IMPLANT STRATEGIES FOR DAIRY STEERS

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INTRODUCTION

The availability of growth promotant options on the market today (Table 1) targeted to cattle ranging from young calves to growing and finishing steers provides dairy steer producers the flexibility of designing an implant strategy to meet their goals for an economic return for a specific market niche. Expectations in typical beef feed yards are for a return of $10 to $30 per dollar invested in growth promotants (Anderson, 2001). In an evaluation of 37 steer trials, Duckett et al. (1996) observed that implanted cattle increased daily gains 18%, feed intake 6%, feed efficiency 8%, carcass weight 5%, and rib-eye area 4% compared to those receiving no implants. Overall carcass traits and tenderness were not significantly affected negatively by implanting although implanted cattle had a 14.5% decrease in the percentage choice. The net return was $18.32 in cattle sold live and $13.53 on a grade and yield basis per implant investment, the latter being offset by decreases in choice grades. Guiroy et al. (2002) found that although anabolic implants improved the efficiency of absorbed energy, the finished body weight of steers to reach the same body composition as non-implanted increased from 30 to 90 lbs, depending on the implant strategy used. If producers decide that they will not use implants because of a specific market niche and consumer preference, then a premium of $30 to $60/steer will be necessary to make this option economical (Anderson, 1998).

The challenge with long-fed dairy steers is to integrate a suitable implant strategy with feeding programs at each phase of production to maintain an economic return. This paper will review general recommendations for implanting strategies for feedlot cattle under varying nutritional regimens with application to dairy steers in the feedlot and on-pasture. The focus will be on Holstein steers.

MECHANISM OF ACTION

To attain the full benefit of growth promotants all implants must be administered in the middle third of the back side of the ear or in the last third of the ear if part of the ear is lost through frost bite (Griffin and Mader, 1997). Incorrect placement of the implant causing implants to be lost or abscessed implant sites will reduce daily gain by an average of 0.13 lbs (Berry et al., 2000). A quality assurance implant placement program is an important consideration to improve the consistency of the response to implants. An example known as zero defect implanting which has reduced implant defects and abscesses was discussed by Cook (2000). Cattle must be fed to meet their nutrient requirements (NRC, 1996) for projected performance during the growing and finishing period for implants to be effective.

The basic mechanism of action of growth promotants relates to either their estrogenic or androgenic activities or a combination of both. Feed intake is typically increased by estrogenic implants resulting in enhanced gain in addition to changes in body composition. It has been suggested that the effects of estradiol are mediated through alteration of the somatotrophic axis with increasing levels of circulating somatotropin (ST) and insulin-like growth factor-1(IGF-1). The release of growth promotant from an implant declines after a few days but is maintained at a high enough effective level to stimulate a growth response. Implants vary in the length of time they remain effective for growth stimulation which is the premise of re-implantation strategies (Griffin and Mader, 1997; Cook, 2000). The synthetic androgen, trenbolone, is approved for steers and heifers in the form of trenbolone acetate (TBA). Trenbolone acetate is a synthetic steroid with similar structures to both testosterone and estradiol. Trenbolone binds to both testosterone and estrogen receptors in muscle and other tissue (Anderson, 1991). Androgens have a direct effect on muscle cells which result in a net increase in protein accretion and have an indirect benefit of interfering with anti-anabolic effects of corticosteroids competing for corticosteroid binding sites (Cook, 2000). Trenbolone has no direct effect on adipose tissue but will reduce fat deposition by altering nutrient partitioning. The combination of TBA with estradiol (E) or zeranol (synthetic estrogen) enhances the growth, efficiency of feed nutrient utilization, and muscle deposition in steers (Anderson, 1991).

IMPLANTS AND NUTRIENT INTERRELATIONSHIPS

General perspective:

The effect of anabolic implants on nutrient requirements are accounted for by the relationship to protein, fat and energy accretion at a constant body composition and finished body weight. NRC (1996) indicated that protein content of gain equivalent to a 77 lb change in final shrunk body weight (FSBW) results from using estrogenic implants and 154 lb equivalent change in FSBW for the combination of TBA and E compared to not using an implant. Evaluation of the effect of 120 mg TBA in combination with 24 mg E (Revalor S®) vs. no implant administered to large frame 867 lb cross-bred steers by Johnson et al. (1996) showed a 82% increase in carcass protein accretion during the first 40 days after implanting. There were no effects on carcass fat deposition except a lower kidney, pelvic and heart (KPH) fat accumulation. Net energy requirements for gain have been reduced by at least 5% when anabolic implants are used (NRC, 1996).

