'Super Cows' on the drawing board

ITHACA, NY - Modern American dairy cows are second to none when it comes to milk production. Now, scientists have made a major advance that could turn these animals into "super cows" by markedly increasing the efficiency of milk production.

Scientists from Cornell University reported this week that a group of typical dairy cows increased milk yield up to 41 percent (more than 25 pounds of milk per day) when given daily shots of laboratory-produced bovine somatotropin (growth hormone). Bovine somatotropin is an experimental protein which was produced by Monsanto Company.

Highlights of findings made in a study conducted at Cornell to determine the effects of long-term use of biosynthetic hormone, or methionyl bovine somatotropin (MBS), on cows' productivity and health are:

– the composition and quality of the milk was the same as ordinary milk;

– treated animals remained in good health throughout the test that lasted for more than six months;

– calves born to these animals were healthy at birth and grew normally afterward; and

– efficiency (milk per unit of feed) increased markedly.

Cornell scientists reported these findings at the 1984 Cornell Nutrition Conference for Feed Manufacturers in Syracuse (October 30-November 1). This is the first long-term study of its kind to improve the productivity of dairy cows.

The findings mean that farmers around the world are closer to the day when they may be able to use such a practice to dramatically increase the efficiency of milk production.

The study was conducted by Dale E. Bauman, professor of nutritional biochemistry in the New York State College of Agriculture and Life Sciences at Cornell, and graduate student Philip J. Eppard. Monsanto Company supplied the somatotropin for the experiment.

"Methionyl bovine somatotropin" (MBS), the biosynthetic bovine growth hormone, is a product made by genetically modified microorganisms created through recombinant DNA technology, known popularly as gene splicing.

Both natural and biosynthetic somatotropins are proteins. To be effective for boosting cows' milk yields, somatotropin must be in the blood stream, hence the hormone is injected into muscle, Bauman explained. If the substance is taken orally, it has no effect because it is digested like any other protein.

Conducted in 1982-83 at Cornell's Animal Science Teaching and Research Center, the study was a continuation of Bauman's earlier work that involved short-term use of both natural and recombinantly derived bovine growth hormone. In these studies, hormone-treated cows boosted their milk production by 10 to 40 percent.

In the recent long-term study, researchers gave three groups of six animals different amounts of MBS daily for 188 days during the last two-thirds of lactation. This is the period when a cow's milk yield normally drops off; milk production following calving peaks during the first 60 to 100 days of lactation. For comparison, another group of six cows received natural somatotropin isolated from the pituitary gland; still another group of six cows was used as control.

Results of the Cornell study surprised even the researchers. MBS-treated cows increased their milk yields by 23 to 41 percent.

"These results are surrounding," Bauman commented. "Increased milk yields from test animals are dependent on how much hormone was used daily."

The cows that received the highest dose of MBS (40.5 miligrams per day) boosted production by 41 percent. Another group that was given 27 mg per day produced 36 percent extra milk. Increases in milk yields from still another group that received the least amount of MBS (13.5 mg per day) averaged 23 percent.

The extra milk produced by each of the cows that received the highest dose (40.5 mg) amounts to more than 25 pounds per day, or more than 10 quarts of milk. One quart of milk weights about 2.15 pounds.

The nutritional composition of the milk thus produced, in terms of percentages of milk protein, fat, and lactose (sugar), was not affected.

"The dramatic gain in production efficiency of the cows treated with the hormone, as demonstrated in this study, is equal to that resulting from 10 to 20 years of genetic improvements in cows achievable through traditional animal breeding programs," Bauman said.

The amount of the experimental protein used daily per animal was small. If 40.5 mg were used daily, for example, the amount of somatotropin required to treat one animal for 200 days would amount to less than two-tenths of an ounce, Bauman estimated.

Bauman also reported that the cows were in good health throughout the study. Twenty-eight of 30 cows used in the experiment were pregnant. Subsequently, these animals calved successfully, and their offspring grew normally.

"We observed no ill effect on the health of the test animals and their young," Bauman pointed out.

Commenting on the scientific significance of his work, Cornell's Bauman said that results clearly demonstrate that somatotropin is one of the key controls that channel more nutrients to milk synthesis in dairy cows.

"It is impressive that even in high-producing cows, manipulation of this single control (by administration of somatotropin) can dramatically increase the efficiency of milk production," he noted.

Looking ahead, the Cornell scientist said that the world is faced with an ever-increasing population, projected to double to 10 billion people by the year 2030.

"We have to produce as much food in the next 40 years as we have produced in all history," Bauman stressed. "For this reason, improvements in the efficiency of food production are crucial."