7-1987

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Shin, Seung Y.; Kliebenstein, James B.; Belyea, Ronald L.; and Bennett, Myron D., "The Effects of Bovine Growth Hormone (bGH) on Dairy Farm Profitability by Type of Government Program" (1987). Economic Staff Paper Series. 11.
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Abstract
Administration of Bovine Growth Hormone (bGH) to dairy cows has been shown to increase milk production. Injecting milk cows with bGH results in increased milk production per cow from 10 to 40 percent (Kalter et al.). This response is rapid and continues as long as treatment is given. Presently, the injection is daily, but research is ongoing to develop implants to eliminate this tedious and laborious approach. Some feel that bGH will be available for commercial use within two or three years. It is now in the testing stage for Food and Drug Administration (FDA) approval,
The Effects of Bovine Growth Hormone (bGH) on Dairy Farm Profitability by Type of Government Program

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Staff Paper No. 172
July 1987

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EFFECTS OF BOVINE GROWTH HORMONE (bGH) ON DAIRY FARM PROFITABILITY BY TYPE OF GOVERNMENT PROGRAM

INTRODUCTION

Administration of Bovine Growth Hormone (bGH) to dairy cows has been shown to increase milk production. Injecting milk cows with bGH results in increased milk production per cow from 10 to 40 percent (Kalter et al.). This response is rapid and continues as long as treatment is given. Presently, the injection is daily, but research is ongoing to develop implants to eliminate this tedious and laborious approach. Some feel that bGH will be available for commercial use within two or three years. It is now in the testing stage for Food and Drug Administration (FDA) approval.

Kalter et al. projected that there will be a strong incentive for dairy farmers to adopt the bGH once it is commercially available. They estimate that the cost of buying and administering the hormone significantly lower than its benefits. A study of New York dairy producers indicates a rapid adoption rate with at least half of the state herd on treatment within the first year of availability (Kalter et al.). An adoption rate of that speed will be accompanied by structural adjustments that may be relatively just as rapid.

An interesting phenomenon is that it appears that bGH will reach the market at a time when the government is making strong moves to
reduce milk production levels and cut the burdensome surpluses. This could heighten adversity to bGH implications for the dairy sector. Without government support, producer-level adjustments to bGH may be quite severe and rapid. Use of bGH may result in a rapid increase in surplus milk stocks and government expenditures for their support. Initially, bGH may lead to dramatically lower milk prices as the adjustment to fewer cows in production begins to occur.

National dairy policies to adjust for these potentially large increases in milk produced must be developed. With the current political environment, it can be expected that federal dairy policy will change to a more market-oriented policy. Adoption of bGH may accelerate this movement (Magrath and Tauer). Nonetheless, adjustments will be difficult with a concurrent move to a free market policy. A view forming in the dairy industry is self regulation or industry control through quotas, milk quality checks, etc. This would potentially lead to fewer cows, higher productivity per cow, and further enhanced per cow efficiency with bGH. The size of this adjustment and the structure of the dairy industry would be impacted by milk production response to the bGH, its rate of adoption, and the level and scope of the government milk program.

The purpose of the study is to investigate the impact of bGH on farm profitability under selected government policy options of free market, price support, or a milk quota plan.
METHOD OF ANALYSIS

Potential profitability of using bGH was investigated for a representative Missouri dairy farm for two milk production levels per cow (12,500 pounds and 15,000 pounds per cow). Three scenarios were selected: the base (without bGH), a 10 percent increase in milk productivity per cow above the base, and a 25 percent increase in milk productivity per cow above the base. Returns over variable costs, crop enterprise selection, and crop sales were compared for each response scenario and at each production level. Milking herd size was 65 cows.

Three market structures were evaluated. The first structure assumed that current government price supports were retained at a level of $10.50/cwt (Boehlje and Cole). The second market structure evaluated the implication of bGH response on farm profitability with a free market policy. The milk price was based on the Iowa study (Boehlje and Cole) and set at $9.50/cwt. with a 10 percent bGH response and $8.27/cwt. with a 25 percent bGH response.

