DAIRY BEEF IMPLANT STRATEGIES: THE BENEFIT OF TBA-CONTAINING IMPLANTS FOR HOLSTEIN STEERS

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Introduction

Approximately 20% of the beef tonnage produced in the United States is derived from Holsteins, through harvested dairy beef or cull dairy cows (Randy Blach, Cattle-Fax, personal communication). This represents a significant contribution to the U.S. beef supply. More and more large commercial feed yards have seen the opportunity available with feeding Holstein steers. Inherent variation between dairy and beef breeds of cattle warrant altering management of Holstein steers to account for these differences. Differences in social behavior, energy requirements, feed intake, days on high grain rations, and body protein and fat accretion provide opportunities for the feed yard. One management strategy that needs to be evaluated and altered between Holstein steers and beef steers is the implant program. The benefits of implants, and more specifically the trenbolone acetate (TBA)/estrogen combination implants, may be more pronounced in Holstein steers than beef breeds.

The Good And The Bad of the Holstein Steer

Holstein steers possess several positive attributes as related to desirable carcass characteristics. Holstein steers tend to marble well at an early age relative to beef breeds with less external fat. Because Holsteins are typically harvested at an early age, the end product tends to be tender.

The negative of the Holstein steer is they are less muscled than most beef breeds of cattle. They also have a higher maintenance requirement and are more prone to environmental stress than most beef breeds. Maintenance energy requirements of Holstein steers are around 20% higher than conventional beef breeds (NRC, 1996). This difference can be exacerbated in inclement weather because Holsteins carry less external fat and are thinner hided than beef breeds. Garrett (1971) reported that Holstein steers were 12% less efficient at converting energy intake above maintenance for protein than Hereford steers. This may be the reason for Holstein steers to be lighter muscled than beef breeds. Perry et al. (1991) reported that Holstein steers had smaller rib eye area (REA) than either Angus or Angus x Simmental cross steers. Because of the length of time most Holsteins are on feed, and the fact that dry matter intakes are higher in Holsteins (NRC, 1996; Fox et al., 1992), they tend to exhibit more metabolic challenges than beef cattle.

What Implants Do

Estrogenic implants (Ralgro®, Ralgro®Magnum™, Synovex® C/S/H, Component™ EC/ES/EH, Compudose®, Encore®, Duralease®) increase dry matter intake (DMI) and average daily gain (ADG), while reducing feed conversion (F/G). From a carcass standpoint, estrogen implants increase hot carcass weight (HCW), REA and decrease marbling score (Duckett and Andrae, 2001). Part of the performance response can be attributed to increased DMI observed with estrogenic implants. Estrogenic implants increase DMI approximately 6% (NRC, 1996). It is thought that exogenous estrogen exerts an indirect effect on the pituitary gland to increase growth hormone secretion (Trenkle, 1997), but there is also a direct effect of estrogen on skeletal muscle receptors, as estrogen receptors are present in bovine muscle (Trenkle, 1997). Increases in circulating levels of somatotropin and IGF-1 have been shown with estrogenic implants (Johnson et al., 1996). The net effect of estrogenic implants is thought to be increased protein deposition through increased protein synthesis.

Duckett and Andrae (2001) reported that the percent improvement for a single estrogen only implant compared to a non implanted steer averages about 16.4% for ADG, 6.2% for F/G, and 3.2% for HCW. The authors also suggest that part of the reduction in marbling score (MS) observed with implanted cattle, and thus a potential quality grade reduction, is the result of a “dilution effect”. By increasing REA, even without changing the actual deposition of marbling, there is a perception by the grader that marbling has been reduced. A single estrogen or estrogen/TBA implant decreases MS approximately 4% and increases REA up to 4% (Duckett and Andrae, 2001).

Trenbolone Acetate (TBA) contained in the newer combination estrogen/ TBA implants (Synovex® Plus™, Synovex® Choice, Revalor®-S, Revalor®-IS, Revalor®-200, Component™ TE-S, Component™ TE-IS, Component™ TE-200) is a potent androgen. The reason for the use of TBA in newer implants is that TBA has 8 to 10 times more anabolic (muscle stimulation) activity than testosterone propionate while its androgenic (male characteristics) activity is only 3 to 5 times greater (Bouffault and Willemart, 1983). Trenbolone Acetate increases cellular protein production and reduces corticotrophin hormone production. Since corticotrophin hormones increase the catabolism of protein, it is thought that TBA reduces protein turnover (Mader, 1998). The net effect is improved protein deposition. This reduction in protein turnover may result in a reduction in the energy requirement for gain since protein turnover is an energetically inefficient process.

