EFFECTS OF SUSTAINED RELEASE SOMETRIBOVE ON MILK PRODUCTION AND BODY CONDITION REPLETION IN LATER LACTATION: A FIELD STUDY.

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Recombinant bovine somatotropin (rbST) has been widely studied as a potential management tool for increasing milk production of dairy cows. Although milk production is generally increased by rbST supplementation, the magnitude of response is variable among herds and cows within herds. Management has been suggested as a major determinant of herd response [1]. However, conclusive evidence that management level modifies rbST response is lacking. Most studies have failed to show a relationship between rbST response and herd production level, a crude measure of herd management. To date, most studies have shown that cows starting rbST treatment in mid lactation show greater response than do cows starting rbST treatment in either earlier or later stages of lactation. Multiparous cows generally respond better than primiparous. Attempts to relate rbST response to pretreatment production levels, genetic potential, pretreatment body condition score (BCS) and nutrient content of the diet have yielded conflicting results. For complete reviews see [2, 3, 4]. Most studies have evaluated rbST response in herds with above average production and in cows over a narrow range of BCS. It would be beneficial if farmers choosing to employ rbST could select cows which would respond maximally and if they could adjust their management styles to predefined goals so as to obtain optimum response. At present there is no way to select cows for rbST response [5].

The purpose of this experiment was to investigate management and cow factors which might impact rbST response over a wide range of conditions.

Materials and Methods

Seven herds (5 in PA and 2 in IL) were selected for range of herd production, range of management styles and DHIA use. Descriptive classification of herds is presented in Table 1. Basic design was to place all cows on study at approximately 100 DIM and continue until two weeks prior to dry off. Some latitude in start date was permitted. Cows with known health problems were removed from consideration. Within herd, cows were grouped by production, parity (PAR 1 = primiparous cows; PAR 2 = cows with 2 or more lactations) and lactation stage (STG 1 <141 DIM; STG 2 > 140 DIM) and randomly assigned to either control (CON) or supplemented (BST) groups. CON cows received no injection, while BST cows received 500 mg sometribove (recombinant bovine somatotropin) in a sustained release vehicle, injected subcutaneously every two weeks. Cows were further classified as to pregnancy status, either open (NPREG) or confirmed pregnant (PREG). Cows not confirmed pregnant at the start of the study were considered open. Cows were fed as per the recommendations of the herd nutritionist. Study herds were fed a variety of roughages, grains, by-products and supplements which were usual for the geographic area and offered water ad libitum. Nutrient content of rations fed to study cows is presented in Table 2. Ration ingredients were sampled monthly and rations were rebalanced to reflect nutrient changes. Descriptive classification of study cows is presented in Table 3.

Table 1. Description of Trial Herds

	Herd 1	2	3	4	5	6	7
Herd Size	67	45	76	85	101	140	70
Herd Avg. (Kg/yr)	9027	7483	7905	6737	8300	8636	7637
Fat %	3.7	3.6	3.7	3.8	3.4	3.6	3.7
Linear Score SCC	3.8	4.3	4.2	4.8	4.6	3.8	4.0
Serv./Conception	1.7	1.9	2.8	1.9	2.2	2.0	2.7
Calving Interval	12.5	13.1	13.1	13.5	13.2	13.5	14.0
Milking Frequency	2	2	3	2	2	2	2
Milk System	Bucket	Bucket	Parlor	Parlor	Pipe.	Par.	Pipe.
Housing System	Tie Stall	Tie Stall	Free Stall	Free Stall	Tie Stall	Free Stall	Free Stall
Feeding System	Compo-nent	Compo-nent	TMR + Computer Grain	TMR + Hay	TMR	TMR + Hay	TMR

Table 2. Nutrient Content of Rations

	Herd 1	2	3	4	5	6	7
NE_l (Mcal/kg)	1.61	1.61	1.58	1.56	1.63	1.65	1.65
CP (%DM)	16.4	14.4	14.9	15.9	17.3	15.7	19.8
UIP (%CP)	33.0	34.8	31.0	36.5	31.0	33.0	36.9
ADF (%DM)	20.3	21.8	23.5	24.3	19.2	20.7	25.3
NDF (%DM)	34.5	37.6	38.0	32.7	25.1	27.0	27.5
Ca (%DM)	0.51	0.52	0.70	0.75	0.76	0.51	1.06
P (%DM)	0.47	0.31	0.40	0.44	0.45	0.47	0.46
Mg (%DM)	0.27	0.21	0.27	0.29	0.22	0.27	0.33

