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Economic Impacts Associated with Recombinant Bovine Somatotropin (rBST) Use: Comment

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The article "Economic Impacts Associated with Recombinant Bovine Somatotropin (rBST) Use," which appeared in *AgBioForum* 3(2&3), merits somewhat closer scrutiny. The article was based on a pair of regression models which Ott and Rendleman (2000) had developed for herd milk production and for herd "non-milk productivity." These regression models are quite similar to a series of models that Ott, Wells, and Wagner (1999) and Ott and Novak (2001) had created to examine economic losses associated with Johne's disease and with bulk-tank somatic cell counts, respectively. For comparison, I present the models of Ott, Wells, and Wagner (1999) and of Ott and Novak (2001) in Table 1.

Either Ott and Novak (2001) need to retract the square root of the percent of rBST use as an explanatory variable for milk production, or Ott and Rendleman (2000) ought to reconsider the quadratic expression for the percent of rBST use in their model for milk production. Both models lead to very different conclusions about the relationship between rBST use and milk production, and both cannot be correct.

In particular, the model of Ott and Rendleman (2000) indicates that herd milk production (pounds/cow) increases (at a decreasing rate) as the percent of cows treated with rBST increases from zero to 87 (where herd milk production reaches its maximum), and then *decreases* as more cows are treated with rBST. This can only happen if rBST treatment *reduces* milk production in 13% of cows, which would be a significant research finding. However, the model of Ott and Novak (2001) suggests that herd milk production simply increases (at a decreasing rate) as the percent of cows treated with rBST increases from 0 to 100, and reaches its maximum when *all* cows are treated. The model of Ott and Novak (2001) does not imply that rBST treatment reduces milk production for any cow. The R-squared values presented for the two models are almost identical. Only 12.6% of respondents used rBST, and most used rBST in fewer than one-half of their cows (Ott and Rendleman, 2000). The model of Ott and Novak (2001) may be regarded as superior because it is more parsimonious in parameters (i.e., it has one less term than the model of Ott and Rendleman, 2000). There may have been too few respondents who administered rBST to >87% of cows to justify Ott and Rendleman's (2000) inference that maximum milk production occurs when rBST is administered to 87% of cows.

Ott and Rendleman's (2000) conclusion that "the optimal rBST use of 73% is at the national level, that is, if all of the nations' cows were combined into a single herd" is not correct. The results of the survey are only applicable to the population from which the participating operations were sampled (i.e., operations with ≥30 dairy cows in the 20 states included in the survey, Ott, Wells, and Wagner 1999). Because the survey was limited to a rather narrowly defined population, the results cannot legitimately be applied to "all of the nations' cows." Moreover, an estimate of this dimension is incomplete when unaccompanied by a quantitative statement of its uncertainty. For a national estimate of optimal rBST use, I would prefer to see a treatment consistent with standard guidelines for computing, evaluating, and expressing uncertainties in measurements (National Institute of Standards and Technology, 1994). Simply presenting the results of varying prices of rBST and milk is inadequate, because price represents only one component of the uncertainty associated with the computation of optimal rBST use.

The descriptions of the procedures for developing the various models create the impression that too much "tweaking" of variables may have occurred. For example, initial analyses indicated nonlinear relationships between a number of explanatory variables and the dependent variable, for which Ott, Wells, and Wagner (1999) compensated, in one instance, by using the natural logarithm of the explanatory variable, and, in another, by applying the square root. A consequence of performing repeated analyses on a set of data, in order to arrive at models that fit the data well, is that the models' predictive ability for new data may be considerably less than indicated (Neter & Wasserman, 1974).

Finally, a livestock-production analysis that does not incorporate land, capital, and especially feed and labor among the variable inputs is somewhat unusual. Furthermore, creating a dependent variable that combines dollar values attributed to quantities of various outputs (as Ott and Rendleman, 2000, did for "non-milk produc-

Table 1. Models of "annual adjusted value of production" and of milk production in US dairy herds.

Variable	"Annual Adjusted Value of Production" ($ per cow) Regression Coefficients Model 1[1]	Model 2[1]	Model 3[2]	"Milk Production" (kg/cow) Regression Coefficients[2]
Percent rBST Use (square root)	35.43	36.38	33.74	140.00
Herd Size (natural logarithm of number of cows)	103.82	98.99	104.53	384.07
Region				
Midwest	Base	Base	Base	Base
West	-26.36	-31.50	-46.40	-202.65
Southeast	-216.50	-231.80	-326.76	-1128.97
Northeast	-51.79	-60.69	-49.30	-235.39
DHIA Use (yes/no)	214.79	203.45	203.03	834.09
Intensive Pasture Grazing (yes/no)	-110.96	-119.36	-116.66	-452.91
Bulk Tank Somatic Cell Count (cells/ml)				
<200,000	Base	Base	Base	Base
200,000-399,999	-90.71	-77.28	-103.90	-371.69
≥400,000	-297.60	-287.63	-292.39	-958.90
Holstein Breed (% cows that are Holstein)	7.55	7.51	6.86	24.56
Registered Herd (≥90% cows registered, yes/no)	60.28	60.63	84.95	218.94
Days Dry – Not in Milk (≥70 days, yes/no)	-81.08	-79.91	-85.80	-327.12
Percent Change in Cow Inventory	-8.95	-8.75	-10.62	-1.61
Johne's Disease				
Negative herd	Base	—	—	—
Positive herd	-97.01	—	—	—
Johne's Disease				
0% cull cows with clinical signs	—	Base	—	—
>0%, <10% cull cows with clinical signs	—	-41.93	—	—
≥10% cull cows with clinical signs	—	-194.85	—	—
Intercept	—	—	8,884.5	4070.91
R-Squared	0.50	0.52	0.509	0.474

1. Ott, Wells, & Wagner, 1999
2. Ott and Novak, 2001

tivity") is not a standard method for analyzing multi-output production (Debertin, 1986).

Based on experiences with National Animal Health Monitoring System pilot surveys, Wineland and Dargatz (1998) observed that collecting reliable economic information, which would permit valid micro-economic analysis, represented a principal weakness of their on-farm studies. It is hoped that this commentary on the analytic approach of Ott and Rendleman (2000) will serve as a foundation for improvements in the design and analysis of future surveys, and help to clarify some of the issues associated with the economic impact of rBST use.

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