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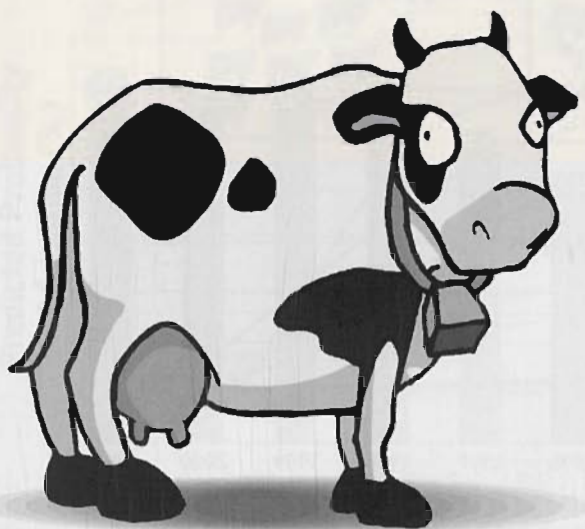
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## **rBST Adoption in the United States:**

# That Was the Juggernaut... That Wasn't

BY BRADFORD L. BARHAM AND JEREMY FOLTZ



Ten years ago, Monsanto announced its intent to market recombinant bovine somatotropin (rBST), a genetically engineered

hormone that stimulates treated cows to produce more milk. A political firestorm immediately erupted. The Food and Drug Administration was enmeshed in a review process that took several years and produced more documentation than any agricultural technology before or after. Congress considered legislation that would ban or restrict rBST's release, and eventually did vote to delay rBST's commercial release by half a year until the executive branch provided a comprehensive assessment of the technology (U.S. Government).

State legislatures around the country debated labeling laws that would require milk products to identify whether they came from cows treated with rBST. Vermont, Wisconsin, and Maine actually passed legislation, though compliance with Wisconsin's law was strictly voluntary. Elsewhere (California, for example), some state agencies tacitly encouraged bottlers and processors to identify products as coming from cows not treated with rBST.

The rBST controversy was arguably the most intense public debate that has ever occurred in the United States

When rBST first came to market, both advocates and opponents of the technology thought it would be a juggernaut that would completely remake the American dairy industry. Ten years later, it looks like just another tool.

about an emerging agricultural technology. Although the battle was bigger than it might have been if it had emerged after some of the genetically modified crops that were also under development, the opposition was broad and deep in its commitment to block the commercial release of rBST.

The breadth came from coalitions that formed at various levels among farmers (especially from populist farm organizations and certain regions of the country), environmental and consumer organizations, and animal welfare activists. The depth came from the intensity of opposition to this "juggernaut" technology and its anticipated effects on family farms, consumers, the environment, and animal health. And, a large proportion of the debate hinged on what would happen to family farms if rBST were introduced. Ironically — and in the interest of full disclosure — even the very academic positions the authors of this paper hold are a product of that era. The Wisconsin state legislature created an institute at the University of Wisconsin to address the implications of rBST and other emerging technologies on family farms.

## The Beef Over rBST

At the core of the debate was the view held by both proponents and opponents that rBST would be very widely adopted, especially by larger dairy farms. The technology promised high per-cow productivity gains —20 percent or more for treated cows. Opponents then argued that the ensuing expansion of milk production, especially in a broader context of declining federal milk price support programs, would result in disastrous declines in dairy prices and hence ruinous competition for dairy farmers, increased surpluses of cheese and butter, and unnecessarily large government payments. Small and moderate-sized family farms were thought likely to be the hardest hit, because they would be less likely to adopt rBST and they would be more vulnerable to falling prices.

Underlying this dismal picture were several assumptions: high rBST adoption rates, major increases in milk productivity, and a size-biased technology adoption process. A few analysts at the time, such as Larson and Kuchler (1990), warned that rBST adoption could be much less profitable than anticipated. However, opponents and proponents, including Monsanto, each had their reasons for sustaining the juggernaut idea: the former to strengthen their dire forecasts, the latter to boost early sales and rapid adoption of the product. Thus, the debate rarely

engaged the possibility that rBST might not be much more than a minor addition to the technology options available to dairy farmers. Now, ten years later, that is essentially what the research finds.

One often overlooked aspect of the rBST controversy is that it has served effectively as a huge barrier to entry for all potential competitors to Monsanto. Indeed, in the 1980s, Monsanto, Eli-Lilly, Upjohn, and American Cyanamid were each working on some form of rBST for

Figure 1.