Table 3. Pre-treatment Herd Averages

	Herd 1	2	3	4	5	6	7
# of Cows	34	24	30	44	34	38	24
BCS	2.66	2.54	2.53	2.51	2.26	3.26	3.08
Milk (Kg/d)	29.3	25.3	21.6	20.3	23.0	32.1	27.8
Fat %	3.96	3.60	3.74	3.96	3.75	3.48	3.88
Protein %	3.14	3.04	3.38	3.57	3.51	3.47	3.25
LS (SCC)	3.35	3.04	3.02	3.54	4.22	2.09	3.12
3.5% FCM (Kg/d)	31.6	25.5	22.3	21.5	23.5	31.4	29.7
BST Response (Kg/d)	5.7	2.2	2.4	4.8	4.3	4.1	3.3

All Herds

Number of Cow/Treatment:	N	NPREG	PREG	PAR 1	PAR 2	STG 1	STG 2
CON	118	91	27	36	82	52	66
BST	124	90	34	40	84	57	67

Variables monitored included BCS, body condition repletion (BCR, defined as BCS change from pretreatment), milk production, milk fat %, milk protein %, SCC and 3.5% FCM. Measurement of production variables began two weeks prior to treatment initiation and continued weekly (at day 3 and day 10 of injection). Production measurement was by DHIA personnel and determination of milk components was performed at the respective state DHIA centers. BCS was performed every other week by trained evaluators using a 5 point scale (1 = very thin; 5 = extremely fat). Data presented for all variables is for cows remaining on study from 8-25 weeks. Data were statistically analyzed using GLM of SAS with pretreatment variables as a covariate. The model included:

$$Y = Mean + PRE + BST + HRD + STG + PREG + PAR + SWK + aTFI + Error$$

Where Y = Observed response
Mean = average
PRE = covariate response
BST = effect of rbST
HRD = effect of the herd
STG = effect of the stage of lactation
PREG = effect of pregnancy
PAR = effect of cow parity
SWK = effect of weeks on study
aTFI = all two factor interactions
Error = composed of all higher factor interactions

Milk production and BCR were subjected to regression analysis to identify changes due to rbST treatment. Means presented are adjusted least squares means.

Results

Sometribove treatment resulted in significantly greater production of milk (Table 4) and 3.5% FCM. Response was in the range of those previously reported [6, 7]. As would be expected for overall main effects, STG 1 cows produced more milk than STG 2 cows and PAR 2 cows produced more than PAR 1 cows ($P<.001$). Also as expected, HRD had a significant effect on milk production ($P<.001$). rbST Treatment resulted in a small, but significant decrease in the rate of production decline (-.36 kg/wk for BST versus -.44 for CON, $P<.001$). Considerable range in response existed among herds (Table 3). Differences in response did not appear to be related to measurable management factors.

Table 4. Effects on Milk Production

	rbST		
	CON	BST	SEM
Kg/day	21.4	25.3	±0.07
N	118	124	
	P < 0.001		

	Days in Milk		
	STG 1	STG 2	SEM
Kg/day	25.5	21.2	±0.13
N	109	133	
	P < 0.001		

	Parity		
	PAR 1	PAR 2	SEM
Kg/day	22.6	24.1	±0.17
N	76	166	
	P < 0.001		

HRD effects showed significant interaction with BST, STG, PREG and PAR ($P<.001$). BST showed significant interaction with PREG ($P<.001$), but not with STG. This would indicate that cows beginning treatment around 100 DIM respond the same to rbST supplementation as those begun after 140 DIM. This observation is at variance with those made by other authors who demonstrated lower response at later stages of lactation.

rbST Treatment had no effect on milk fat percent (Table 5). Other changes in milk fat were as would be expected in cows of declining production. There was a small, but significant effect of rbST on milk protein percent (3.48 for CON versus 3.41 for BST).

Table 5. Effect of Sometribove on
Production Measures (LS Means)

	CON(N=118)	BST(N=124)	SEM	P
BCS	2.78	2.56	±0.02	0.45
BCR	0.12	-0.06	±0.012	0.60
Milk (Kg/d)	21.4	25.3	±0.16	0.001
Fat %	3.84	3.86	±0.02	0.40
Protein %	3.48	3.41	±0.008	0.001
LS (SCC)	3.17	3.18	±0.04	0.70
3.5% FCM (Kg/d)	22.5	26.5	±0.18	0.001

Neither BCS nor BCR were affected by rbST treatment. Rate of BCR was affected to a large extent by herd and to a lesser extent by rbST treatment (Figure 1). Initially, cows treated with rbST lost some condition (approximately -.25 BCS units) while their untreated herdmates repleted body condition at a rate typical of the herd. After nine weeks of treatment, BST cows regained condition at the herd rate. Over the 25 weeks of the experiment, however, CON cows repleted condition at 0.030 units/wk while BST cows repleted at 0.016 units, resulting in a difference for rbST treatment of -0.43 units after 25 weeks of treatment.

