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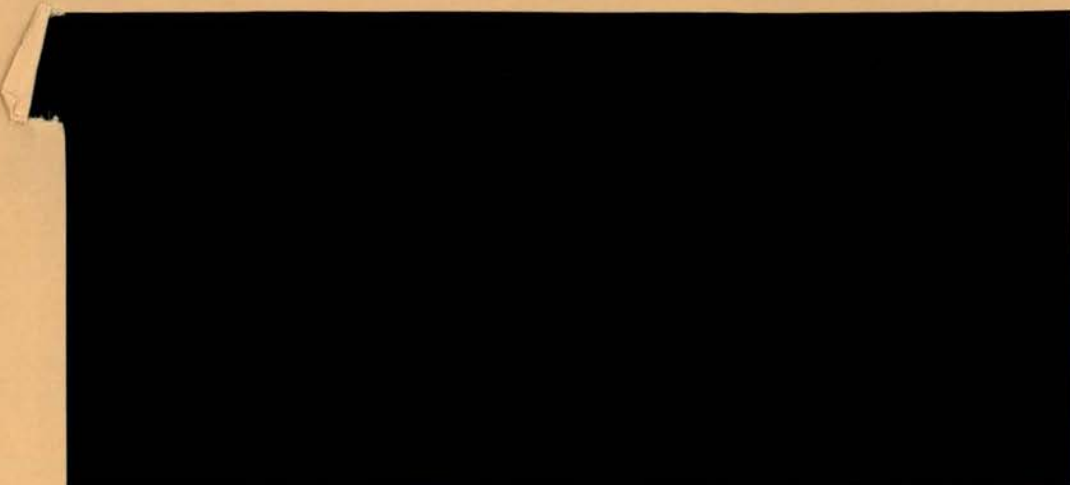
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A SURVEY OF CALIFORNIA DAIRY FARMERS:
POTENTIAL ADOPTION OF BOVINE SOMATOTROPIN

by
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A SURVEY OF CALIFORNIA DAIRY FARMERS: POTENTIAL ADOPTION OF BOVINE SOMATOTROPIN

I. Introduction

In order to evaluate the impact of bovine somatotropin (BST) in California, it is necessary to assess what dairy farmers think of BST. A survey was conducted among California dairy farmers to determine their attitudes and concerns about BST. A sample of 153 dairy farmers (7 percent) was drawn randomly from a complete list of all Grade A dairy farmers in the state. The selected farmers were telephoned between August 10 and October 23, 1987 in an attempt to estimate the potential adoption rate of BST by California farmers. This assessment may provide a better idea of the potential impact of BST on milk production and prices in California. The survey results may be of service to law makers and budget analysts as they analyze the consequences of BST on state and federal dairy price support spending.

BST is a naturally occurring hormone produced in the pituitary glands of cattle. Recombinant DNA technology has allowed commercial production of large quantities of BST at high levels of purity. Daily injections of BST in cows stimulate feed intake, increase milk production, and increase the efficiency of feed conversion per unit milk. Research results of daily BST injections have shown up to a 41 percent increase in milk production over middle and late stages of lactation (Bauman and Eppard, 1985).

Although BST research has been and is being conducted in California, results of particular interest to California are not yet available. The only BST research results available so far are from trials on a few cows showing widely different response rates to BST use. A seven university research project sponsored by American Cyanamid, on full lactation BST treatments, showed increases in milk production of BST treated cows ranging from 5.9 percent to 34 percent (Chalupa, 1987). A two lactation study at the University of Minnesota resulted in milk production increases from 9 to 39 percent the first year of treatment, and 6 to 37 percent the second year (Annexstad and Otterby, 1987).

Research by Bauman and Eppard (1985) found no adverse effects from BST use over a full lactation with respect to mastitis, milk fever, ketosis, conception,

services per conception, calf birth weight, calf growth weight, normal late lactation weight gain, 28 blood components, temperament or behavior of the cow, or production through the following lactation without BST. However, BST has not yet been approved for commercial use by the Food and Drug Administration (FDA). Some would like to see BST banned from commercial use indefinitely, while others see it as yet another advancement in technology in the evolving dairy industry. According to American Cyanamid Research, FDA approval for commercial use of BST is not likely before 1989. Meanwhile, research is being conducted to determine its long-run effects prior to release. Approval could lead to large increases in milk production, but this will depend on how fast BST is adopted and by whom.

To an industry plagued by surpluses, BST is controversial. The cost of the federal dairy program for the fiscal year ending September 1986 was 2.5 billion dollars (Hoard's Dairyman, November 25, 1986, p. 1021). The United States Department of Agriculture purchased 9.2 percent of the nation's milk production in 1985 (USDA, 1986). The 1985 Farm Bill permits the USDA to cut federal price supports if the Commodity Credit Corporation purchases of dairy products is more than five billion pounds. Although California has its own pricing system, federal price supports do influence California prices; for each dollar decline in the federal price support, California class 1 price decreases by 42 cents (California Department of Food and Agriculture, 1985).

