Research Link

Estimating farm-animal feed efficiency

Agricultural Research Service (ARS) scientists have discovered new formulas to determine the amount of feed required to maintain life — called basal metabolism — in farm animals. In recently published articles in the *Journal of Animal Science,* the researchers argue that in ewes, factors other than weight, such as age, breed and nutritional history, need to be taken into consideration when predicting basal metabolism. The discovery should lead to more efficient use of feed and may save producers money.

Livestock use the feed they receive to support their basal metabolism, to maintain their current weight and to grow. Changes in any of these factors can change how efficiently feed is used for production. Metabolic rates decrease as animals grow older.

Efficiency of feed use is important because feed accounts for about 60% of the total production cost of cattle and sheep. ARS animal scientist Harvey Freetly, and ag engineers John Nienaber and Tami Brown-Brandl, are conducting studies to help farmers develop low-cost feeding strategies, focusing on how much feed is actually needed and how feed is used by animals.

Their research, conducted at the ARS Roman L. Hruska U.S. Meat Animal Research Center (MARC) in Clay Center, Neb., shows that the breed of an animal affects how fast its metabolism decreases as it ages. Since it is not practical to create separate feed requirements for each breed of sheep, these scientists have proposed that breed differences in basal metabolism can be accounted for by describing the maturity of the animal rather than its age. Studies are being extended to determine if similar relationships occur in cattle.

ARS is the chief scientific research agency of the U.S. Department of Agriculture (USDA).

Doubling wildrye chromosomes creates opportunity

It's amazing what 14 more chromosomes can do for Russian wildrye, a pasture grass introduced to the U.S. Northern Plains area from Siberia in 1927.

John Berdahl, a plant geneticist with the ARS, has created Russian wildrye plants that are called tetraploids because they have double the usual 14 chromosomes. The extra chromosomes result in a plant that produces larger seeds and much more robust seedlings, solving the biggest barrier to wider use of the grass.

Russian wildrye helps keep cattle well fed by providing forage with higher digestibility and protein, especially in late summer and fall when other grasses, such as crested wheatgrass, tend to become less nutritious. But farmers and ranchers still often choose those other grasses because they're easier to grow.

Berdahl, plant physiologist Al Frank and colleagues at the ARS Northern Great Plains Research Laboratory in Mandan, N.D., hope to change that by using tetraploids to breed new Russian wildrye varieties. They expect to one day see them planted extensively on marginal land in the Northern Plains and Intermountain Region.

Berdahl and colleagues created the new plants without any gene transfer or sophisticated biotechnology. Instead, they induced chromosome doubling by pressurizing flower-bearing stalks in canisters filled with nitrous oxide gas, commonly known as "laughing gas." The nitrous oxide technique enables production of numerous tetraploid seeds and development of genetically diverse populations from which to select superior plants.

It will take about five years to

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release the first tetraploid Russian wildrye variety to seed growers. Then it will take a few more years for seed growers to produce enough pedigreed seed for sale to farmers, bringing the new variety to market around 2010.

New aid for stewardship of Southwestern rangelands

Wildlands that border Arizona's scenic upper San Pedro River are covered with hardy grasses and rugged desert shrubs. But hungry cattle could easily overgraze these tasty, nutritious plants. In turn, overgrazing can lead to flooding and erosion.

To prevent that from happening, scientists at the Southwest Watershed Research Center at Tucson, Ariz., are readying a new, computer-based aid that the region's ranchers, wildlife managers and other specialists can use to safeguard this ecosystem. The researchers' invention converts details about the rangelands into numerical form. This information comes from satellite imagery, weather records and studies of how rangeland plants grow. The Tucson center is part of the ARS.

With mathematical formulas or equations that the ARS scientists wrote, an ordinary personal computer can process this information into customized color maps and other helpful printouts. These maps display projections of what plants will be available for the animals in coming months, and where those plants will be found, given expected weather conditions.

The researchers have dubbed their new, computer-driven mathematical model SEHEM, short for "Spatially Explicit Hydro-Ecological Model." Susan Moran, hydrologist and research leader at the Tucson center, and Yann Nouvellon, a NASA-funded ecologist, led the work.

Computer models that forecast weather and simulate plant growth aren't new. What makes SEHEM unique is its reliability and validity over hundreds of square miles.

Moran, Nouvellon and co-workers tested SEHEM by asking it to project rangeland plants' growth for specific periods. For the test, they chose periods of time for which they already had accurate information. When they compared SEHEM's projections to these records from earlier years, they found that the SEHEM output was very close to what had actually occurred on the rangelands.

To further improve SEHEM, Moran and colleagues are now fine-tuning the equations that drive it. By 2004, she expects to have a practical, easy-to-use version ready for consumers to try out. Moran will make SEHEM the basis for a similar model for the Great Basin rangelands of Utah, Idaho and Nevada.