Percentage of Cows Nationally in Herds Treated with rBST (1994-2001)

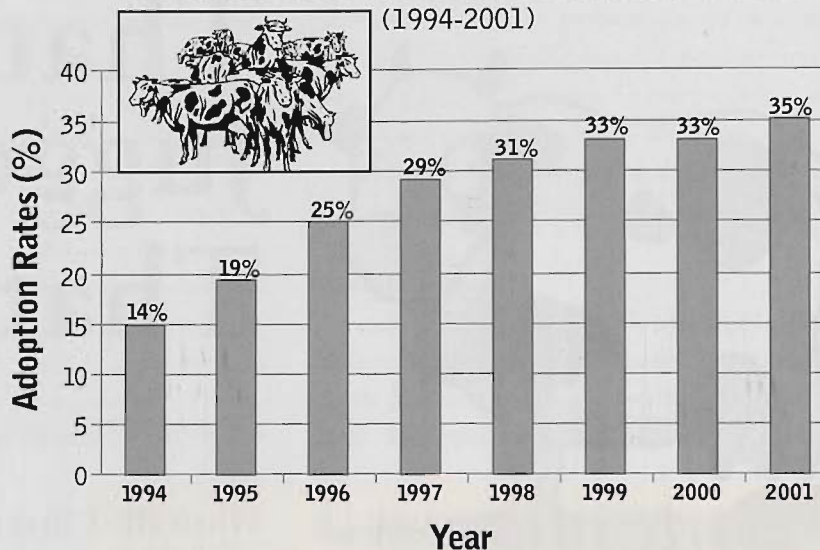
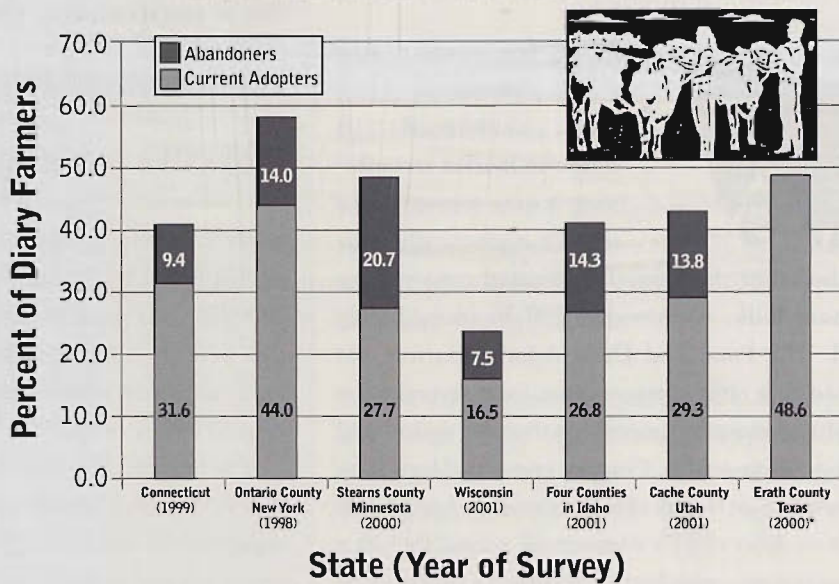


Figure 2.

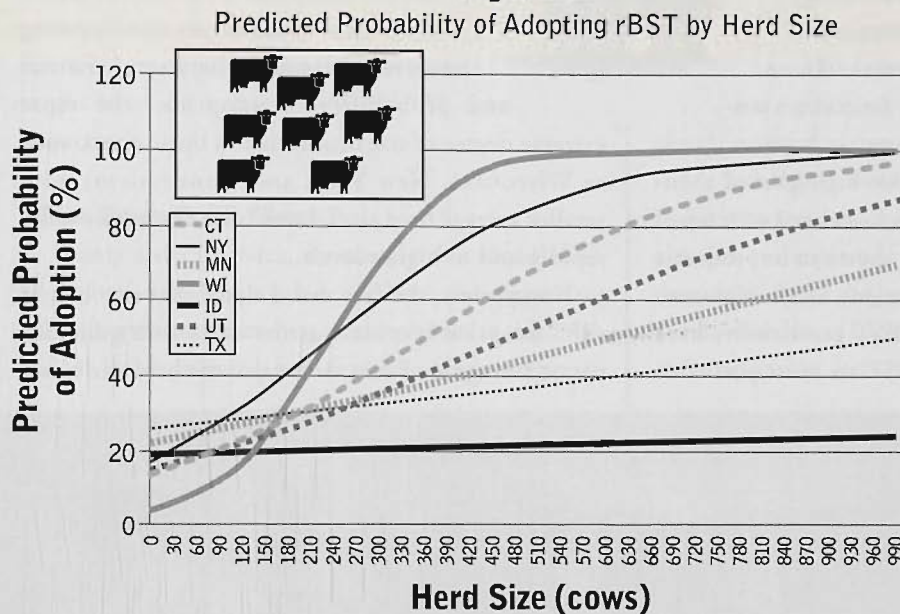
Adoption & Abandonment of rBST by State Sample