Similar to estrogenic only implants, combination estrogen/TBA implants improve ADG, F/G, HCW, REA and reduce MS (Duckett and Andrae, 2001). The magnitude of these responses appears to be greater with combination implants than either estrogenic or androgenic implants alone, suggesting a synergistic effect (Mader, 1998). We often attribute the improved performance benefit and reduction in quality grade observed with the higher dose combination implants (Synovex Plus, Revalor-S) to the fact that these implants contain TBA, but we must also keep in mind that the estrogen levels in the higher dose combination implants like Synovex Plus and Revalor-S (20 and 24 mg, respectively) are also higher in estrogen content compared to the estrogen only products (Table 1.). Duckett and Andrae (2001) report that Estrogen/TBA implants improve ADG over non-implanted steers by 19%, while reducing F/G by 10.4%. On average, HCW is increased 4.75% (Duckett and Andrae, 2001).

Where TBA Containing Implants Fit In a Holstein Steer Feeding Program

It is the opinion of the author that a combination implant containing TBA should be utilized at least once during the feeding program of almost every Holstein steer fed today, unless being fed under a "Natural Beef" program. As mentioned earlier in this paper, an implant containing both estrogen and TBA works in a synergistic manner. The mode of action of these two hormones is different, and thus, an additive response is obtained. Apple et al. (1991) reported that Holstein steer performance was improved more with a combination estrogen/TBA implant than with either of those hormones individually (Table 2.).

Schaefer and Siemens (1998) showed that one dose of Synovex Plus significantly outperformed one dose of Synovex S in 965 lb. Holstein steers. In the study, Synovex Plus implanted steers weighed an additional 53 pounds at slaughter. When the Holstein steers were evaluated on a grid, Synovex Plus treated Holsteins netted an additional $46.59 over non-implanted steers and an additional $15.34 over Synovex S implanted steers. Beckett (2002) used an initial dose of Encore, a long-acting estrogen only implant, with and without an estrogen/TBA combination implant (Component TE-S) during the last 96 days on feed, and observed an additional 46 pounds of final weight when the TBA implant was incorporated into the program (Table 3).

Steers given a TBA combination implant during the latter phase of the feeding program gained 5.2% faster and converted 2.9% better than the Encore only steers. Although not significantly different, carcasses from steers implanted with an estrogen/TBA combination implant graded 11 percentage units less Prime and Choice carcasses than the Encore only steers. Profit analysis of the data provided by Beckett (2002) suggested the Encore/TE-S implanted steers would have made approximately $30.70 more than the Encore only implanted steers if marketed in a cash market and approximately $25.71 more if marketed on a grid using a $7 choice/select spread.

Because energy intake is typically highest, and feed conversion poorest during the latter-phase of feeding, the response to a TBA containing implant should be greatest during this time period. The negative effect on quality grade observed by Beckett (2002) when a combination TBA implant was given during the last 96 days on feed (Table 3.) may have been caused by "estrogen stacking." In theory, estrogen release from a long acting implant like Encore should exceed 180 days, which was the number of days into the feeding program that the estrogen/TBA combination implant was administered to the Holstein steers. More and more work by Fort Dodge and Intervet would suggest that the level of estrogen given to feedlot cattle has as much negative effect on quality grade than the TBA in combination implants.

Another benefit of a TBA containing implant is the potential improvement in REA obtained with these implants. More emphasis is being placed on REA in Holstein steers as premiums for REA in Holstein grids become more prevalent. Although not observed in every trial, REA is often increased with estrogenic/TBA combination implants over estrogen only implants. In many cases, this increased REA is a function of increased HCW with TBA containing implants. Bartle et al. (1992) reported that estrogenic implants increase protein content of gain similar to an increase of one frame score, whereas, a combination estrogen/TBA implant increases the protein content of gain by two frame scores. That difference in frame-score would be equivalent to an increase in final shrunk weight of about 16 and 32 lbs., respectively (NRC, 1996). Bartle et al. (1992) also reported increased REA with estrogen/TBA combination implants over estrogenic implants only. Apple et al. (1991) observed an increase in REA in Holstein steers when a Synovex S plus Finaplix–S were used concomitantly versus either Synovex S or Finaplix-S dosed individually (Table 2).