While impact studies of BST have been and are being conducted at the national level, the effect on the California dairy industry remains unclear. It is likely California's response to BST will differ because its industry differs from the rest of the country. Average herd size in the U.S. is 60, in California it is 400. Annual production per cow is 13,031 pounds in the U.S. and 16,667 pounds in California. Growth in milk production in the U.S. over the past twenty years has averaged one percent per year, in California it has been four percent per year. Total cow numbers have been declining in the U.S. and increasing in California (California Dept. of Food and Agriculture, 1985, 1975, 1965). Rapid technological adoption and more cows have been the key to California's increasing milk production. These characteristics of the California dairy industry will affect its response to and adoption of BST.

II. Survey Results: Characteristics of California Dairy Farmers and Farms

A sample of 153 dairy farmers was drawn randomly from a complete list of all Grade A dairy farmers in the state. The sample size equals seven percent of all Grade A dairymen in California.

Of the 153 dairy farmers, seven had sold out or participated in the dairy termination program. There were ten rejections and five dairymen who could not be reached or did not respond. Thus, there were 131 respondents representing 146 dairies. The response rate is 86 percent.

The survey covered three regions in California: 78 dairies in Northern California, 36 dairies in the South Valley, and 32 dairies in Southern California. The number of responses from each region is representative of the distribution of Grade A dairies in California. See Figure 1 for a map of the regions.

The survey results in this section will be divided into two sections. The first part will focus on the characteristics of the responding dairy farmers. The second part will focus on the characteristics of their dairies, such as size, production, and facilities.

A. Characteristics of Responding Dairy Farmers

The average respondent was about 46 years old, had a high school education, and had managed a dairy for 21 years. Ninety percent of the respondents said they were involved in daily operation and decisions on their dairy.

Fifty-six percent of the respondents said they plan to increase their total milk production in the next few years. Of these, 56 percent plan to increase production through improved genetics or breeding, nearly half would do so by adding more cows, 29 percent preferred improved feed management. Since many respondents gave multiple answers, percentages add up to more than 100 percent. Thirty-eight percent of the respondents did not plan to increase their production. For a full list of responses, see question four of the survey on BST in the appendix.

Respondents get their information on dairy operation from a variety of sources. Over 40 percent of the respondents considered dairy industry magazines a major source of information on dairy operation. Nearly 34 percent felt their

veterinarian was a major source of information. Twenty-four percent felt other dairymen were a major source of information. See question 33 of the survey in the appendix for a complete breakdown of responses.

One of the most difficult questions for respondents was to estimate the cost to produce a hundredweight of milk on their dairy. Milk production costs include labor, feed, interest payments, overhead, and all other costs needed to run the dairy operation. One farmer said he was scared to figure out what his costs are. There were 69 responses ranging from \$4.83 to \$13.05 per hundredweight of milk. The rest of the respondents could not estimate their costs. The South Valley was the least cost region at \$9.42 per hundredweight, and not surprisingly, Southern California was the highest cost region at \$10.18 per hundredweight. Northern California respondents had an average cost of \$9.59 per hundredweight of milk.

Respondents reported growing three percent of their concentrate and a third of their roughage. South Valley respondents grow the highest percentage of their crops, 6 percent of their concentrate and 42 percent of their roughage. Southern California respondents grow the least, none of their concentrate and 13 percent of their roughage. Northern California respondents grow 2 percent of their concentrate and 36 percent of their roughage.

Dairy farmers in the three regions feed different amounts of grain or concentrate to their cows. Inside and outside of the barn, Southern California respondents feed an average of 30 pounds to their high string per day, and 23 pounds to their low string. South Valley respondents feed 26 pounds to their high string and 13 pounds to their low string. Northern California respondents feed 22 pounds to their high string and 13 pounds to their low string.

Four questions in the survey concern technology use. Farmers were asked whether, and how long, they had used a personal computer, isoacids, silage inoculates, and buffers. Of the four, the most positive response was towards computers. Those who had them, were happy with them. Many who did not have a computer expressed a desire to purchase one. Seventeen percent of the respondents had been using a personal computer for an average of 2.8 years. See question 35 of the survey for more details.

Three percent of the respondents feed isoacids to their cows. They have done so for an average of one year. Seventeen percent of the respondents have used silage inoculates for an average of five and a half years. Forty-three percent add buffers to their feed. They have used them an average of 3.6 years. See questions 36-38 of the survey for details.

B. Characteristics of the Dairies

Responses in this section are based on 146 dairies, involving 74,168 milking and dry cows. The average milking herd size was 508 cows milking and dry. Regional differences in herd size and cow numbers included in the survey are listed below:

Table 1. Average Herd Size and Total Number of Cows of Respondents to the Survey

	<u>Herd Size</u>	<u>Total Number Cows</u>
California	508 cows	74,168 cows
Northern California	381 cows	29,722 cows
South Valley	590 cows	21,246 cows
Southern California	725 cows	23,200 cows

Productivity of a dairy is measured by the rolling herd average, the herd average in pounds of milk per year per cow. The rolling herd average expected for 1987 by survey respondents is 17,885 pounds. Their rolling herd averages for 1986 and 1985 were 17,084 pounds and 16,735 pounds, respectively. Northern California respondents had an expected rolling herd average for 1987 of 17,454 pounds. South Valley respondents expected a rolling herd average for 1987 of 17,880 pounds. Southern California respondents expected the highest rolling herd average for 1987, 18,935 pounds.

