognize that if the soil surface could be stabilized down to just a very small depth, erosion might be greatly reduced.

“Most important,” says Norton, “was the finding that PAM didn’t have to be mixed into the soil. Only the surface layer—less than the top one-sixteenth inch or less of soil—has to be treated, to let water into the soil.”

NSERL agricultural engineer Dennis C. Flanagan, working with Norton and Shainberg, conducted

Several years ago, ARS scientists at the NSERL worked with world-renowned soil scientist Isaac Shainberg, who is now director of the Volcani Institute in Israel. They wanted to determine how electrolytes, which are natural electrical conductors in rainfall and runoff water, could affect estimates of soil erodibility. During Shainberg’s visit, the idea of using gypsum and other soil amendments to control soil erosion by water from agricultural fields was also discussed.
very promising, says Norton, in producing a high-organic-matter, high-nitrogen, and high-phosphorus, soil-like material that is environmentally friendly.

This work has been done cooperatively with Purdue researchers and has received funding from several Indiana sources—the Eli Lilly Company, Lafayette; Purdue University power plant, West Lafayette; Amax Coal Company, Brazil; and the Indiana Department of Commerce, Indianapolis.

Now that Norton and NSERL scientists have documented some of the chemical, physical, and biological processes that occur on soils that have gypsum applied, they are currently studying the effects on crop yields.

Cooperating farmers report encouraging results. In one of over 50,000 acres of field tests, Ken Curtis of Prairie City, Illinois, used high-purity gypsum, a scrubber byproduct from a coal-fired unit of City Water, Light, and Power of Springfield, Illinois. He applied 3 tons of gypsum per acre to a 20-acre field of no-till soybeans, randomly applying various amounts.

“Treated soybeans yielded 63 bushels per acre—4 bushels more than the nongypsum control. I didn’t expect that much response so quickly,” says Curtis.