For the third structure, a milk quota plan, was considered as an alternative production control program. Farmer participation in the quota was optional. The quota plan was structured to provide a price support for participating farms while nonparticipants would receive the free market price. Producers in the quota plan received the $10.50 support price and could not increase production above their base level. Nonquota farms received the free market price and did not have a production restriction.

Each farm had Class I, II, and III land. Farm size was 375 acres, 100 acres of Class I, 175 acres of Class II, and 72 acres of Class III,
I with the remainder as wasteland. Labor availability of 2.3 man-years was modeled on a seasonal basis and broken into four time periods. Ration requirements, net energy and crude protein consumption, etc., constraints were built into the study in accordance with National Research Council (NRC) recommendations. Net energy and protein consumption increased to support the extra milk production. Increases in feed intake and nutrient requirements were necessary to support the extra milk produced in response to bGH (Bath and Bauman et al.). Linear programming was used to measure likely impacts from bGH adoption. The objective function was to maximize return over variable fixed costs. Production activities were milk, raising replacement heifers, and raising crops. Feeds used were soybean meal, corn, wheat, corn silage, alfalfa hay, and permanent pasture. Soybean meal is purchased. Sales included corn, wheat, alfalfa hay, and milk.

Cost and return data were taken from representative enterprise budgets (Bennett). Adjustments for bGH adoption were made where necessary and as determined through previous studies (Bath; Kalter et al.; Magrath and Tauer) and discussions with dairy scientists familiar with bGH. Prices paid for soybean meal were $7.50 per hundred weight, corn could be sold for $2.35 per bushel, wheat for $2.80 per bushel, and alfalfa hay for $65.00 per ton. Milk prices were $9.50 per cwt. with the remainder as wasteland. Labor availability of 2.3 man-years was modeled on a seasonal basis and broken into four time periods. Ration requirements, net energy and crude protein consumption, etc., constraints were built into the study in accordance with National Research Council (NRC) recommendations. Net energy and protein consumption increased to support the extra milk production. Increases in feed intake and nutrient requirements were necessary to support the extra milk produced in response to bGH (Bath and Bauman et al.).
10 percent bGH response and $8.27 with a 25 percent response to bGH.

RESULTS

Milk Price Support Condition

Information when milk price is supported at the base level (10.50/cwt.) is shown in the top half of Table 1. The return over variable costs (ROVC) increased with increasing response to bGH. This ROVC increase ranged from 10-11 percent for farms with 10 percent response to 25-27 percent for the 25 percent response rate.

Economic benefits through bGH use were similar for both production groups. Benefits for high-producing herds increased slightly faster than for the low-producing herds. Increased returns were accompanied with increased feed costs. To meet these changes, crop enterprises and crop sales changed slightly to meet these increased feed requirements.

Free Market Price

Boehlje and Cole estimated that increased production will decrease market milk prices by 9.5 percent for the 10 percent bGH response level (from $10.50 to $9.50 per cwt.) and by 21.2 percent for the 25 percent bGH response level (from $10.50 to $8.27 per cwt.). This causes returns over variable costs to fall below the base level for the increased production levels (lower half of Table 1). The marginal return per cow decreased from $416 (base) to $375 (10%) and $312/cow (25%). With a government price support and a 25 percent bGH response, the marginal return per cow was $661 as compared with $312 without the
price support.

Gross returns per cow with the free market milk price changed little as bGH response rate changed. This was true for both production levels. This indicated that increased milk production levels from bGH are offset by decreased milk price in a free market system. However, returns over variable costs per cow were significantly lower due to higher feed requirements, labor and bGH costs.

Farm enterprise organization under the free market approach was the same as that for the milk support program. Marginal return to land as well as labor costs remained unchanged. This implies that the capitalized value of land will remain stable and be little affected by bGH adoption.