Eighty-eight percent of the dairies surveyed milk twice a day. Nine percent of the dairies milk three times per day. Three percent of the dairies milk both three and two times per day. Of those milking twice a day, none had plans to milk three times a day. Respondents were very adamant about this. Many used

words such as "absolutely not" and "never." One farmer commented that, "Three times a day milking is the worst thing in the world because it increases your costs, increases milk which we don't need, and it hurts cows."

Most dairies surveyed belong to some sort of monthly milk testing program. Sixty-four percent belonged to Dairy Herd Improvement Association (DHIA) or Dairy Herd Improvement Registry (DHIR). Ten percent of the respondents had a private monthly milk test. Twenty-one percent of those surveyed had no test of any sort. The rest of the respondents self-tested or had a milk-o-meter that recorded production automatically.

Dairies in the survey had an average of six and a half percent registered cows in their herd. Herds in Northern California had the highest percentage, eight percent. The South Valley herds had an average of six percent registered cows. Southern California had an average of three percent registered cows.

Herringbone and Flat Barns were the most popular type of milking parlors among the respondents, with 48 percent of the respondents reporting Herringbone parlors and 34 percent, Flat Barns. See question 22 of the survey in the appendix for more details on the types of parlors.

Corrals with shade were the housing of choice for 51 percent of the dairies. Thirty-one percent of the dairies had free-stalls. Twenty-five percent of the dairies have corrals without shade. Eight percent of the dairies have seasonal pasture. Totals add up to more than one hundred percent because, some dairies, such as those with pasture, had more than one type of housing.

III. Survey Results: Attitudes towards BST

Given the controversy surrounding BST approval for commercial use, it was surprising that many dairy farmers had not heard of it. Of the respondents, 21.4 percent said they had not heard of bovine somatotropin or bovine growth hormone. Almost three-quarters, or 76.3 percent, said they had heard of it. The remainder, 2.3 percent, did not know whether they had heard of it or not.

Of the 103 respondents who had or might have heard of BST, 77 percent said that magazines or newspapers were their major source of information about BST. The next most important sources of information about BST were other

dairymen and meetings, with 18 percent and 16 percent, respectively. Since many respondents had multiple sources of information, the percentages add up to more than one hundred. See question six of the survey for more information on sources of information about BST.

A. Adoption Rates and Concerns about BST

Participants were asked whether they would use BST right away, or wait, or not use it at all. Most said they would wait after BST introduction to see how it worked on other dairies. They said they are cautious about trying new products in general. There were regional differences in the length of time respondents would wait after BST availability. Milk producers in Northern California would wait only seventeen months. Dairymen in the South Valley would wait twenty-five months after introduction before trying BST. The most cautious producers are in Southern California, where the average wait is twenty-six and a half months.

Twenty-nine percent of the respondents said they would not use BST. Approximately a fifth of the respondents had not heard of BST. The remainder of respondents who had heard of BST were divided between using right away and not knowing whether they would use it. Adoption rates of respondents who had and had not heard of BST are listed in Table 2.

Table 2. Survey Response to BST Use

Had not heard of BST	21%
Had Heard of BST and:	
Would wait	34%
Would not use BST	29%
Would use BST as soon as available	8%
Don't know	8%

Of those who would not use BST, their main concern was over consumer reaction to BST and its effects on milk sales. Their second major concern about BST was its effect on cow health. Two other frequently cited reasons were that

their creamery or cooperative would not take BST milk and concern about the safety of BST milk. For details on concerns of those who would not use BST, see question 17 of the survey. This question was asked in an open ended way to elicit the respondents' own concerns. Most respondents had several concerns. Even among those who would or might use BST, 82 percent had concerns about it. Only 12 percent of potential users said they had no concerns about BST.

Question 10 asked potential users of BST with concerns about it what their major concern was. Most had more than one concern. The concern potential users of BST cited most often was that BST would increase production and adversely affect prices. The second most frequent concern was that BST use might adversely affect consumer opinion and hence milk sales. Concern that BST milk might not be safe and that BST treated cows might "burn out" were the next most frequently cited concerns.

Potential users were asked whether they would be willing to give daily injections. Of this group, 64.5 percent would not be willing to give daily injections of BST to their cows, 12.9 percent would be willing, and 22.6 percent might be willing to give injections.

A further question asked of possible users was what percent of their herd they would try on BST, 46 responded. On average, potential users would try BST initially on 52 percent of their herd. In Southern California, milk producers would try BST on 69 percent of their herd. Recall that herd size is largest in Southern California, and that dairymen there would wait the longest time after commercial release of BST before using it.

Potential users of BST would try it for an average of eight and one half months on part of their herd before trying it on their whole herd. Northern California respondents would try it an average of seven months. In the South Valley, the average it is nine and a half months. In Southern California, it is eleven months.