Guiroy et al. (2002) in a summary of 13 studies with 13,640 cattle (66% steers), calculated the adjusted FSBW at a 28% empty body fat final BW (AFBW) and observed that the response to anabolic implants is due to a combination of decrease in the proportion of dry matter intake (DMI) needed for maintenance, reduced energy content of gain and efficiency of use of absorbed energy. Implant strategy did reduce the percentage of steers grading low choice compared to non-implanted steers. In addition to effect of implants, considerations for use of ionophores (additive response with implants), previous plane of nutrition, environmental conditions and frame size/breed effects are accounted for by NRC (1996) and refined by Cornell Cattle Systems 5 (CCS5; 2002).

Holstein steers are very sensitive to environmental stressors such as high temperatures and humidity, low temperatures with wet hair coat, wind speed with wet hair coats, and muddy conditions (Chester-Jones et al., 1998). These conditions affect DMI and performance and reduce effectiveness of an implant program. The maintenance energy (NE_m) requirements of Holstein steers can be reduced by use of implants (Ainslie et al., 1992). They found that NE_m for steers receiving a Revalor® implant was 60 kcal per unit of metabolic BW (MBW) compared to 77 kcal per unit of MBW for non-implanted steers. Holstein steers that have the propensity for compensatory gain (such as feeding a high energy diet following a period of higher roughage feeding) will improve energy utilization for both NE_m and NE_g which may be further enhanced by implant strategies (NRC, 1996).

Table 1. Selection of implant products available for growing and finishing steers[a]

Brand Name	Estrogen mg/implant	Progesterone (P) mg/implant	Androgen mg/implant	Re-implant Window, d	Estimated Pay-out, d
Lower Potency					
Ralgro®	36 mg zeranol[b]	----------------	----------------	45 to 90	70 to 100
Synovex C®	10 mg estradiol benzoate (EB)[c]	100 mg P	----------------	45 to 90	100 to 140
Component E-C®	10 mg EB	100 mg P	----------------	45 to 90	100 to 140
Calfoid®	10 mg EB	100 mg P	----------------	45 to 90	100 to 140
Moderate Potency					
Finaplix S®	------------------	----------------	140 mg TBA[d]	70 to 100	60 to 100
Component T-S®	------------------	----------------	140 mg TBA	70 to 100	60 to 100
Revalor IS®	16 mg E	----------------	80 mg TBA	120	100 to 140
Revalor G®	8 mg estradiol -17 β (E)	----------------	40 mg TBA	120	100 to 140
Synovex S®	20 mg EB	200 mg P	----------------	70 to 100	100 to 140
Component E-S®	20 mg EB	200 mg P	----------------	70 to 100	100 to 140
Implus S®	20 mg EB	200 mg P	----------------	70 to 100	100 to 140
Compudose®	25.7 mg E	----------------	----------------	140 to 170	170 to 200
Encore®	43.9 mg E	----------------	----------------	140 to 170	300+
Higher Potency					
Magnum®	72 mg zeranol	----------------	---------------	70 to 100	100 to 120
Revalor S®	24 mg E	----------------	120 mg TBA	90 to 100	100 to 140
Revalor 200®	20 mg E	----------------	200 mg TBA	90 to 100	100 to 140
Component TE-S®	24 mg E	----------------	120 mg TBA	90 to 100	100 to 140
Synovex Plus®	28 mg EB	---------------	200 mg TBA	90 to 100	100 to 140

[a]Adapted from Griffin and Mader (1997), Anderson (1998) and Loy (2001).
[b]Zeranol contains 30-33% the estrogenic activity of estradiol-17β
[c]Estradiol benzoate is 72% the estrogenic activity of estradiol-17β
[d]TBA = trenbolone acetate

Feedlot implant strategies are based on target market dates, genetic potential of the cattle, predicted changes in market prices and feed costs. If low choice grade is 28.6% empty body fat then the relationship between implanted cattle, frame size and BW to attain low choice marbling grade is shown in Table 2. Implanting changes the growth curve upward to a higher level. For example implanted cattle of frame score 5 will have to be fed out to a heavier BW that is similar to frame score 6-7 to attain their genetic physiological and biological maturity (Nichols et al., 2001). Depending on the spread between choice and select grades, a decision can be made to look at the risk:benefit of marketing at a lower quality grade. Empty body fat (EBF) for Standard, Select, Low Choice, and Mid Choice Quality grades are 21.1%, 26.2%, 28.6%, and 29.9%, respectively (Nichols et al., 2002).