The government support program provided a 15 percent higher return over variable costs over the free market policy when the base production level was 12,500 pounds and the bGH response rate was 10 percent. Returns were 16 percent higher for the 15,000 pound herd with a 10 percent bGH response rate. At the 25 percent bGH response rate, the government support provided returns 40 percent higher for the 12,500-pound production level and 43 percent higher return for the 15,000-pound production level. Thus, with the present support system, heavy incentives will remain for overproduction. Under the government support scenario, marginal returns per cow increased by 59 percent between the base and 25 percent response (from $416 to $661) for the 12,500-pound herd (Table 1). The increase for the 15,000 pound herd was 54 percent ($549 to $847). Marginal return per cow decreased as bGH response increased under the free market scenario. For the 12,500-
pound production level, marginal return decreased by 25 percent with the 25 percent response rate. For the 15,000-pound production level, this reduction was 22 percent (Table 1).

Differences in marginal returns per cow by response levels provide insight into what producers could afford to pay for bGH. With government price supports, bGH benefits to 15,000 pound producers was $118 ($667-$549), if the response rate is 10 percent. A 25 percent response rate yielded a benefit of $298. These increased benefits will either get capitalized into the price of the product, the value of the cow, or the value of the price support. Under a free market policy, marginal returns declined as response rates increased. It should not be startling that marginal returns are greater for a 15,000-pound herd than for a 12,500-pound herd. Given this, it appears that bGH is a hormone that is interactive with production level. Higher-producing herds will benefit more than lower-producing herds.

**Impacts from Milk Quota Plan**

Milk production quotas are receiving attention as a possible way of controlling milk production. This study considered the effects of development of a milk quota plan along with bGH adoption on the return over variable costs. The milk quota plan used in this study is unlike that of California and Canada (Fallert and Goodloe) because it was assumed that milk producers have the option of participating or not participating in the quota plan. Those participating in the quota plan would have production restricted to some level (quota) and receive a supported milk price. Those not under the quota plan receive the free
market price. For simplicity, the quota is presumed to be the base production level. Nonparticipating producers would not have a quota and would sell milk under free market (supply-demand) conditions without price supports. Quotas were investigated according to the following participation levels: 0, 25, 50, 75, and 100 percent of production.

Milk prices for the nonquota farm were computed under free market conditions and based on findings by Boehlje and Cole. The free market price is based on overall level of milk production. For example, with a 10 percent bGH response rate, milk production will not increase if all producers are in the quota plan. There will be a corresponding reduction in the size of the dairy herd. The supported milk price will be $10.50/cwt. Alternatively, if all producers are nonquota producers and total milk production increases by 10 percent, the milk price will be $9.50/cwt. Milk price for the other participation levels are between these extremes.

Results for the milk quota are shown in Table 2 for the 15,000-pound producer. Relative results were similar for the 12,500-pound producer. With a participation level of 25 percent, milk producers in the quota plan receive a higher return over variable costs. Returns are 5.8 and 14.3 percent greater for the 10 percent and 25 percent bGH response rates, respectively.

Returns over variable costs for the nonquota farm increased as participation in the milk quota plan increased. With a 10 percent bGH response rate and participation of 75 percent, the return over variable costs for the nonquota farm exceeded that for the quota farm. For a 25
percent bGH response rate, the break-even participation level is about 62 percent. Thus, the break-even participation level is for about 2/3 of the producers to participate.

SUMMARY AND CONCLUSION

The administration of bGH and its effect on milk production levels can result in major changes in dairy farm profitability. However, future directions in dairy legislation will likely play a large role in these changes.

With government price supports, the return over variable costs to the representative farms increased by 10 to 27 percent, depending on bGH response rates and average base milk production levels. As milk production increased by using bGH, crop sales declined and purchased feed increased. With this scenario dairy farmer profit increased, mainly at the expense of larger government expenditures and milk surplus stocks.

Through the use of a free market policy, milk price will decrease as milk production increases, resulting in declining returns over variable costs or profit levels. Under free market conditions a production increase of 25 percent would result in a 21 percent reduction in the milk price. Return over variable costs would decline by 11 percent. In summary, the price-depressing effects offset the output-enhancing effects of the technology, causing dairy farm income levels to decline. Thus, without some government intervention in the adoption process, adjustments in the dairy industry may be rather dramatic.
With the income depressing effects in mind, a milk quota plan was examined as a government support alternative. If the government supports the milk price and regulates the milk supply, milk producers in the quota plan could increase their return over variable cost from the free market scenario. Return over variable costs for nonquota farms increases as more milk producers participate in the milk quota plan. Break-even quota participation level occurs when about two-thirds of the milk production is under quota plans. If something less than two-thirds of the producers choose to be in the quota plan, returns over variable cost would be higher for quota producers. The quota plan appears to have merit because it can be effective in controlling production level and has minimum government financial outlays.