The following questions of potential users are to clarify what dairy farmers know about BST. When asked how they might change their cows' feed ration, 56 percent of 62 potential users said they would talk to their nutritionists about it. Only 37 percent of possible users recognized that they would need to increase the amount of feed or total digestible nutrients (TDN) in their rations. Thirty-

six potential users of BST were able to identify the string on which they would try BST if they were to use it. Of those, only 22 percent identified confirmed pregnant, or 90-110 days fresh, cows as the string they would try on BST. This follows the recommendation of the pharmaceutical companies doing research on BST. It would appear that most potential users do not have a lot of information about BST.

In summary, California dairy farmers would proceed cautiously. They have many concerns about BST use. The majority of respondents would wait an average of twenty and one half months after BST was introduced before trying it. They are also adverse to giving daily injections, therefore, widespread BST use is not likely unless implants are available. The major concerns of potential BST users were its impact on prices due to increased production, consumer reaction to BST, and whether BST milk would be safe. The major concerns of those who would not use BST were consumer reaction, concern about BST's effect on cow health, and that their creameries would not take BST milk.

B. Comments of Dairymen

The comments in this section illustrate the respondents' concerns. Comments were asked for at the end of the survey. They were also taken down during the survey as respondents mentioned them. Comments are paraphrased from notes of telephone conversations with dairy farmers.

A general comment that came up many times was concern over the surplus of milk. Many did not feel that a product like BST was needed under such circumstances. It was felt that BST would exacerbate the milk surplus problem.

Several farmers expressed concern about consumer reaction to BST and its effect on milk sales. They were concerned that negative reaction towards BST milk would cause a drop in sales. Customers were perceived as being extremely sensitive to residues in milk:

There's no question that I would use BST, but I can't imagine consumers would accept it.

I'm worried about what the public will think of the milk. I'm afraid of a media scare.

Several farmers questioned the riskiness of BST. They are concerned about the potential negative reaction of consumers towards BST, a drop in milk sales, the effect of BST on cows, etc. They view BST as very risky for dairymen:

The risk is on the farmers, not the drug companies.

I think drug companies will make more on BST than farmers will.

Dairymen are paying to get other dairymen out of business with the Dairy Termination Program, while drug companies will make money on BST.

Many milk producers felt that BST is not natural. They had concerns that BST use would taint the reputation of milk as a wholesome product. There was also a feeling that BST use is not a natural way to produce milk, that somehow it would be cheating:

BST is artificial, people eat too much artificial food.

BST is not natural, I don't even use unnatural feeds like urea.

We spend too much on advertising a natural product to use BST.

I'd like to see BST outlawed. A man should work on his own merit with feed and animals, not chemicals.

Recall that the majority of the respondents would wait after release of BST before using it. They were cautious, even negative, about using BST. Many potential users said they did not support BST use, but felt they would be forced to use it to stay in business:

I'm not for BST, but if my neighbor uses it, I'll use it.

BST is against my philosophy, but I may be forced to use it.

I wouldn't use it if I felt it hurt the surplus. I would use it if I felt I was hurting myself not to.

A few potential users expressed no concerns about BST and were ready to use it as soon as it was released. Others felt they simply did not know enough

about BST. Some respondents felt lack of information about BST gave people a negative attitude about it and that the misinformation needed to be corrected before BST could be used:

The more education about BST, the more understanding there is.

I was skeptical about BST when I was first approached by a drug company survey. It seemed feasible as I found out more about it.

A few respondents were not satisfied with the research that has been done on BST. They felt the research done was not convincing enough or did not offer information that was relevant to their situation:

I am skeptical about research results; what researchers get and what I get are two different things.

Most results about BST are from the Midwest, not California.

BST isn't adequately tested, especially for long-run effects.

A few dairy farmers were skeptical about government approval of BST. They expressed concern over premature approval of BST for commercial use and subsequent withdrawal of approval. One dairyman said that the Food and Drug Administration has reversed itself so many times, that even if they were to approve BST, consumers would not believe it.

Many dairymen had concerns about the effect of BST on cows. Some felt that cows were producing at their limit now and that further production increases would lead to health and reproductive problems. There was also concern that no one would use separate needles for injections and that shared needles would spread disease:

I'm opposed to daily shots and needle sharing.

Cows aren't machines.

To increase the production of high producing cows we'd have to milk three or four times a day to prevent udder problems.

If you loved animals you wouldn't give them shots everyday. They would get used to it, but it would be stressful for them.

In summary, most dairy farmers are very concerned about their industry and the surplus of milk. They are cautious about BST use because of concerns over consumer reaction and side effects on cows. There is a feeling that BST is not a natural method of production but that it may be necessary to use it to be competitive. There is a cynicism towards the companies that manufacture BST, the researchers that test it, and the government agencies that will approve its use. The overall implications of the comments are that dairy farmers view BST as risky. They want to be absolutely assured that BST is safe, economic and that consumers would accept it, before using it themselves.

C. Characteristics of Potential BST Users vs. Non-Users

There were five categories of response by California dairy farmers to BST use: 34 percent had heard of BST and would wait an average of twenty and a half months after release before using it, 29 percent had heard of BST and would not use BST, 21 percent had not heard of it, 8 percent had heard of BST and would use BST as soon as it was available, and 8 percent had heard of BST and did not know whether they would try BST. In this section the characteristics of respondents in each group will be examined. The purpose is to look for factors which might be associated with acceptance or rejection of BST.