Schaefer and Siemens (1998) compared Synovex S to Synovex Plus in heavy Holstein steers and reported increased ADG and F/G (Table 4) as well as increased REA of nearly 1 square inch. Beckett (2002) also observed an increase in REA when long-fed Holstein steers were implanted with an estrogenic/TBA combination implant versus an estrogen only implant (Table 3.) Only in the study of Apple et al. (1991) did the calculated REA/100 lb. of HCW appear to be improved versus an estrogen only implant. In a study by Guichon et al. (2002), REA and REA/100 lb. of HCW were improved in beef calves implanted with two doses of Synovex Choice, an intermediate dose estrogen/TBA implant, over two doses of Synovex S. This increase in REA/100 lb. HCW may have been the result of supplying TBA to these calves at an earlier age and supplying two doses of TBA.

Conclusion

With our knowledge of Holstein steer genetics and growth we can design implant strategies to complement these characteristics to efficiently produce carcass characteristics that are in high demand by the consuming public. Feeders raising Holstein steers too often look for and implement the easiest implant program they can find, which often results in lost dollars for the feeder. Granted, several factors (labor, facilities, etc.) play into developing an implant program, but in the end, the implant strategy that makes the feeder the most money should be the ultimate determinant of one strategy over another. Implant strategies can be developed for Holstein steers that improve live performance, improve carcass attributes, minimize reduction in quality grade and ultimately improve profitability to the feeder.

A TBA combination implant should be administered at least once during the feeding period of Holstein steers. If administered only once, the estrogen/TBA combination implant should be given as the last implant prior to harvest. Improvements in ADG, F/G, final weight, HCW and REA in most cases will more than offset a reduction in quality grade if Holsteins are marketed in a quality-based grid. With the newer intermediate dose estrogen/TBA implants available today, improvements in performance with little if any quality-grade reduction observed over estrogen only implants can be a win/win scenario for the feeder and packer. Possible implant scenarios for long-fed Holstein steers are provided in Tables 5 and 6,

Table 1. Currently Approved Cattle Implants [1]

Implant	Zeranol	Estrogen	Estradiol Benzoate	Progesterone	Testosterone Propionate	Trenbolone Acetate	Approved Animals
Ralgro®	36 mg						Calves, Stockers, Feedlot
Ralgro®Magnum™	72 mg						Feedlot Steers
Duralease™		14.5* mg	20 mg				Feedlot Steers & Heifers
Compudose®		24 mg					Steers, Feedlot Heifers
Encore®		43.9 mg					All Steers
Synovex® C		7.2* mg	10 mg	100 mg			Steers, Heifers
Synovex® S		14.5* mg	20 mg	200 mg			Steers > 400 lbs.
Synovex® H		14.5* mg	20 mg		200 mg		Heifers > 400 lbs.
Synovex® Choice		10.1 * mg	14 mg			100 mg	Feedlot Steers
Synovex Plus®		20.3* mg	28 mg			200 mg	Feedlot Steers & Heifers
Component™ E-C		7.2* mg	10 mg	100 mg			Calves < 400 lbs.
Component™ E-S		14.5* mg	20 mg	200 mg			Steers > 400 lbs.
Component™ E-H		14.5* mg	20 mg		200 mg		Heifers > 400 lbs.
Finaplix®–S/ Component™ T-S						140 mg	Feedlot Steers
Finaplix®–H/ Component™ T-H						200 mg	Feedlot Heifers
Revalor®-S/ Component™ TE-S		24 mg				120 mg	Feedlot Steers
Revalor®-H/ Component™ TE-H		14 mg				140 mg	Feedlot Heifers
Revalor®-200/ Component™ TE-200		20 mg				200 mg	Feedlot Steers & Heifers
Revalor®-IS/ Component™ TE-IS		16 mg				80 mg	Feedlot Steers
Revalor®-IH/ Component™ TE-IH		8 mg				80 mg	Feedlot Heifers
Revalor®-G/ Component™ TE-G		8 mg				40 mg	Stockers

*Estradiol Benzoate contains 72.35% Estradiol 17β. [1]Refer to manufacturer's label for the most accurate claims.

