RETURN TO START

Growth Hormone

1. Introduction and Production Responses

Growth Hormone is one of several biological chemicals that circulate in the bloodstream and regulate the normal functions of the body. Like Luteinizing Hormone (LH) and Follicle-Stimulating Hormone (FSH) which regulate reproduction, GH is a protein produced by the pituitary gland, located at the base of the brain. As each animal species produces a unique GH, the hormone produced by the cow is often designated bGH - bovine Growth Hormone. Bovine Somatotropin (BST) is another name for the same hormone.

The use of injected Growth Hormone (GH) to increase milk production in cattle was first reported by Russian scientists in 1937. Other experiments were conducted over the following 40 years, confirming and expanding on the initial work, but these early experiments were very limited in scope because the hormone had to be extracted from the pituitaries of slaughter cows. It took the pituitaries from several hundred slaughter cows to obtain enough GH to treat a single cow.

In the early 1980's new advances in biotechnology made it possible to produce large quantities of bGH in bacterial culture. Using *recombinant DNA* technology, the piece of genetic material (DNA) which codes for GH production in the cow is spliced into the genetic code of the bacteria. As bacterial cells grow and multiply in a liquid culture medium, bGH is produced as a by-product, referred to as either recombinant bGH (rbGH) or recombinant BST (rBST).

The availability of rbGH has made possible a large number of research and commercial trials which have demonstrated its effectiveness and safety as a means of increasing milk production in well-managed herds. As a result, the commercial use of rbGH was approved in the US in 1993.

We have conducted several rbGH trials at the University of Alberta and, in cooperation with other scientists, at several other sites in Western Canada. This article will discuss typical production responses. Subsequent articles will deal with the effects of rbGH on cow health and reproduction, the economics of using rbGH and public concerns about the consumption of milk from rbGH-treated cows.

Milk yield and milk composition

Although the original reports of rbGH use demonstrated milk yield increases of 23-41%, average responses obtained in experiments conducted over the past 20 years have been in the 10-15% range. These experiments have included cows of different breeds, genetic potential and parity across many geographic locations. Several have been long-term studies, continuing for up to 8 lactations.

We conducted a study at the University of B.C. Oyster River Farm where cows were treated with rbGH for three consecutive lactations. rbGH was administered by daily injection at two dose levels - 10.3 and 20.6 mg per day in 2ml of saline beginning at 28 to 35 days in milk and ending at 70 days prior to expected calving. Control cows received only the saline injection.

The first-calf heifers included in the first lactation on treatment did not respond to either dose level of rbGH. Figure 1 shows the pattern of milk yield responses for multiparous cows in their third lactation on treatment.

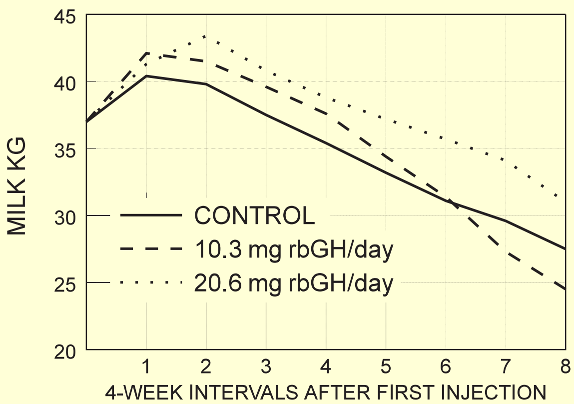

Figure 1 : Effect of rbGH on milk production from third+ lactation cows in their third lactation on treatment.

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rbGH also produced changes in milk fat and protein content. Figure 2 demonstrates these changes for cows in their third lactation on treatment.

Average milk yield and 3.5% fat-corrected milk yield responses for all three lactations on treatment are shown in figure 3. As fat test affects the energy value of milk, correcting milk yield to a standard fat test makes it possible to compare production responses on an equivalent energy basis. As shown in figure 3, this removes much of the variability seen in comparisons of raw milk yield.