Table 3 lists the number of responses by category. Also listed are the number of dairies these respondents operate.

Table 3. Number of Responses and Dairies by Category

	Survey Total	Not Heard of BST	Respondents Who Have Heard of BST			
			Use Right Away	Not Use BST	Wait	Don't Know
Responses	131	28	11	38	43	11
Dairies	146	29	17	40	49	11

Age and education appear to play a role in BST acceptance. Table 4 shows BST acceptance categories by age, education and years operating a dairy. Younger, more educated respondents are more likely to want to use BST right

away. Older, less educated respondents tend not to have heard of BST. Average age, better educated milk producers tend to adopt a "wait and see" attitude. The "don't knows" can be characterized as younger than average, with average education. Those who would not use BST are slightly older than average and slightly better educated. Since those who would use BST right away tend to be younger, it is not surprising that they have operated dairies fewer years than the all other categories, except for those who do not know whether they would use BST or not.

Table 4. Acceptance of BST by Age, Education, and Years Operating by Category of Response (in years)

	Survey Total	Not Heard of BST	Respondents Who Have Heard of BST			
			Use Right Away	Not Use BST	Wait	Don't Know
Age	46.4	50.4	36.7	48.7	46.2	38.1
Education	11.7	9.2	12.9	12.2	12.7	11.5
Operating	21.3	24.8	15.6	24.4	19.9	12.6

There was little regional difference in the distribution of how dairy farmers responded to acceptance of BST use, except in the "Use Right Away" category in which Southern Californians were more heavily represented and Northern Californians were less so.

Respondents who would use BST right away tend to have a much larger herd size than any other group of respondents. Their average herd size is 818 cows, compared with those who would "wait and see" whose herd size average 497 cows. The category of respondents with the highest production per cow is those who would "wait and see." Those who would use BST immediately have the second highest production per cow. Respondents who have not heard of BST have the lowest production per cow. Table 5 has complete breakdown of herd size and production by categories of response.

There is little difference among categories of respondents in dairy organization membership, such as cooperatives or Western United Dairymen. However, respondents who would use BST "right away" or would "wait and see,"

Table 5. Average Herd Size and 1987 Rolling Herd Average by Category of Response (in cows and lbs. per year)

	Survey Total	Not Heard of BST	Respondents Who Have Heard of BST			
			Use Right Away	Not Use BST	Wait	Don't Know
Herd Size	508	466	818	436	497	449
Rolling	17,935	16,171	18,067	17,982	18,906	17,821

seem to be much more involved in their community than other categories. Community involvement is measured by the number of non-dairy organizations they belong to.

The respondents who would "wait and see" have the highest percent of registered cows, 10.8 percent. The respondents who do not know whether they would use BST have the lowest percent registered cows, 1 percent.

Type of monthly milk test also varies with category of response to BST use. Respondents who have not heard of BST also have the lowest percentage of monthly milk testing. Respondents who "don't know" have the greatest number of self or milk-o-meter testing. Respondents who have the highest percentage of private testing are those who would use BST right away. Respondents with the highest percentage membership in DHIA or DHIR are those with a "wait and see" attitude.

It is interesting to look at the adoption of other technologies and whether they seem to correspond to the acceptance of BST. Questions were asked about five different technologies in the survey: three times a day milking, personal computers, isoacids, silage inoculates, and buffers. Three times a day dairies were most frequently found among respondents who would "wait and see." The respondents who would use BST "right away" had the highest frequency of 3x and 2x milking on the same dairy. All of the respondents who would not use BST had 2x dairies, and 97 percent of the respondents who had not heard of BST milked twice a day.

The two categories with the highest ownership of personal computers are those who would use BST "right away" and those who would "wait and see." The categories with the fewest personal computers were those who had not heard

of BST and those who would not use it. The only dairymen that are currently using isoacids however, are in the categories of those who would not use BST and those who do not know whether they would. The "don't know" category has the highest percentage of silage inoculate users. Those that would not use BST have the lowest percentage of silage inoculate users. The final technology, buffers, are most widely used by the "don't know" category, and least used by those who have not heard of BST.

Respondents with herringbone parlors seem more likely to use BST right away. Respondents with side-opening parlors are more likely to say they would not use BST. Owners of flat barns are more likely not to have heard of BST. Housing also seems to be correlated with BST acceptance. Owners of corrals with shade and without shade are strongly represented in the categories of using BST "right away" or not having heard of BST. Freestall owners appear to be cautious about BST, they are strongly represented in the "wait and see" and "don't know" categories.

A final question of interest is, how willing are the different categories to give daily injections to their cows? Of those who would use BST "right away," 36 percent would be willing to give daily injections, and 45 percent might be willing to give daily injections. Only 18 percent would not be willing to give their cows daily injections. Of those who will "wait and see," 72 percent would not be willing to give daily injections. Of the respondents who do not know whether they would use BST, 55 percent would not give daily injections, 9 percent might, and the rest did not know.

