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IMPLANT STRATEGIES FOR CALF-FED HOLSTEIN STEERS

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ABSTRACT: Two hundred fifty-two Holstein steers (126 kg) were used in a 295-d feeding trial to evaluate the influence of implant strategies on growth performance and carcass characteristics. Steers were blocked by weight and assigned to 36 pens (7 steers/pen). The treatments were: 1) no implants; 2) Synovex-C (100 mg progesterone/10 mg estradiol implant) on d 1, Synovex-S (200 mg progesterone/20 mg estradiol implant) on d 98 and d 196; 3) Synovex-C on d 1, Synovex-S on d 98, and Finaplix (200 mg trenbolone acetate) plus Synovex-S on d 196; 4) Synovex-C on d 1, and Synovex-S on d 70, 140, and 210; 5) Synovex-C on d 1, Synovex-S on d 70 and 140, and Finaplix plus Synovex-S on d 210; 6) Synovex-C on d 1, Synovex-S on d 70, and Finaplix plus Synovex-S on d 140 and 210. Initial and final weights averaged 126 and 515 kg, respectively. Daily weight gain (kg/d), DM intake (kg/d), and feed efficiency (DM intake/ADG) averaged 1.32, 6.93, and 5.25, respectively. Implanting increased ($P < .01$) ADG (12.2%), DMI (4.6%), and feed efficiency (6.7%). Implanting at 70-d intervals was not superior ($P > .10$) to implanting at 98-d intervals. Daily weight gain was not affected ($P > .10$) by addition of TBA. However, feed efficiency increased (linear effect, $P < .05$) with increasing use of TBA implants. Based on NE intake, observed ADG was 95, 97, 99, 97, 100, and 101% of expected for treatments 1 through 6, respectively. Observed versus expected ADG increased (linear effect, $P < .05$) with increasing frequency of TBA implants. Dressing percentage averaged 62.3, decreasing ($P < .01$) with increasing frequency of TBA implants. Fat thickness (18%, $P < .05$) and marbling score (19%, $P < .01$) were greater for non-implanted steers. Marbling scores were greater (10%, $P < .05$) for 98-d than for 70-d implanting intervals. Of the implant strategies evaluated, we conclude that implant strategy 3 provides for an optimal combination of growth performance and carcass quality of calf-fed Holstein steers.

Key Words: Implant, Holstein, Performance

Introduction

Numerous studies have been conducted to evaluate the relative efficacy of various implant strategies on the feedlot performance and carcass characteristics of beef cattle, particularly yearlings. In contrast, very little work has been reported that evaluates implant strategies for calf-fed Holstein steers. The number of Holstein steers placed into the feedlot has increased dramatically during the past 20 years. Currently, calf-fed Holstein comprise in excess of two thirds of the total cattle on feed in the Desert Southwest. The objective of this study was to evaluate the influence of interval between implanting with estradiol and frequency of implanting with trebolone acetate on growth performance and carcass characteristics of calf-Holstein steers.