Table 2. Relationships between Steer Frame Score and Body Weight to Reach 28% EBF[a]

Frame Score	1	2	3	4	5	6	7	8	9
BW, lbs	882	954	1029	1102	1175	1250	1322	1395	1470

[a]Adapted from Nichols et al.(1999)

Finished Holstein steers are typically frame score 8 or 9. Perry et al. (1991) found that when fed to the same degree of marbling, frame score 8 Holstein steers were not different in ADG or DOF but utilized their feed 7% more efficiently when compared to heavier frame score 9 steers. This reduced feed cost of gain. They recommended that Holstein calves with smaller frames should be selected for long-fed Holstein feeding systems and implanted accordingly with expectations of increasing the final market weight by 50 to 100 lbs to ensure a good percentage will attain a low Choice grade.

Protein and implant interrelationships:

Higher protein requirements for lean tissue gain with larger frame cattle implanted with medium or high potency implants are now suggested based on the emphasis on metabolizable protein which requires different protein levels to optimize performance without increasing the feed cost of gain (Chester-Jones et al., 1998). These authors noted that for implanted Holstein steers fed high energy diets with an ionophore, the lbs of protein required/day increase with faster rates of gain or at heavier BW. The proportion of crude protein (CP) in the diet for a given gain decreases as heavier cattle eat more.

A review by DiCostanzo (1995) evaluated 54 studies using steers between 770 and 1245 lbs fed for 110 to 170 days on feed to describe the relationships between use of medium and high potency implants to dietary protein concentrations on feedlot performance. It was found that CP concentration affected feedlot performance independent of implant strategy. Crude protein intake (CPI) was highest for steers fed high dietary CP regardless of implant strategy. Steer CPI was highest for those implanted with medium or high potency implants and lowest for non-implanted steers regardless of CP dietary concentration. It was noted that the benefit of feeding higher CP diets depends on choice of implants and steer performance response. For maximum performance it was suggested that a high potency terminal implant and 13.3% CP were required. Average daily gain increased 0.13, 0.14, and 0.15 lbs/lb DMI for non-implanted, medium and high potency implanted steers, respectively. Average daily gain increased 0.10 lbs for every percentage increase in dietary CP. It was shown that implanting yearling feedlot steers with high or medium potency implants required less CP/gain (0.73 and 0.76 lb CP/lb gain, respectively) compared to non-implanted steers (0.83 lb CP/lb gain). DiCostanzo (1995) observed that urea was an effective supplemental source fed at < 1% diet DM in diets fed to steers implanted with TBA-based products.

A number of studies at Iowa State University have focused on protein feeding strategies (Trenkle 1995; Lima et al., 1995;Trenkle, 2002) with or without medium or high potency implants. Work has indicated that yearling or young steers implanted with TBA and E have greater protein needs. Charolais x Simmental steers were fed high concentrate diets containing urea (0.85% diet DM; 10.5% CP diet DM) or soybean meal (SBM; 10% diet DM; 13.5% CP diet DM) with monensin sodium (14 mg/lb DM) with or without Revalor-S® implants (implanted on day-1 and re-implanted day-70). Cattle were fed for 183 or 204 days. The greatest economic benefits came from average gain advantages over 141 days for implanted steers. During the first 70 days steers fed SBM gained 27% faster and were 20% more efficient that those fed urea, but by the end of the study there were no effects of CP supplement. Feeding SBM vs. urea increased carcass weight (CW) 21 lbs in implanted steers. Percentage choice decreased from 62% with non-implanted to 47% for implanted steers over 183 days but no effect after 204 days on feed. Implants increased rib-eye area (REA) 1.9 sq. in. vs. no implants with greatest difference between days 150 and 180. Neither protein source influenced the sensory value of the steaks. Quantity of polyunsaturated fatty acids (PFA) in muscle and fat tissue were not affected by implants.

Programmed protein feeding systems using NRC (1996) guidelines were evaluated for 600 lb Angus steer calves (Trenkle, 2002):

- Program 1 – diet of 13.5% CP (MP ratio – percent of NRC requirement 0.90) for 84 days then reduced to 11.85% (MP ratio 1.1) implanted with Component E-S on day-1 and Component TE-S day-84 (all steers on each program).
- Program II – diet of 13% CP for 84 days, 11.85% CP from 84-112 days and 11.25% CP (MP ratio, 1.19) to 180days. Implant the same as I.
- Program III fed 13% CP for 84 days, 11.85% at 84-112 days and 10% CP (MP ration, 1.07) to 180 days.

Feed/gain was lowest for steers on Program I. No other performance or carcass trait differences were noted. The implications of the study were that amount of protein fed to finishing cattle can be reduced without affecting performance and that requirements for ruminally degraded protein as estimated by NRC (1996) may not need to be met with finishing cattle fed high concentrate diets.