To summarize, fast adopters of BST tend to be younger, better educated, and to have larger herds. Potential adopters are also more likely to own multiple dairies. They have the most productive cows, are more likely to belong to DHIA, and are most likely to milk three times a day or both two and three times a day on the same dairy. They tend to own computers and to use buffers. They are more active than non-adopters in both dairy and non-dairy organizations.

IV. Summary and Conclusions

A telephone survey of 153 randomly selected Grade A California dairy farmers was conducted during August through October of 1987 to assess attitudes and concerns towards Bovine Somatotropin (BST). The survey revealed that 34 percent of the respondents would wait an average of twenty and a half months after BST is commercially available before trying it, 29 percent would not use it, 21 percent had not heard of BST, 8 percent would use it as soon as it became available, and 8 percent did not know whether they would try BST or not.

Of those who said they would not use BST, 39 percent were concerned about consumer reaction to BST, 29 percent were concerned about the effects BST would have on cow health, and 24 percent would not use BST because their cooperative or creamery would not take BST milk. Of the potential BST users, 82 percent had concerns about BST. The three major concerns were: 38 percent felt BST would increase production thus adversely affecting prices, 28 percent were concerned about consumer reaction to BST, and 23 percent thought that BST milk might not be safe.

Potential users of BST rejected the idea of giving daily injections. Only 13 percent would be willing to give daily injections. Therefore, widespread use of BST does not look likely until some kind of implant or slow release product is available.

Respondents who said they would not use BST tend to be better educated and older than average. They have the smallest herd size among the different categories of respondents. Their production per cow tends to be a little better than average. All of the respondents who opposed BST milked twice a day. They tended to use computers, silage inoculates, and buffers less than the average respondent. They were distributed proportionally among the regions.

Those who would use BST right away tend to be better educated and younger than average. Their herd size and production per cow is also higher than average. They tend to own multiple dairies more frequently than any other category. They are more heavily represented in Southern Californian than other categories of acceptance. They have a higher proportion of private and DHIA testing than average, and they are the category most likely to be using both twice and three times a day milking. Those who would use BST right away also

are more likely to own a computer for record keeping, use silage inoculates, and buffers than the average respondent.

The respondents with a "wait and see" attitude were of average age, but better educated than other categories of respondents. Their herd size is slightly lower than average, but their production per cow is the highest among the categories of respondents. Regionally, they were distributed in about the same proportions as actual respondents. They were most likely to have DHIA or DHIR testing, and most likely to milk three times a day. This group also had higher than average use of computers for record keeping, silage inoculates and buffers.

In conclusion, despite the controversy, a large proportion of California dairy farmers has not heard of BST. Those that have heard of it often do not have much information about it. Since there are controversies surrounding BST, and consumer reaction to it, more information and research are needed to prepare for its commercial availability. The initial impact on California's milk production by BST will be noticeable, as the dairy farmers in California who intend to adopt BST first are those with the largest herds, among the most productive cows and often own multiple dairies.

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VI. Appendix

A. Survey Instrument

To determine an adoption rate, a survey of milk producers was conducted to assess their receptiveness to BST technology. The survey was a cross-sectional, individual, structured, telephone interview. The survey was conducted from August 10 to October 23, 1987. Respondents were randomly selected from a complete list of all the state's grade A milk producers, who account for 97 percent of California's production. A complete population list of Grade B milk producers was not available.

The sample size was 153 dairy owners, or 7 percent, of the Grade A dairies in California for the year ending 1986. Of the 153 there were 131 responses, for a response rate is 86 percent. Of the remainder, 4.5 percent of the respondents had sold out, 3 percent did not respond or could not be reached, and only 6.5 percent actually refused to participate in the survey. The 131 responses represent 146, or 6.6 percent of the Grade A dairies in California.

Regionally, the response rate was very representative of California Grade A dairies. Northern California has 54 percent of the dairies in the the three regions surveyed, 53 percent of the dairies responding were from that region. The South Valley has 25 percent of the dairies in the three regions, exactly 25 percent of the responses to the survey were from that region. Southern California has 21 percent of the Grade A dairies in the three regions, 22 percent of the dairies responding to the survey were from that region.

The Del Norte region was not surveyed at this time as it is only 4 percent of the Grade A dairies in California, and in a sample of this size would represent only six dairies. It was felt that six dairies was not a large enough sample of this region to be representative. In order to increase the size of the sample in Del Norte, it would have been necessary to increase the overall sample size to assume representative regional distribution. Funds were not available to do so.

The structure of the survey followed recommendations by Dillman (1978) on survey method, and by Rogers (1962) on identification of innovators. The survey was divided into two parts. The first part probed farmers' attitudes about production plans and BST. The second part solicited factual information on the farm and farmers' characteristics. The survey begins with general questions about production and production plans. Survey questions included concerns and attitudes towards BST, as well as, willingness to use it. Many of the questions were asked in an open ended way to prevent biasing answers. Since information on commercial use of BST is limited, it was important not to bias answers by providing prior information about it. Farmers were also asked how long after BST is available would they wait until using it (if at all), and on what portion of their herd they would try it on. Check questions were asked to assess farmers' knowledge of BST.