\*Abandonment rates not available for Texas.



Figure 3.



the market. Deterred by the tremendous costs that Monsanto incurred to secure FDA approval, no other competitor has attempted to enter. Thus Monsanto's Posilac™ is still the only form of rBST on the market.

### Not the Juggernaut

Eight years after the release of Posilac it is clear that rBST has fallen well short of being a juggernaut technology. According to Monsanto, rBST currently is used on about 15-17 percent of the nation's dairy farms. However, this point must be placed in the proper context. Farm-level numbers understate the actual use of rBST, because they do not account for the size of farms where rBST is adopted.

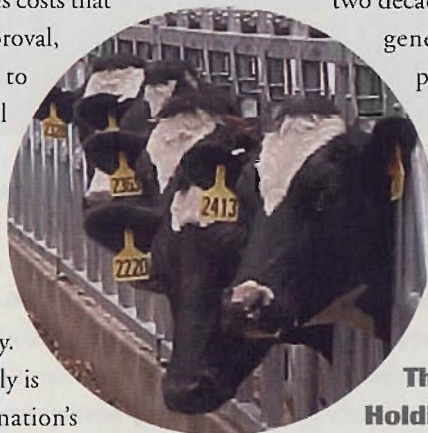
Figure 1 uses data obtained from Monsanto to show rBST's adoption path in terms of the percent of the cows nationally that are on farms where rBST is being used. The initial figure in 1994 was 14 percent, which doubled by 1997 to 29 percent. Over the next five years, rBST adoption growth slowed considerably so that in 2001, 35 percent of the nation's cows were on farms using rBST.

This rate of adoption leads to rather moderate estimates of its impact on national milk production. On aver-

age, a farmer will treat 50 percent of a given dairy herd with rBST. This, combined with the 35 percent statistic, means that about 17 percent of the nation's dairy cows are rBST-treated. Even with a liberal assumption of a 20 percent production increase for treated cows, rBST use can account for only a 3.5 percent boost in total milk production. That increase is equivalent to a bit more than two years of the secular trend in milk productivity growth over the past two decades associated with improvements in genetics, nutrition, and management practices. Simply put, these adoption figures are not ones of a juggernaut technology. They are more akin to the kind of adoption path one might expect for a dairy technology that was only profitable for a relatively small portion of farmers.

### The State of rBST Adoption: Holding Back or Walking Away?

Farm-level adoption and abandonment rates for rBST are reported in Figure 2 for samples that were undertaken in different states as part of a USDA regional study of structural change in dairy farming and its impacts on local communities. What is most striking about this figure is that in those the states for which data were gathered on abandonment of rBST, between 25 and 40 percent of those who have tried rBST no longer use it. In



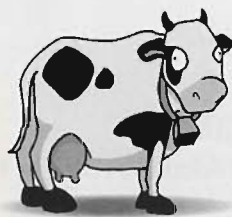
About 17 percent of the cow's milk in the U.S. comes from cows treated with rBST. In some parts of the country, dairy farmers use labels to signify untreated milk.

(photos courtesy of the authors)



other words, abandonment of the technology has been extensive. Moreover, the “abandoners” look very much like the adopters in terms of farm size and technology use, and are quite distinct from non-adopters along those same dimensions.

Part of the explanation for this high level of abandonment is likely to be the profit associated with use of the technology. While rBST was shown to be profitable in experiment station trials, simulations, and in Monsanto literature, on-farm studies of rBST profitability have not found that farms that use rBST are more profitable



size for data from a number of states. While most of the curves show a strong positive relationship between herd size and probability of adoption, the more extreme degree of size bias occurs in those states, such as Wisconsin, New York, and Connecticut, with smaller average herd sizes, but whose curves rise more rapidly and to higher levels.