OVERVIEW OF SOME IMPLANT STRATEGIES EVALUATED IN BOTH BEEF AND HOLSTEIN STEERS IN CONTROLLED STUDIES

There have been numerous beef cattle studies evaluating systems for implanting and re-implanting cattle. Much less data is available for Holstein steers using the more recent implants available. The discussion below will include selected beef breed information that can be applied to Holstein steers. Considerations include target market date, phase of production, feeding system (programmed or target feeding, number of feeding times/day, diet composition etc.), cattle age and breed, days in the feedlot, potential for compensatory growth, time of day implants are given, implant sequence, and number of implants. An implant database has been established through the Texas Tech Beef Animal Science Dept. web site (www.asft.ttu.edu) which has been developed in partnership with Intervet. Summary performance and carcass data are available for many designed implant strategies.

Examples of Holstein Steer Studies:

Work by Chester-Jones et al. (1992a) evaluated the effect of using low to moderate implant strategy for high-energy fed Holsteins from one week of-age to market weight. All calves received their first implant by 42 days of-age when still housed in individual stalls. Strategies compared single, double or triple implants given within 200 days over the growing and finishing period.The study confirmed that for young calves a single implant may have a longer effective pay out than estimated concurring with results by Schaefer et al. (1986). Steers were marketed when pen averages reached 1100 lbs. Percentage choice grade declined with increasing number of implants. Results are summarized in Table 3.

Table 3. Response to single or multiple implants of Ralgro®(R) vs Synovex® (S) for Holstein steers[a]

Implant Sequence Steer Groups (G)	P1[b] BW	P1 ADG	P2[b] BW	P2 ADG	P3[b] BW	P3 ADG	P4[b] BW	P4 ADG	Overall ADG	DOF to 1100 lb
Initial implant @ 42 d of-age – GA[c]	lb	lb	lb	lb	lb	lb	lb	lb	lb[d]	BW[d]
Ralgro (R)	154	1.08	393	2.43	698	2.87	1082	2.32	2.32	426
Synovex (S) –C	148	1.05	393	2.29	708	3.13	1077	2.47	2.41	412
42, 126 d – GB[c]										
Ralgro	159	1.09	391	2.33	708	3.09	1066	2.10	2.28	432
SC, Synovex S (SS),	149	1.07	392	2.26	717	3.08	1083	2.44	2.39	385
42, 126, 210 d –GC[c]										
R-R-R	138	0.91	390	2.36	717	3.08	1083	2.52	2.43	409
SC-SS-SS	137	0.82	409	2.52	702	3.49	1077	2.77	2.55	385

[a]Adapted from Chester-Jones et al.(1992a);
[b]P1 = period 1, day 42 to 53 in individual stalls – all implanted; P2 = period 2, 157 days on feed, 2nd implant given at end of P2; P3 = period 3, 257 days on feed, 3rd implant given at 199 days on feed; P4 = period 4, 257 to av 410 days. Steers marketed at pen average of 1100 lbs; all period and end BW were taken after withholding feed and water 16 h.
[c]P2 Daily gain - GB, GA Ralgro vs GC Synovex ($P < .05$), GB Synovex vs GC Synovex ($P < .07$).
[d]Overall Daily gain – GC Synovex vs GA, GB Ralgro and GB Synovex ($P < .05$);
DOF- GC Synovex vs all other groups ($P < .05$).

In a previous study by Chester-Jones et al. (1991), Holstein steers that had received 3 implants prior to 120 days of projected market weight received either no implant, Synovex S or Synovex S combined with Finaplix. Gain response to the 4th implant was an increase of 18% and feed/gain 10% less than non-implanted steers. Days on feed were 17 day less for steers receiving four implants. Carcass quality was decreased compared to non-implanted steers. Feed cost/gain was highest for non-implanted steers. Benefits of performance response and less time on feed may offset reduction in gross return from lower carcass quality. A question was asked in a study by Chester-Jones et al. (1996) if delaying the first implant for high-energy long fed Holstein steers until later in the growing period would achieve a greater response when DMI are higher than multiple implants from 42 days of-age? Steers were implanted with a single Compudose® at 600 lbs and gained 19% faster than non-implanted steers to a pen average market weight of 1270 lbs.

Beckett and Algeo (2002) also investigated the effects of delaying implants during the early and intermediate growing phases for Holstein steers from 343 lbs BW. One group of steers received no implants. Other strategies were: a) Ralgro® day 0, TBA + E day 60, none day 120, and TBA + E day 180; b) None day 0, TBA + E day 60, none day 120, TBA + E day 180; c) None day 0, Ralgro® day 60, Ralgro® day 120, TBA + E day 180; d) None day 0 and day 60, Ralgro® day 120, TBA + E day 180. Daily gains did not differ within implant strategy. Implanted steers gained faster, had heavier final weights, and greater REA compared to non-implanted steers. Percentage Choice carcasses were lower for strategy b (27%) and c (31.6%) compared with non-implanted steers (57.9%). Strategy a (40.5%) and d (52.8%) were not different from other treatments. Less desirable meat tenderness was evident in delayed implant groups compared to non-implanted steers. The authors concluded that performance and carcass quality grade were not adversely affected for a delayed implanting strategy but may decrease meat tenderness compared to earlier implants.