Return over variable costs for the quota farm was 4.4 percent lower than that for the government support price scenario when bGH response was 10 percent. When the bGH response was 25 percent the government price support provided a return 11 percent above that of the quota plan. When compared with the free market scenario, returns under the government price scenarios were 9.8 percent higher at the 10% response rate and 25.1 percent higher at the 25 percent bGH response rate. However, the full government price support has two major drawbacks: first, it would be very expensive to implement and, second, huge dairy surpluses would occur, neither of which would be politically acceptable.
### Table 1
Comparison of Government Price Support and Free Market Results

<table>
<thead>
<tr>
<th>Scenario</th>
<th>ROVC (^{(a)})</th>
<th>Marginal Return Per Cow</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12,500 lbs</td>
<td>15,000 lbs</td>
</tr>
<tr>
<td><strong>Milk Price</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supported (^{(b)})</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Response</td>
<td>62,701</td>
<td>71,376</td>
</tr>
<tr>
<td>10% Response</td>
<td>68,969</td>
<td>79,025</td>
</tr>
<tr>
<td>25% Response</td>
<td>78,638</td>
<td>90,642</td>
</tr>
<tr>
<td><strong>Free Market</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Response (^{(c)})</td>
<td>62,701</td>
<td>71,376</td>
</tr>
<tr>
<td>10% Response (^{(d)})</td>
<td>60,032</td>
<td>68,300</td>
</tr>
<tr>
<td>25% Response (^{(e)})</td>
<td>55,990</td>
<td>63,465</td>
</tr>
</tbody>
</table>

\(^{(a)}\) Return over variable cost.

\(^{(b)}\) Price support is $10.50 per cwt.

\(^{(c)}\) Milk price = $10.50 per cwt.

\(^{(d)}\) Milk price = $9.50 per cwt.

\(^{(e)}\) Milk price = $8.27 per cwt.
Table 2
Return Over Variable Costs for Quota and Non-Quota Producer Under Selected Quota Participation Levels (15,000 lbs Production Level)
Dollars Per Herd Per Year

<table>
<thead>
<tr>
<th>% of Producers in Milk Quota</th>
<th>ROVC Quota Farm(^a,b)</th>
<th>ROVC Non-Quota Farm(^a,c)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10% Production Increase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>----</td>
<td>68,300 (9.50 $/cwt)</td>
</tr>
<tr>
<td>25</td>
<td>75,085</td>
<td>70,982 (9.75 $/cwt)</td>
</tr>
<tr>
<td>50</td>
<td>75,085</td>
<td>73,663 (10.00 $/cwt)</td>
</tr>
<tr>
<td>75</td>
<td>75,085</td>
<td>76,344 (10.25 $/cwt)</td>
</tr>
<tr>
<td>100</td>
<td>75,085</td>
<td>----</td>
</tr>
<tr>
<td>25% Production Increase</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>----</td>
<td>63,465 (8.27 $/cwt)</td>
</tr>
<tr>
<td>25</td>
<td>79,634</td>
<td>69,680 (8.78 $/cwt)</td>
</tr>
<tr>
<td>50</td>
<td>79,634</td>
<td>76,018 (9.30 $/cwt)</td>
</tr>
<tr>
<td>75</td>
<td>79,634</td>
<td>83,087 (9.88 $/cwt)</td>
</tr>
<tr>
<td>100</td>
<td>79,634</td>
<td>----</td>
</tr>
</tbody>
</table>

\(^a\)Return over variable costs.

\(^b\)Milk price is $10.50 per cwt.

\(^c\)Milk price is shown in the parentheses.
REFERENCES


Background for 1985 Farm Legislation, Agriculture Information  