Material and Methods

Two hundred fifty-two Holstein steers (126 kg) were used to evaluate effects of implant strategies on growth-performance. Calves were purchased as steers (previously castrated via elastration). They originated from Tulare, California and were shipped to the University of California Desert Research Center on December 6, 1994. Upon arrival steers were vaccinated for bovine rhinotracheitis-parainfluenza$_3$ (TSV-2®, SmithKline Beecham, West Chester, PA), clostridials (Fortress 8®, SmithKline Beecham, West Chester, PA), and pasteurella haemolytica (One Shot®, SmithKline Beecham, West Chester, PA), and treated for parasites (Spotton®, Miles, Shawnee Mission, KA). Steers were injected with 1 million units of vitamin A (Vita-jec® A&D "500", RXV Products, Porterville, CA) and 2 grams vitamin C (Amtech Group Inc., Phoenix Scientific, Inc., St. Joseph, MO). Following a 2-wk receiving period, steers were blocked by weight and randomly assigned with weight blocks to 36 pens (5.48×9.14 m with 26.7 m^2 of shade). The treatments were: 1) no implants (**NI**); 2) Synovex-C (100 mg progesterone/10 mg estradiol implant; Forte Dodge Animal Health, Forte Dodge, IA) on d 1, Synovex-S (200 mg progesterone/20 mg estradiol implant; Forte Dodge Animal Health, Forte Dodge, IA) on d 98 and d 196 (**CSS**); 3) Synovex-C on d 1, Synovex-S on d 98, and Finaplix (200 mg trenbolone acetate; Hoechst Roussel Agri-Vet Co., Somerville, NJ) plus Synovex-S on d 196 (**CSSF**); 4) Synovex-C on d 1, and Synovex-S on d 70, 140, and 210 (**CSSS**); 5) Synovex-C on d 1, Synovex-S on d 70 and 140, and Finaplix plus Synovex-S on d 210 (**CSSSF**); 6) Synovex-C on d 1, Synovex-S on d 70, and Finaplix plus Synovex-S on d 140 and 210 (**CSSFSF**). Treatments were randomly assigned to pens of cattle, within weight blocks, providing 6 pens/treatment. Diets were prepared at weekly intervals and stored in plywood boxes located in front of each pen. Steers were allowed ad libitum access to dietary treatments. Fresh feed was provided twice daily. Estimates of steer performance were based on pen means. Cattle were shipped for slaughter when pen groups, within treatments, reached an estimated final shrunk weight of 515 kg. Hot carcass weights were obtained from all steers at time of slaughter. After the carcasses were chilled for 48 h the following measurements were obtained: 1) longissimus muscle area (ribeye area), taken by direct grid reading of the eye muscle at the twelfth rib; 2) subcutaneous fat over the eye muscle at the twelfth rib taken at a location 3/4 the lateral length from the chine bone end; 3) kidney, pelvic and heart fat (KPH) as a percentage of carcass weight and 4) marbling score (USDA, 1965). Assuming the primary determinant of energy gain was weight gain, the energy gain was calculated by the equation: EG = (.0557 $W^{.75}$)$g^{1.097}$, where EG is the daily energy deposited (Mcal/d), g is weight gain (kg/d) and W is the mean body weight (kg; NRC, 1984). Maintenance energy expended (Mcal/d, EM) was calculated by the equation: EM = .084$W^{.75}$ (Garrett, 1971). From derived estimates of EM and EG, the NE_m and NE_g value of the diets were obtained by means of the quadratic formula ($x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2c}$) where a = -.41EM, b = .877EM + .41DMI + EG, c = -.877DMI, and NE_g = .877NE_m - .41. This trial was analyzed as a randomized complete block design experiment (Hicks, 1973).

Results and Discussion

Treatment effects on growth performance are Shown in Table 1. Daily weight gain (kg/d), DMI (kg/d), and feed/gain averaged 1.32, 6.93, and 5.25, respectively. Implanting increased (P < .01) ADG (12.2%), DM intake (4.6%), and feed efficiency (6.7%). Implanting at 70-d intervals was not superior (P > .10) to implanting at 98-d intervals. Daily weight gain was not affected (P > .10) by addition of TBA. However, as with previous studies (Simms and Kuhl, 1993; Mader 1994; Shain et al., 1996) the combined use of TBA and estradiol enhanced (P < .01) feed efficiency. Furthermore, feed efficiency increased (linear effect, P < .05) with increased frequency of TBA implants. Implanting increased (P < .01) the NE_m and NE_g values of the diet by 3.4 and 4.7%, respectively. Dietary NE also increased (linear effect, P < .01) with increasing frequence of TBA implanting. The magnitude of the increase in dietary NE due to estradiol implanting is consistent with previous studies (Zinn, 1985).

Based on dietary NE intake, observed ADG was 95, 97, 99, 97, 100, and 101% of expected for treatments 1 through 6, respectively. Observed versus expected ADG increased (linear effect, P < .05) with increasing frequency of TBA implants.

Dressing percentage averaged 62.3, decreasing (P < .01) with increasing frequency of TBA implants. Fat thickness (18%, P < .05) and marbling score (19%, P < .01) were greater for NI steers. Nevertheless, there were no treatment effects (P > .10) on percentage of cattle grading choice.