Implanting strategy for 280 lb calf-fed Holsteins from a study in California was summarized by Guerrero (1999). The implant strategy, performance and carcass data are summarized in Table 4. It was concluded that implanting Synovex C® on day 1, Synovex S® on day 98 and a combination implant on day 196 (Synovex S® and Finaplix® in this case) appeared to be the optimum for performance and carcass quality. This agrees with the strategy purported by Pritchard (1993) of increasing implant potency with every subsequent re-implant.

Table 4. Effects of Implant on Performance and Carcass Quality of Calf-fed Holstein Steers Fed Continuous High-Energy Diets[a]

Parameter	NI [b]	CSS [b]	CSSF[b]	CSSS [b]	CSSSF [b]	CSSFSF[b]
Initial BW, lb	278	279	280	282	278	278
Final BW, lb[c]	1111	1130	1143	1136	1136	1153
ADG, lb[d]	2.65	2.93	3.00	2.93	2.95	3.02
DMI. lb[d]	14.7	15.5	15.5	15.5	15.2	15.3
DM/gain, lb[de]	5.56	5.27	5.16	5.30	5.12	5.10
Hot CW, lb[d]	694	708	708	717	706	708
Dressing, %	62.5	62.7	61.9	63.1	62.2	61.4
Choice, %	82.2	81.0	64.3	66.3	79.6	72.2
Yield Grade	2.82	2.84	2.78	2.71	2.71	2.53
Retail yield, %	52.0	51.9	52.2	52.2	52.1	52.8

[a]Adapted from Guerrero (1999), University of California Desert Research and Extension Center using 252 purchased Holstein steers

[b]NI = No Implant; CSS = Synovex C® (SC) on day1, Synovex S® (SS) on day 98 and 196; CSSF = SC day 1, SS day 98, SS and Finaplix® (SF) on day 196; CSSS = SC day 1, SS days 70, 140, and 210; CSSSF = SC day 1, SS days 70, and 140; SF day 210; CSSFSF = SC day1, SS days 70, SF days 140 and 210.

[c]Finished weight for harvest was an average shrunk BW of approximately 1113 lb.

[d]NI vs all implants ($P < .01$); Implanted cattle 12% > ADG and 4.6% > DMI than NI.

[e] The use and increased frequency of Finaplix® implants enhanced feed efficiency ($P < .05$);

One of the earlier studies which evaluated the effect of using a single TBA (140 mg) and E (28 mg) implant (Revalor®) for finishing steers included breed differences between Holstein steers and beef breeds on feedlot performance, carcass quality and composition (Perry et al., 1991). Holstein (H) steers were compared to Angus (A) or Angus x Simmental (AS) cattle when fed a 85% concentrate diet. One half of the steers were implanted (I) with TBA and E, the others received no implant (NI). Steers were harvested when they achieved adequate marbling to attain a low Choice grade as determined by ultrasound. A summary of the results are shown in Table 5. Compared to NI steers daily gain was increased by 17, 26, and 21% for H, A, and AS, respectively. Implanting increased daily protein and fat accretion by 23%. Holstein steers required more DOF to attain the minimum marbling score. Live BW to reach a low Choice degree of marbling was increased 55 to 99 lbs. The implant was given > 120 days before harvest so did not compromise marbling score or number of steers grading Choice.

Table 5. Effect of a Single Trenbolone Acetate and Estradiol Implant (I) vs No Implant (NI) on Performance and Carcass Composition of Finishing Holstein, Angus, and Angus x Simmental Steers Fed a 0.60 Mcal/lb NE_g diet[a]

Parameter	Holstein (H)		Angus (A)		A x Simmental (AS)	
	I	NI	I	NI	I	NI
Performance:						
Init. BW, lb[bc1]	576	572	627	642	642	636
Final BW, lb[dc2-4]	1173	1126	1166	1078	1133	1120
DOF[125]	210	226	143	146	123	152
ADG, lb[c1-5]	2.86	2.44	3.76	2.97	3.92	3.23
DM/gain, lb[c1-5]	6.50	7.08	5.26	6.06	5.06	5.78
Carcass Composition:						
Marbling score[e]	5.0	5.5	5.4	5.4	5.4	5.6
Dressing %	61.8	62.1	62.4	62.8	61.2	62.2
Hot CW, [lbc2-4]	724	693	717	673	700	693
Conformation[fc1]	6.2	6.3	8.9	8.6	9.1	8.3
REA, sq in[c1]	11.32	10.93	12.03	11.32	12.41	12.32
Backfat, in[c1]	0.29	0.24	0.51	0.43	0.36	0.34
Body Composition:						
Carcass fat, %	30.2	30.7	32.7	32.8	31.1	29.8
Carcass prot.%	15.2	14.5	14.4	14.1	14.8	14.9
Prot.gain, lb/d[c1-5]	0.53	0.44	0.64	0.51	0.73	0.59
Fat gain, lb/d[c1245]	0.97	0.88	1.43	1.17	1.41	1.06