Questions in Part Two concern farm and operators' characteristics. The farm characteristics of interest were: farm size, type of equipment, productivity, costs and use of other technologies. Characteristics of the farmer that would indicate the degree of innovation according to Rogers, include the productivity level, use of other technology, as well as, the farmers' education, age, how actively he seeks information and what his community involvement is. From Rogers' (1962) and Rogers and Stanfield's (1968) writings on innovation, hypotheses were constructed concerning who is likely to adopt BST:

Projected adoption rate will be no greater than 50-70 percent of the population, at the time of the survey.

Producers with high levels of production are more likely to adopt BST.

Producers with large herds are more likely to adopt BST.

DHIA producers are more likely to adopt BST.

Low cost producers are more likely to adopt BST than high cost producers.

Southern Californian producers are more likely to adopt BST than producers in other regions in California.

Three times a day milkers are more likely to adopt BST than two times a day milkers.

Young dairy farmers are more likely to adopt BST than older farmers.

The data from the first part of the survey should show farmers' willingness to adopt BST and how much time must pass before he can collect sufficient evidence on whether to use it. This can be used to categorize the respondents according to Rogers' classes of technology adopters. The second part provides data on farm and farmer characteristics of these groups.

B. Survey on Bovine Somatotropin

Part I - BST

1. What is your herd size? (dry and milking, cows and first calf heifers)

Averaged 508 Cows & First Calf Heifers.

2. Roughly, what is your rolling herd average in pounds per year? If you do not know, what is your average production per cow per day (for example: 6 gallons per cow per day for milking cows)

1987 Averaged 17,935 lbs/cow/year.

What was your production per cow per year last year?

1986 Averaged 17,122 lbs/cow/year.

What was your production the year before?

1985 Averaged 16,782 lbs/cow/year.

3. Do you plan to increase your total milk production in the next few years?

- a. 56% Yes. Go to #4
- b. 38% No. Go to #5
- c. 5% Might/not sure.
- d. 2% Moving/selling out.

4. How would you prefer to increase milk production?

- a. 0% Three times a day milking.
- b. 47% More cows.
- c. 0% Bovine Somatotropin. Go to #6
- d. 56% Breeding or Better replacement heifers.
- e. 29% Better Feed Management.
- f. 14% Overall Management
- g. 5% Culling.
- h. 4% Better Facilities
- i. 3% Mastitis Control.
- j. 2% Other.

5. Have you heard of Bovine Somatotropin (BST), also known as Bovine Growth Hormone?

- a. 76.3% Yes. Go to #6
- b. 21.4% No. Go to Part II.
- c. 2.3% Don't know/might have.

6. What has been your major source of information about BST?

- a. 77% Magazines or Newspaper.
- b. 6% Co-op/Creamery.
- c. 18% Other Dairy Farmers.
- d. 3% Extension or farm advisor.
- e. 16% Meetings.
- f. 10% All Over.
- g. 7% Veterinarian.
- h. 12% Other.

7. BST will probably be commercially available in 1989 or early 1990. Would you use BST as soon as it became available, would you wait, or not use it at all?

- a. 10.5% Use. Go to #9.
- b. 37% Not use. Go to #17.
- c. 42% Would wait/might. Go to #8.
- d. 10.5% Haven't thought about it/don't know. Go to #8.

8. How long would you wait to tell if BST is worth using? (That is, how long do you think BST would have to be available to tell if it's worth using?)

Open: Averaged twenty and a half months for those who answered 7c or 7d.

9. Do you have any concerns about BST?

- a. 82% Yes. Go to #10.
- b. 12% No. Go to #11.
- c. 6% Don't really know enough to say.

10. What is your major concern about BST?

- a. 38% Increases in production would adversely affect prices.
- b. 23% Milk would not be safe.
- c. 18% Cows would burn out.
- d. 3% Not cost effective.
- e. 3% Not enough research.
- f. 8% Method of application.
- g. 5% Reproductive problems.
- h. 28% Public opinion effecting marketing of milk.
- i. 9% BST is not natural.
- j. 6% Residues in beef.
- k. 5% BST would mean fewer dairy farmers.
- l. 19.5% Other responses, less than 3% each.

11. How would you change your cows' feed ration if you gave them BST?

- a. 5% No change.
- b. 37% Increase amount of feed or TDN content of ration.
- d. 56% Will talk to nutritionist/feed dealer.
- e. 19% Don't know.
- f. 3% Follow instructions/Salesman.

12. What percent of your herd would you try BST on, if you were to try it?

- a. Averaged 52% If 100%, go to #14. If 0%, go to #17.
- b. Don't know. Go to #15

13. And how would you choose the cows?
Would you choose:

- a. 8% Randomly.
- b. 38% High string.
- c. 17% Medium string.
- d. 17% Low string.
- e. 0% First calf heifers.
- f. 22% Confirmed pregnant.
- g. 12% Other.

14. If you try BST on part of your herd, how long would you wait before trying it on your entire herd? Averaged eight and a half months.