Rate of Body Condition Repletion

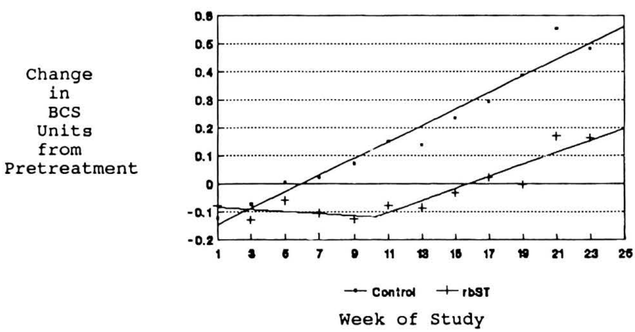

Figure 1.

Discussion

The fact that there was no interaction between STG and rbST supplementation was unexpected. This may be due to the fact that stage represented a wider range of DIM in this study or that pregnancy effects were not separated out from stage of lactation effects in earlier studies. Presumably, a greater percent of cows would be pregnant in later lactation, and therefore would suffer greater milk declines. Indications from this experiment are that pregnant cows suffer sharper production declines than nonpregnant cows (Table 6) and that rbST may reduce this decline. This observation suggests that rbST may reduce the negative impacts of pregnancy hormones on milk production. However, possible effects of stage of pregnancy were not examined.

Table 6. Estimation of Interaction between
rbST and Pregnancy on Milk Production

	NPREG		PREG	
	Kg/day	SEM	Kg/day	SEM
BST	26.4	±0.14	24.3	±0.28
CON	23.5	±0.13	19.3	±0.28

There was no evidence of elevated SCC in this study (P>.70). This may reflect good mastitis management programs in effect on trial farms although herd SCC scores were in an average range. More probably, this may indicate that cows in this study started on treatment at later stages of lactation when they are less susceptible to new mastitis infections.

The strong effect that HRD had on BCS and BCR as well as the rate of body condition repletion, is difficult to understand. If feed energy was a significant predictor of BCS or BCR, then differences in herds should be minor. This observation may reflect some genetic differences in the rate of body condition repletion among the trial herds or may reflect a difference in total dry matter intake. The effects of rbST on body condition are consistent with those previously reported. Although BCS of treated cows ranged from 1.5 to 4.0, there was no significant correlation between pretreatment BCS and response to rbST supplementation (Table 7). Similarly, overall herd BCS was not correlated with herd response (data not shown). We conclude from this that BCS of treated animals had no effect on response to rbST in this study.

Table 7. Correlation by Cow of Response to Sometribove

		Pre-Treatment		
		Milk	BCS	LS (SCC)
BST	R^2	-0.38	-0.04	0.08
	P	0.001	0.63	0.34
CON	R^2	-0.41	-0.23	0.10
	P	0.001	0.01	0.26

For all variables the largest source of variation was the pretreatment measurement. Lactation week was the second largest source. Herd effects, a measure of management level, explained little (0.87%) of the total variation although some management effects are confounded with pretreatment measures. For cows initially treated after day 100, response to rbST appears to be more related to the unexplained physiological state of the animal than to management factors. Pregnancy status, stage of lactation, parity and their interactions contribute only 2-10 % of total explainable variation. We conclude that over the range of herd management represented in this study, management and body condition had a small impact on total herd response to rbST.

Summary

Herd response to rbST was 3.9 Kg/d with variability among herds. Pregnant cows appeared to respond better than nonpregnant cows. rbST Had no significant effect on body score or repletion of body condition. Body score was not correlated with rbST response. In this study, herd management did not appear to explain much of the variation in response.

La respuesta de rbST en establos fue de 3.9 Kg/Dia con variabilidad entre establos. Las vacas prenadas aparentemente respondieron mejor que las vacas no prenadas. rbST no tuvo un efecto significativo en el escor corporal de las vacas o reposicion de condicion corporal. El escor corporal tampoco fue correlacionado con la respuesta de rbST. En este estudio, el manejo del establo no aparece explicar la variacion en respuesta.

La réponse des troupeaux á la rbST variait mais était en moyenne de 3.9 Kg/jour. Les vaches gestantes avaient une meilleure réponse que les vaches non gestantes. rbST n'avait pas d'effet significatif sur la note ou le gain d' état corporel. La réponse n'était pas en correlation avec la note d' état corporel. Dans cette étude, la gestion du troupeau ne semblait pas expliquer la variation de réponse observée.

References

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