[a]Adapted from Perry et al.(1991)
[b]Initial BW of Holstein steers < others (P <.01);
[c]Contrasts P < .01 or P < .05; 1 = H vs others; 2 = I vs NI; 3 = HI vs HNI; 4 = AI vs ANI; 5 = ASI vs ASNI;
[d]Final BW - steers were harvested when ultrasound attenuation indic marbling required for low Choice grade. Final BW were adjusted by dividing hot CW by overall dressing percentage 61.7%.
[e]Marbling score: 4 = slight; 5 = small;
[f]Conformation score: 6 = $Good^+$; 7 = $Choice^0$; 8 = $Choice^+$;

Work by Ainslie et al. (1992) found that Holstein steers implanted with Ralgro® at 350 lbs and fed dry corn and SBM diets containing 7, 22, or 40 % of diet DM as alfalfa silage had higher ADG and lower Feed/Gain over a 98 day growing period compared to non-implanted steers. Steer performance decreased with increasing alfalfa silage levels mainly due to lower DMI. In this study at 98 days, all steers were switched to a 90% concentrate finishing diet and half of the steers were implanted with Revalor®. Steers were harvested when they reached a low Choice marbling score as determined by ultrasound. Implanted steers gained

18% faster and 11% better feed efficiencies compared to non-implanted steers during the finishing period. Overall implanted steers reached their finished BW 37 days earlier than non-implanted steers. Diet and implant program did not consistently affect carcass traits. Level of alfalfa silage in the growing diet did not influence the days to reach finished weights when fed a high-energy finishing diet.

Implants evaluated for pasture-based Holstein steers:

The evaluation of managing Holstein steers in an intensive rotational grazing system was conducted at the University of Wisconsin Lancaster Research Station from 1995 through 1997 as reported by Chester-Jones et al.(1998). Steers were purchased from a high grain feeding system or off Southern States pastures. Systems evaluated singly or in combination were: a) Unsupplemented or implant control; b) Synovex S® on day 1 and day 84 of the grazing period ; c) Daily feeding of 200 mg lasalocid (Bovatec®) in 1 lb of a pelleted wheat middlings supplement (B) and, d) Supplement of coarsely ground corn up to 1% BW. When steers received the SB combination, the corn supplement and Bovatec® equalled 1% of BW. Pasture quality and availability varied across the years. Energy but not protein tended to be a limiting factor in growth rates. Corn supplementation increased BW gains in all years but was relatively inefficient conversion to weight gain. Cost of gains tended to be lower when corn was supplemented in combination with an implant or ionophore. Corn supplementation was beneficial particularly when pasture was limiting. Synovex S® improved daily gains in each year but they exert significant advantage when fat deposition is possible which did not occur in the 380 to 490 lb steers until year 3 when control steers gained over 2.3 lbs daily indicating good pasture availability. In this year the response to an implant investment of $5 was a gain yield due to implanting of $34.30. Comerford et al. (2001) used 400 lbs Holstein steers assigned to either 4.5 month grazing then 80% concentrate diets in a feedlot until harvest; 4.5 month grazing with access to molasses-based liquid supplement then similar high corn diets in the feedlot; or placed in the feedlot for the entire feeding period. Half the steers in each treatment were singly implanted with Revalor S®. Implanting steers did not affect carcass traits, carcass composition or finishing phase performance in the feedlot. Implanted steers had faster ADG. Supplementing or unsupplementing pasture-fed Holstein steers in the growing period decreased quality grades and carcass BW when compared to cattle fed throughout in the feedlot.