Nonetheless, the fact that a significant size bias in rBST adoption is evident across states with quite disparate average herd sizes means that the herd size bias is



than those that do not (Stefanides and Tauer). The modest profitability impact of rBST appears to be reflected in the relatively high levels of abandonment of rBST.

One possibility is that many more of these farmers might have stuck with rBST if it were priced competitively, as might have happened had other potential rBST suppliers not been dissuaded by the barriers to entry associated with regulatory approval.

### **rBST Adoption Patterns: A Bias for Bigness**

Recent on-farm studies (using data from California, Connecticut, Idaho, Minnesota, New York, Wisconsin, Idaho, Utah, and Texas) show that both larger herd-size (or scale) and higher use of complementary (productivity-enhancing) technologies, such as herd records and improved feeding techniques, strongly increase the likelihood that farmers will try rBST on their herds. In some states, younger and better-educated farmers are also more likely to adopt rBST, but these effects are not as prevalent or as significant as the herd size and complementary technology use factors.

The size bias in rBST adoption is illustrated across different states in Figure 3, which shows the predicted probability of rBST adoption as a function of herd

relative and not absolute. In other words, in Wisconsin where the average herd has about 60 cows, the probability of adoption rises to 50 percent for farms with 250 cows and to nearly 100 percent with farms of 500 cows. Meanwhile, in Utah, where the average herd size is about 250, a 250-cow farm has only a 25 percent predicted probability of adopting rBST, and a 500-cow farm has only a 50 percent probability.

This evidence confirms the idea that larger farms are more likely to adopt rBST, with the caveat that “larger farm” is a relative term. This puzzle can probably best be explained by the different organization of production across states.

It could be that farms that have specialized their labor tasks are more likely to adopt rBST, because such specialization may be critical for managing the herd in a way that makes rBST use profitable. For example, it may be that a non-specialized family labor farm in the West or South would have, on average, 400 cows while in the Upper Midwest and Northeast a fully integrated, non-specialized livestock and crop cultivation operation might have 75 cows. The difference would be due to less effort invested in cropping, nutrient management, and cer-





tain types of animal care. By contrast, operations that specialized over the different ranges of tasks across those two states might have, on average, 800 and 150 cows, respectively.

### What Does It All Mean?

Nearly a decade later, we can say this about rBST adoption in the U.S.: It has not been the juggernaut technology that contending sides imagined it might be. Indeed, its adoption has been limited to a relatively small

adopters of rBST in terms of herd size and complementary technology use.

rBST does appear to be a technology that has a place, especially on larger farms that have already invested in complementary productivity-enhancing technologies. However, rBST adoption also seems unlikely to grow much in the years ahead without major changes in the price of the technology, the structure of dairy farming, or the price of milk. These changes might attract abandoners back to the fold — or the herd — and make adoption attractive for those that have not yet

adopted rBST. It seems safe to say now that rBST will be remembered in the historical annals of agricultural biotechnologies as the juggernaut that was not.

### For More Information

Barham, B., J. Foltz, S. Moon, and D. Jackson-Smith, "A Comparative Analysis of rBST Adoption

and Disadoption Across Major U.S. Dairy Regions," under review at *Review of Agricultural Economics*.

Larson, B. and F. Kuchler. "The Simple Analytics of Technology Adoption: Bovine Growth Hormone and the Dairy Industry." *Nor. Cent. J. Ag Econ.* 12 (January, 1990): 109-123.

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rbST use tends to be higher on larger dairy operations. Overall, it the technology appears to be more popular with farmers who use other productivity-enhancing technologies.

(photos courtesy of the authors)

proportion (15 percent) of the nation's farmers, and to a significant minority (35 percent) of the nation's cows. The overall impact of rBST on milk production levels has been the functional equivalent of two years of secular growth trends in milk productivity associated with other improvements in herd management, genetics, and feeding practices. As such, it would be hard to argue that it has played much of a role in shaping the structure of dairy farming in the U.S.

Moderate rBST adoption rates can be explained in part by the fact that a sizable proportion of farmers who have tried rBST have since decided to stop using it. While some might argue that these abandoners could adopt again, interviews with Wisconsin farmers suggest that abandoners are not inclined to return to the technology. Econometric studies underscore this view by finding that rBST adoption has no significant impact on dairy farm profitability. The slowing of rBST adoption in the U.S. can also be explained by the significant differences between adopters and non-