Dairy cows have known it for some time: They make more milk or get fatter when their diet includes high-moisture, finely ground corn instead of dry, rolled corn. Now, Agricultural Research Service studies have shown this scientifically.

“If you change harvesting and processing methods, you can increase corn’s energy value,” says animal scientist Barbara Glenn.

Earlier studies at ARS’ U.S. Dairy Forage Research Center in Madison, Wisconsin, found that high-moisture, finely ground corn ferments rapidly. Feeds that are rapidly fermented in the rumen and fully digested in the intestines provide more energy for the cow to use to produce milk.

But how much more, asked Glenn and former colleague Vic Wilkerson at the ARS Nutrient Conservation and Metabolism Laboratory in Beltsville, Maryland? Wilkerson is now with Land O’ Lakes’ Western Feed Division in Portland, Oregon.

At the Beltsville lab three decades ago, ARS scientists first measured the energy value of feedstuffs for milk production—known as net energy of lactation (NEL). Today the lab is still one of a handful worldwide equipped with calorimetry chambers for net energy measurements.

“As any time we get NEL data, it’s very valuable. There’s very little data published because of the cost of doing the studies,” says Bill Weiss, associate professor of animal science at Ohio State University. Weiss is a member of a National Research Council subcommittee that is revising the nutrient requirements of dairy cattle, including energy values of feeds.

Feed consultants and dairy farmers rely on NRC’s published values to formulate animal rations. But measured NEL values for new corn sources and types are rare; most values are estimated.

Dry corn might have been good enough in the past, but not for today’s top milk producers. Wilkerson calculated each corn’s contribution to the energy value of whole diets. He wasn’t surprised to find high-moisture corn—cut early, while still moist, and then ensiled—is popular with dairy farmers in the North Central and Northeast regions.

The researchers also compared the effect of grinding corn versus rolling it. Small ground particles are reportedly more digestible and thus able to provide more energy, she says. The different corns were mixed with alfalfa, soybean meal, and a powdered mineral supplement.

Wilkerson measured the energy value of diets containing high-moisture corn compared with dry corn. Glenn says high-moisture corn—cut early, while still moist, and then ensiled—is popular with dairy farmers in the North Central and Northeast regions.

But farmers don’t want fat cows any more than they want overly thin...
In the United States, corn with more than 20 parts per billion (ppb) of aflatoxin—which is the equivalent of just 1 ounce in 3,125 tons—is not considered fit for feeding to animals that produce meat or milk for humans.

A known carcinogen, aflatoxin is the metabolic byproduct of *Aspergillus flavus* fungi. Grain with more than 5 ppb gets thumbs down for making food-grade corn products. And in the South and in areas where occasional drought stresses corn and increases *A. flavus* levels, farmers may lose opportunities to produce corn valued for export markets.

Finding natural compounds in corn that affect the toxin-producing machinery of *A. flavus* is a first step toward identifying corn genes that might be modified to make the microbe less harmful. The strategy could be joined with efforts to breed corn that discourages growth of the fungus.

Now, a faster, cheaper test is helping researchers detect genetically regulated compounds in corn that inhibit or promote the ability of *A. flavus* fungi to produce aflatoxin. ARS chemist Robert A. Norton developed the new procedure at the National Center for Agricultural Utilization Research in Peoria, Illinois.

“We can now realistically test a much wider range of compounds for toxin-producing activity—including lipids—using 1 milligram [thousandth of a gram] or less of the test compound,” he says.

Norton purchases the compounds for testing, some of which cost up to hundreds of dollars per milligram, though most cost less. Despite the expense, Norton says that it’s cheaper to buy the compounds than to tediously extract them from corn.

“And with the new testing method, we don’t have to use as much of them,” he says.

His procedure involves placing the test compound, along with about 29 microliters [millionths of a liter] of a nutrient medium and *A. flavus* spores, on a small disk. The disk is hung by a pin from a Teflon cap inside a bottle containing a small amount of water. After 5 days, researchers measure fungal growth on the disk. They use a small amount of solvent to extract aflatoxin from the fungus; high-performance liquid chromatography measures the amount. The method saves time, nutrient medium, and solvent.

Norton currently tests up to 200 samples per week. So far, he has pinpointed several aflatoxin-synthesis inhibitors, including carotenoids that impart yellow color to modern corn hybrids and a colorless benzoxazolinone compound. He also plans to test colorless anthocyanin-related compounds that could be bred into yellow corn.—By **Ben Hardin**, ARS.

Robert A. Norton is in the USDA-ARS Bioactive Agents Research Unit, National Center for Agricultural Utilization Research, 1815 N. University St., Peoria, IL 61604; phone (309) 681-6251, fax (309) 681-6693, e-mail nortonra@mail.ncaur.usda.gov

---

Unshelled feed corn. **JOE LARSON NRCS**