Example Recent Beef Steer Studies:

Mader et al. (1999) found that Revalor G® was an effective initial implant for 715 lb cross-bred steers re-implanted with Revalor S® after 66 days vs. intial Synovex S® and Revalor S® as re-implant; initial Ralgro® and Revalor S® as re-implant; single Revalor S® at day zero or day 66 vs. no implants. Non-implanted steers had lowest gains, poorest feed efficiencies, smallest CW, smallest REA but tendency for highest marbling score. Trenkle (1997) found that Synovex Plus® is an effective single implant for finishing steers when compared to those implanted with Synovex S®, Revalor S® vs. no implants. Steers fed Cattlyst® (laidlomycin propionate) in combination with Synovex Plus® showed an improved feedlot performance compared steers fed Cattlyst® alone. In a 145-day finishing study by Cooper et al. (1999), yearling steers were implanted with either Synovex C® on day 0 followed by Synovex Plus® on day 70; Synovex S® on day 0 and day 70; Ralgro® on day 0 and Synovex Plus® on day 70; and Synovex Plus® on day 0 only. Steers were fed a 13.5% CP diet based on 63% dry rolled-corn, 22.55% wet gluten feed, 7.5% alfalfa hay, 3% tallow and supplement with Rumensin (29 g/ton) and Tylan (10 g/ton). Steers implanted with Synovex C® and re-implanted with Synovex Plus® had better feed efficiencies compared to those implanted with a single Synovex Plus®. Implant strategy did not affect percentage choice carcasses or marbling scores.

Timing of re-implantation has been shown to be as, if not more, critical than product selection. Anderson (2001) reported on a 161 day feeding period with finishing steers twice implanted with either, a) Ralgro® 1st - Component TE-S® 2nd (re-implanted day 50); b) Component E-C® 1st – Component TE-S® 2nd (re-implanted day 50) or c) Component E-C® 1st – Component TE-S® 2nd (re-implanted day 80). Feedlot performance was similar but percentage choice was highest with the 80-day re-implant period. A study by Stanton et al. (1998) with 574 lb black-baldy steers implanted with Revalor S® or Implus S® on day 0. All steers were re-implanted on day 83 with the same type of implants but switched so Revalor S® 1st – Implus S® 2nd and Implus S® 1st- Revalor S® 2nd. Steers were re-implanted either at 9 a.m. or 3 p.m. within each group. Feed efficiency was better for a.m. implanted steers compared to p.m.

An example of a strategy for 550 lb medium to large framed steers given by Griffin and Mader (1997) well illustrated a system for back calculating an implant program from the projected finished harvest date. The steers entered the feedlot October 1st. The initial implant suggested was estrogenic product such as Magnum, Synovex S®, Implus S®, or Component E-S®. In this example, the market BW was predicted to be 1100 lbs at 3 lbs/day gain with finished date of first two weeks in April. With the 120 day pay out for combination TBA and E from the middle of April would mean a 2nd implant the middle to late December (e.g, Revalor S®, Synovex Plus®, Component TE-S®). Alternatively could use a single Compudose® as the initial implant. Examples of the application of a rationale for implanting beef cattle implanting as outlined by Pritchard (1993) adapted to include the current implants on the market. This is based on the premise of increasing potency with each re-implant although the gain response to the number of re-implants is often decreased:

Midwestern calf feeding program of 120 days on corn silage and 120 days on a finishing diet:

- Initial implant lower potency - e.g., Ralgro®, Synovex-C®, Calfoid, Component E-C,®;
- 2nd Implant after 60 days - e.g., Synovex S®, Implus S®, Revalor IS®, Component E-S®;
- 3rd Implant after 90 days – terminal e.g., Synovex Plus®, Revalor S®, Revalor 200®, Component TE-S®; (window 90 to100 days to harvest)
- Alternative option – use Compudose® as a terminal implant at 150 days.

(Note from the above author - could omit initial implant in longer fed cattle but added early weight gain response is beneficial)

A 200 day feeding period:

- Initial implant moderate potency - followed by a higher potency terminal implant at 100 days. (Note from the above author – resorting to 3 moderate potency implants at 70 day intervals can lead to more riding and bullers, especially during last 60 days on feed)

A 100 to 150 day feeding period:

- Two moderate potency implants or 1st implant of low to moderate potency followed by a terminal implant

A 60 to 80 day feeding period:

- Lower potency implant recommended as cattle implant is unknown but moderate potency will lower cost of gain but may more negatively effect carcass quality.

APPLICATION OF IMPLANT PROGRAMS TO HOLSTEIN STEER FEEDING SYSTEMS

A first consideration for Holstein feeders is to define their market niche whether it be sale of feeders or finished cattle. A next step might be to evaluate the facility options available and calculate the capacity and potential turn around time for varying cattle end points. Make sure that feed resources are available to support predicted performance levels and goals. The next concern is selection of healthy uniform calf or steer groups. Implant strategy should be designed to optimize economic return at each phase of production. Strategies can be dynamic to meet changing market conditions. For finished Holstein steers the strategy will be determined by not only the live market price but also the spread between select and choice grades.