15. What percent would your milk production have to increase for you to use BST on your entire herd? (what is the minimum) 85% said BST had to be profitable, 18% wanted an average of 15% increase.

16. Would you be willing to use BST if it required daily injections?

- a. 12.9% Yes. Go to Part II.
- b. 64.5% No. Go to Part II.
- c. 22.6% Might, depends on costs/don't know.

17. If you would not use BST, what is the major reason you would not use it?

- a. 0% Unsure how to change feed ration.
- b. 29% Concern about effect on cows' health.
- c. 21% Concern about effect on milk quality/safety.
- d. 18% Do not want to give cow injections.
- e. 0% Concern about cost of BGH.
- f. 39% Concern about the effect on milk sales.
- g. 5% Prefer other methods to increase productivity.
- h. 24% Coop/Creamery will not take milk.
- i. 16% Not Natural.
- j. 8% BST would make milk surplus worse.
- k. 5% Don't like new things.
- l. 5% Breeding problems.
- h. 24% Other reasons, 3% each.

Part II - Background Information

18. Do you milk three times a day or twice a day?

- a. 9% 3x, go to #20.
- b. 88% 2x
- c. 3% Both 3x and 2x.

19. If 2x, do you plan to go to 3x?

- a. 0% Yes, when? _____.
- b. 94% No.
- c. 4.5% Used to do 3x, not worth it.
- d. 1.5% Might in several years.

20. Do you belong to a monthly milk testing program?

- a. 76.7% Yes, which one? 66.4% DHIA or DHIR, 10.3% private test.
- b. 21.2% No.
- c. 2.1% Self/Milk-o-meter.

21. What percent of your herd is registered? Averaged 6.5%
22. What type of milking parlor do you have?
- a. 47.9% Herringbone/Pregnant Herringbone.
 - b. 14.4% Side opening.
 - c. 0% Rotary.
 - d. 1.4% Diamond/Polygon.
 - e. 0% Trigon.
 - f. 34.2% Flatbarn, (Backout or Walk through.)
 - g. 2.1% Other.
23. What is the average pounds of grain fed per cow in your high string?
Averaged 25 lbs. per cow per day.
24. What is the average pounds of grain fed per cow in your low string?
Averaged 16 lbs. per cow per day.
25. Roughly speaking, what percent of your concentrate/grain do you grow? Averaged 3%.
26. What percent of your roughage do you grow? Averaged 33%.
27. On average, over the past year, how much did it cost you to produce a hundredweight of milk? Include labor, feed, overhead. (Dairy costs only, not calves, heifers, crops.)
Averaged \$9.66/cwt.
28. What percent of your costs for milk production are on feed? Averaged 56%
29. How many years have you operated a dairy farm? Averaged 21 years and four months.
30. How would you describe yourself in relation to your dairy?
- a. 90% an owner who gets involved in day to day operating decisions.
 - b. 7% an owner that lets the herdsman operate from day to day, but you make major decisions.
 - c. 0% an owner that rarely makes decisions on dairy operation.
 - d. 3% other (specify) Herdsman or manager.
31. How many dairy trade associations, lobbying groups or co-ops do you belong to?
Averaged 1.8 clubs.
32. Concerning your community involvement, how many civic, social and service clubs do you belong to?
Averaged .8 clubs.
33. From whom do you get most of your information on dairy operation?
- a. 33.6% Veterinarian.
 - b. 6.1% Farm Advisor or Extension.
 - c. 18.3% Feed company representative or personnel.
 - d. 9.9% Paid consultant, such as a nutritionist.
 - e. 40.5% Trade magazines, like Hoard's dairyman.
 - f. 24.4% Neighbor, friend or other dairymen.
 - g. 23.7% All of the above.
 - h. 18.3% Experience.
 - i. 12.9% Other, various.

34. What kind of housing do you have at your dairy?

- a. 31% Free stalls.
- b. 0% Stanchion.
- c. 25% Corrals, no shade.
- e. 51% Corrals, shade.
- f. 8% Other (specify) Seasonal pasture.

35. Do you use a personal computer for record keeping?

- a. 17% Yes, when did you get it? Average 2.8 years.
- b. 78% No.
- c. 1.5% Computer for milk-o-meter.
- d. 3.5% Other.

36. Do you feed isoacids?

- a. 3% Yes, when did you start using them?
Average of 1 year.
- b. 95% No.
- c. 2% Used to, didn't like them/not worth it.

37. Do you use silage additives (inoculates)?

- a. 17% Yes, when did you start using them?
Average of five and a half years.
- b. 81% No.
- c. 2% Used to, didn't like them/not worth it.

38. Do you add buffers to your feed?

- a. 43% Yes, when did you start using them?
Average of 3.6 years.
- b. 54% No.
- c. 1.5% Used to, didn't like them/not worth it.
- d. 1.5% Don't know.

39. What county is your dairy in? _____

40. What is your age? Averaged 46.4 years.

41. What is the highest year of education you have completed?
Averaged 11.7 years.

42. Would you like to be sent the accumulated survey results?

- a. 92% Yes.
- b. 8% No.

43. That's the end of the survey, do you have any comments?