Body weight

During all three lactations, body weights were at their minimum near the time at which treatments were initiated, then increased gradually for the remainder of the lactation. Although the differences were small and in some cases insignificant, rbGH tended to increase rate of body weight gain.

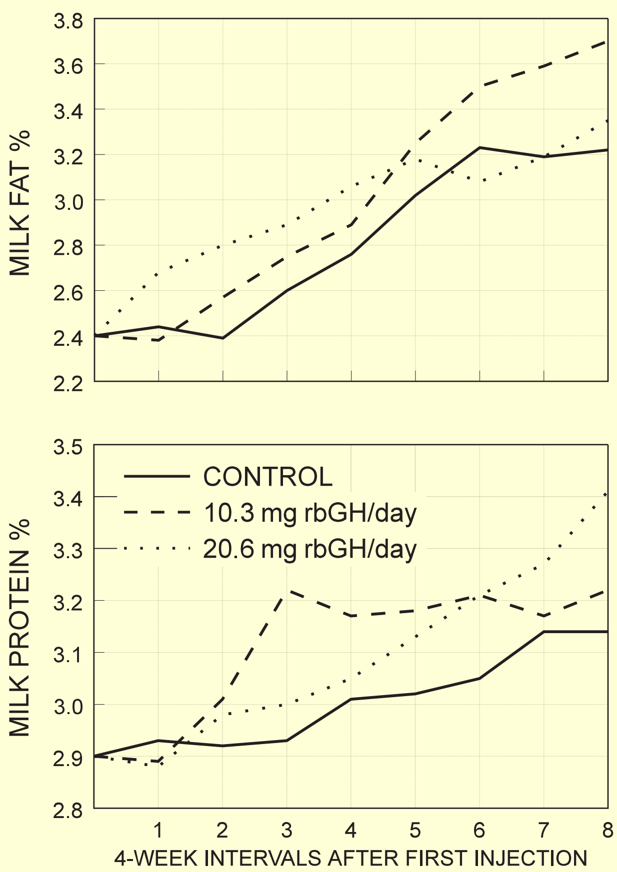

Figure 2 : Effect of rbGH on fat and protein content of milk from third+ lactation cows in their third lactation on treatment.

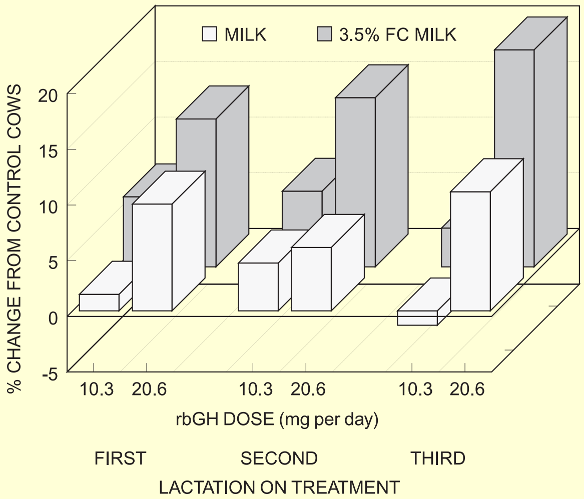

Figure 3 : Average changes in milk yield and 3.5% fat-corrected milk yield over 32-weeks of rbGH treatment.

Feed intake

Where does the rbGH-treated cow get the additional nutrients required to support increased milk production and body weight gain? Although we were unable to monitor total daily dry matter intake (DMI) in our study at Oyster River, many other trials have demonstrated that voluntary DMI increases in response to rbGH treatment.

The timing of changes in milk production, voluntary DMI and energy balance is similar to that seen in untreated, early lactation cows. Milk production usually increases within 2-3 days after rbGH treatment begins. But DMI may not increase until several weeks later. Therefore, in the first few weeks of treatment, cows may experience a period of negative energy balance, depending on :

- their energy status at the start of rbGH treatment;
- the magnitude of the production response to rbGH;
- the energy density of the ration.

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