The industry has shown a number of changes over the last 15 years in the acceptance of finished market weights. In the late 1980's continuous high energy-fed Holsteins were acceptable in the market place with final weights of between 1100 and 1200 lbs. Traditionally above 1000 to 1100 lbs Holstein steers will show a marked decline in feed/gain. In a 2-year study reported by Chester-Jones et al. (1992b), 'green' 612 lbs Holstein steers were fed 78% high moisture corn and 18% corn silage based diets to 1000, 1125, 1250, or 1375 lbs pen average market BW. All steers were implanted and re-implanted with Ralgro®. Steers fed to 1255 lbs provided the best return at the time. As the use of higher potency implants became more prevalent the acceptable BW of market Holstein steers increased to offset a perception that carcass quality was being compromised by overuse of high potency implants to maximize feedlot performance. The limits currently appear to relate to market price, carcass size, conformation, and age as feeding options for Holstein steers will ultimately affect the final market weight for the best return. The young Holstein steer can be pushed with high energy diets to take advantage of their genetic potential for efficient growth characteristics to feeder BW of 300 to 450 lbs. With good management, continuous high concentrate feeding programs work well. An alternative is a two-phase feeding system with a growing period of higher forage:concentrate ratio followed by a higher energy diet. An example based on 20 years of Holstein beef research at the Southern Research and Outreach Center might be 3 to 4 parts corn silage:1 part corn from 350 to 700-800 lbs followed by a finishing diet of equal parts of corn silage:corn (Chester-

Jones et al., 1998). A third system is programmed feeding growing and finishing TMR diets in larger feedlots whereby in some instances, pasture raised feeder Holstein steers are moved into the feedlot at 575 to 675 lbs and transitioned to a finishing diet of 0.63 to 0.64 Mcal NE_g/lb which optimizes performance and net return. These systems will work for lighter feeder steers transitioned through a growing to finishing program (Chester-Jones et al., 1998).

What implant strategies should be used given the above scenarios? Loy (2001) noted that "when developing an implant strategy, the most important implant in terms of improving performance and reducing cost is the last implant used prior to marketing". This applies to projected harvest date or the sale of light or heavy feeders. Implant strategies for Holstein steers have been proposed by Anderson and Chester-Jones (1991), Siemens, (1996) and Chester-Jones et al.(1998).

Proposed implant strategies – use Table 1 as the basis to select implant products:

General Strategy examples:

- Delay lower potency 1st implant for long fed Holsteins to 200-300 lb BW if feed intake and growth is optimum; moderate potency 2nd implant at 500-600 lbs and higher potency TBA + E combination implant at 95-100 days prior to harvest. If the economics of feed cost/gain allow for > 100 days prior to harvest for a higher potency implant it may be a beneficial safeguard. An alternative proposed is to use a single Encore® implant for calves over 45 days of age for at least a 300 day pay-out if handling facilities are limited or use a Compudose® at 500-600 lb as the final implant.

Note – TBA + E implants should not be used in high silage and moderate growth rate finishing diets containing less than 80% concentrate. Estrogenic based implants should be used as TBA combination implants respond the best when steers are fed high concentrate diets. If cattle are not eating well due to environmental stressors, acidosis or other reasons the final implant is suggested to be an estrogenic based product. If there is a lot of size variation within a pen group that will be marketed over a period of time then a final implant of a moderate potency estrogenic or TBA + E combination (see Table 1) product may be preferable.

- Light feeder steer production from pre-weaning to sale at 400 to 450 lbs – potential of 120-140 days on feed- Implant when steers are > 45 days of-age; Lower potency product and possibility of a 2nd implant of moderate potency after 70 days to maintain growth response. Single implant may be adequate as DMI is rapidly increasing post weaning accounting for much of the growth response. Use of two implants from 400-500 lbs to market weight is suggested.

- Heavier Holstein feeder steers from 700-800 to market weight or 100-150 days on feed. Depending on the projected market date and arrangements, implant strategy can be similar to that described above for beef cattle. Two moderate potency implants or 1st

implant of low to moderate potency followed by a terminal higher potency implant 95-100 days or > before market.

- Short–fed 900 to 1000+ lbs finishing steers – 60 to 80 days on feed. Often these steers will be large framed from being fed pasture or higher roughage-based diets and will have the potential for compensatory growth when transitioned to high-energy finishing diets. The strategy proposed for beef cattle above is recommended as implant history is unknown. Lower potency is preferable but a moderate potency will lower cost of gain and reduce the time in the feedlot. The compromise may be more negative effect on carcass quality.

SUMMARY

The availability of single or combinations of estrogenic and androgenic implants to the Holstein steer feeder allows for refinement of implant strategies under varying feeding systems to meet the market and economic return goals as dictated by market price fluctuations. A number of options have been described to illustrate the potential risk:benefits of using implants for growing and finishing cattle. Implant strategies can be readily changed and refined if good record keeping is used to help identify weaknesses of a specific system to be modified.

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