ENERGY

Optimizing dung gas and feed

There are more than 26 million tons of livestock dung awaiting resource exploitation. Under optimum conditions, manure from a single steer can produce $20 worth of methane and $40 worth of protein annually via high-temperature, oxygen-free fermentation. And a research team headed by Andrew Hashimoto at the U.S. Meat Animal Research Center in Clay Center, Neb., has worked out what constitutes optimum conditions.

Protein-rich bacteria naturally present in manure ferment the dung into methane. Production was maximized by loading dry dung at a rate of 0.015 to 0.15 pound per gallon of fermentor volume and retaining it three days at 140° F (60° C). It produced 90 percent more methane than did fermentation at 95° F and 6 days holding time. 46 percent more methane than at 104° F and 4.5 days holding and 8 percent more than at 122° F and 3.5 days retention. But when energy used to maintain fermentor temperature was factored in, 130°F optimized net-energy output.

Dung from cattle fed high-grain rations yields more methane than does dung from animals eating roughage. And the presence of monensin and chlortetracycline — both antibiotics used in feed—does not hurt yields, although monensin delays fermentation startup until bacteria adapt.

Effluent left after gas extraction has a crude protein equivalent of 60 percent. With an amino-acid content similar to soybean-oil meal, it makes a better livestock supplement than nitrogen fertilizer, according to Ronald Prior, a team chemist. It can be fed to cattle as is, or partially dried first by centrifuging. But the latter raises costs and removes more than half the nitrogen present unless a flocculent is added.

There is also an economy to scale. Yearly costs for equipment, labor and utilities drop from $70 per animal in a 1,000-steer feedlot to $15 per animal in a 100,000-steer feedlot, according to an account of the work in the Agriculture Department's January-Feburary issue of AGRICULTURAL RESEARCH.

Fields of frozen natural gas

Vast reserves of natural gas (methane) harboring the energy equivalent of four billion tons of coal may lie frozen solid beneath a crust of Canadian permafrost. But it is locked in an unstable frosty sponge of ice and trace quantities of other gases. Chemists at Canada's National Research Council are studying the behavior of this frozen methane hydrate—electrically and magnetically — and its explosive expansion when heated: A cubic meter of it could release more than 160 m^3 of methane.

In a recent issue of his agency's SCIENCE DIMENSION, NRC's Donald Davidson says Soviet scientists are already exploring production schemes based on changes of temperature, pressure and use of chemical antifreezes. But NRC's studies offer near-term payoffs too. Frozen hydrate deposits have been found growing where gas and moisture combine in drill holes and arctic gas pipelines. If they constrict or plug the gas flow, explosions could result. "That's the problem many people are concerned about," Davidson says, "and an area where the work we do . . . can be helpful right now."

Knocking the wind out of urban chills

What take 12 or 15 years to grow, reduce winter heating bills and are moving from farms to cities? Windbreaks. They lower air infiltration, responsible for a third of the energy used in heating. The Agriculture Department says experiments at Princeton University and Pennsylvania State University showed many urban homes could shave heating costs 3 to 20 percent with properly placed conifers. Biggest savings occurred in homes that were in the open, were loosely constructed or were poorly insulated.

MICROBIOLOGY

Joan Arehart-Treichel reports from Dallas at the annual meeting of the American Society for Microbiology

Monkey model for leprosy

Medical scientists were excited during the 1970s when they found that armadillos were susceptible to leprosy, because at last they had an animal model in which to study the disease, which affects 15 million persons in developing countries. Now another animal—the mangabey monkey—has been found to be vulnerable to leprosy and may also turn out to be an animal model for studying leprosy, Wayne Meyers of the Armed Forces Institute of Pathology in Washington and colleagues report.

A mangabey monkey captured in Africa during the mid 1970s and shipped to the United States has come down with leprosy. Because the time between infection with leprosy and actual disease is three to seven years, the primate probably acquired the disease from Africans who held it captive until it was shipped to the United States.

Antiviral drug from pokeweed

A protein from a southeastern American plant, pokeweed, might make an effective antiviral drug, G. J. Teltow, J. D. Irvin and G. M. Aron of the Southwest Texas State University in San Marcos report, since it inhibits the multiplication of herpesviruses and some other viruses, is easily purified and is not toxic to cells at concentrations used to inhibit virus multiplication.

Cheeseahol: A way with whey

What can you do with all that whey—the byproduct of cheese production that is a serious pollution problem in some areas? Researchers already have reported that treating whey with lactose-fermenting yeast yields a potable alcohol—whey wine (SN: 2/21/81, p. 117). Now M.B. Mumford and D.M. Munnecke of the University of Oklahoma at Norman say fermentation of whey is an economical way to make fuel-grade alcohol.

The researchers placed yeast immobilized on polymer beads in a laboratory-scale reactor, then pumped whey through it. At optimal flow rates the yeast fermented 90 percent of the lactose in the whey into alcohol (ethanol). After another fermentation step (and the addition of glucose) an ample amount of alcohol was produced.

Because free whey provided one-fourth of the material needed for fermentation by this technique, the researchers say that whey might make microbial production of fuel alcohol economical—and help fight whey pollution at the same time.

Helping clay return

Mining the potash and phosphate used in fertilizers presents a slimy problem. It takes 30 years for clay to settle out of slime left over after phosphate and potash mining. Until the clay settles, the slime ties up vast amounts of water and real estate.

Corale Brierley of the New Mexico Bureau of Mines and Mineral Resources in Socorro and Guy R. Lanza of the University of Texas at Dallas studied a number of microbes present both in mining operations and in lab cultures in hopes of finding one that can survive in phosphate and potash slime (which has little nutritional content) as well as remove clay from the slime and thus speed up clay settlement. Now they have found the microbe they were looking for—the mold *Cladsporium*—in a clay waste impoundment in Florida. It was able to survive in slime and help clay settle out of slime by producing a sticky compound that binds clay together.

Brierley and Lanza are now constructing a small pilot plant to see whether the mold can survive in slime and settle clay out of slime under simulated field conditions as well as it can in lab flasks.