Table 2. Effect of Estrogen and Trenbolone Acetate Individually or in Combination on Holstein Steer Feedlot Performance and Carcass Merit [1,2]

	Control	Finaplix-S	Synovex S	Synovex S+ Finaplix S
ADG, lb.	2.69[c]	2.84[bc]	2.95[ab]	3.08[a]
F/G	6.88	6.49	6.63	6.50
HCW, lb.	638[c]	654[bc]	690[a]	699[a]
REA, in^2	10.6[c]	11.5[bc]	11.6[ab]	12.4[d]
Calc. REA/ HCW	1.66	1.76	1.68	1.77
USDA Yield Grade	3.0	2.8	2.9	2.5
Choice, %	100	75	90	50

[1]Apple et al., 1991
[2]Seventy-two Holstein steers fed 249 days. Cattle implanted on days 0, 56, 112, and 168.
[abcd]Means in a row with different superscripts differ (P<.05).

Table 3. Effect of Implant Strategies on Long-Fed Holstein Steer Performance and Carcass Merit [1,2]

	Control	Encore	Encore/TES	R/ES/TE-S
In Weight, lb.	311	311	310	310
ADG, lb.	3.03[a]	3.27[b]	3.44[c]	3.48[c]
F/G, Dry Basis	5.36[a]	5.24[ab]	5.09[b]	5.15[ab]
Final Weight, lb.	1147[a]	1214[b]	1260[c]	1270[c]
HCW, lb.	693[a]	729[b]	760[c]	773[c]
REA, in^2	10.95[a]	11.10[a]	11.91[b]	11.99[b]
Calc. REA/ HCW	1.68	1.52	1.57	1.55
USDA Yield Grade	2.82[ab]	2.96[b]	2.72[a]	2.90[ab]
Choice or Greater, %	85.2[a]	83.9[ab]	72.9[ab]	66.7[b]

[1]Beckett, 2002
[2]Two Hundred-forty Holstein steers fed 276 days. TES = Component TES, R = Ralgro, ES = Component ES.
[abc]Means in a row with different superscripts differ (P<.05).

Table 4. Holstein Steer Responses to Synovex S and Synovex Plus [1,2]

	Control	Synovex S	Synovex Plus	SE
In Weight, lb.	974	964	956	
ADG, lb.	4.09[a]	4.71[b]	5.24[c]	.12
F/G, Dry Basis	6.27[a]	5.72[b]	5.36[c]	.11
Final Weight, lb.	1439[a]	1510[b]	1572[c]	14
Calculated HCW, lb.	808	856	885	
REA, cm^2	12.1[a]	12.3[a]	13.1[b]	.2
Calc. REA/ HCW	1.50	1.44	1.48	
USDA Yield Grade	3.1	3.1	2.9	.1
Marbling Score[3]	6.4[d]	5.8[e]	5.8[e]	.2
Choice or Greater, %[4]	80	67	60	
Implant Advantage, per head, grid basis		$31.25	$46.59	

[1]Shaefer and Siemens, 1998.
[2]Seventy-five Holstein steers fed 116 days and either not implanted, or implanted with Synovex S or Synovex Plus on day 7 of the feeding period.
[3]small^0 = 5.0.
[4]Not analyzed.
[abcd]Means in a row with different superscripts differ (P<.05).

Table 5. Implant Strategies for Long-Fed Holstein Steers: 350 to 1200 - 1250 lb.

1st Implant	Synovex C	90 – 100 days
2nd Implant	Synovex Choice	120 –130 days
3rd Implant	Synovex Choice	To Finish

Table 6. Implant Strategies for Long-Fed Holstein Steers: 350 to 1300 - 1400 lb.

1st Implant	Synovex C	90 – 100 days
2nd Implant	Synovex Choice	120 –130 days
3rd Implant	Revalor-S/Synovex Plus	To Finish

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