A reduction in marbling score has been a consistent response in implanted cattle when cattle are sacrificed at a constant weight (Kuhl et al.,1989; Apple et al.,1991; Samber et al., 1996). Furthermore, marbling scores were greater (10%, P < .05) for 98-d than for 70-d implanting intervals.

Decreasing the interval between implants increased (P < .05) longissimus area and retail yield. Inclusion of TBA implants further increase longissimus area (quadratic effect, P < .05) , and carcass retail yield (quadratic effect, P < .10).

Implications

Of the implant strategies evaluated, implanting at 98-day intervals with estradiol and including trebolone acetate along with the terminal estradiol implant provides for an optimal combination of growth performance and carcass quality of calf-fed Holstein steers.

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Table 1. Influence of implant program on growth performance of calf-fed Holstein steers and NE value of the diet.

	Implant treatments[a]						
Item	NI	CSS	CSSF	CSSS	CSSSF	CSSFSF	SEM
Days on test	315	290.5	287.2	293.0	290.7	290.8	3.5
Liveweight, kg							
Initial	125.9	126.7	126.9	128.0	126.3	126.3	.4
56 d[b]	210.5	213.1	216.8	212.4	214.9	215.0	1.6
112 d[cd]	295.1	304.4	311.7	308.6	304.4	304.3	2.6
168 d[c]	370.9	388.0	396.4	389.2	389.2	394.7	3.8
252 d[c]	447.5	476.8	487.0	477.6	479.3	488.2	4.9
Final[c]	503.9	512.5	518.3	515.2	515.4	522.9	3.5
ADG, kg							
56 d	1.50	1.52	1.60	1.51	1.61	1.60	.04
112 d[c]	1.36	1.52	1.52	1.55	1.53	1.48	.04
168 d[ce]	1.24	1.33	1.36	1.28	1.38	1.52	.05
252 d[c]	.53	.69	.78	.75	.77	.78	.05
Overall[c]	1.20	1.33	1.36	1.33	1.34	1.37	.02
DMI, kg/d							
56 d	5.65	5.77	5.90	5.62	5.81	5.81	.09
112 d[cd]	6.67	7.01	7.22	7.14	6.93	7.05	.08
168 d[cf]	6.96	7.61	7.82	7.46	7.59	7.48	.11
252 d[cg]	6.69	7.46	7.10	7.29	7.06	7.38	.15
Overall[c]	6.67	7.01	7.04	7.02	6.87	6.96	.08
DM intake/gain							
56 d[h]	3.77	3.79	3.69	3.72	3.63	3.64	.05
112 d[b]	4.91	4.64	4.75	4.63	4.55	4.81	.10
168 d[he]	5.89	5.74	5.81	5.88	5.50	4.99	.21
252 d[c]	13.09	11.03	9.35	9.84	9.42	9.67	.75
Overall[ci]	5.56	5.27	5.16	5.30	5.12	5.10	.07
Dietary NE, Mcal/kg							
Maintenance[ci]	2.07	2.11	2.14	2.11	2.16	2.18	.02
Gain[ci]	1.40	1.44	1.47	1.44	1.48	1.50	.02
Observed/expected dietary NE							
Maintenance[ci]	.95	.97	.98	.97	.99	1.00	.01
Gain[ci]	.94	.96	.98	.96	.99	1.00	.01

[a]**NI** = No implants, **CSS** = Synovex-C (d 0) + Synovex-S (d 98) + Synovex-S (d 196), **CSSF** = Synovex-C (d 0) + Synovex-S (d 98) + Synovex-S and Finaplix (d 196), **CSSS** = Synovex-C (d 0) + Synovex-S (d 70) + Synovex-S (d 140) + Synovex-S (d 210), **CSSSF** = Synovex-C (d 0) + Synovex-S (d 70) + Synovex-S (d 140) + Synovex-S and Finaplix (d 210), **CSSFSF** = Synovex-C (d 0) + Synovex-S (d 70) + Synovex-Plus (d 140) + Synovex-S and Finaplix (d 210).

[b]NI vs CSS, CSSF, CSSS, CSSSF, CSSFSF, $P < .05$.

[c]NI vs CSS, CSSF, CSSS, CSSSF, CSSFSF, $P < .01$.

[d]CSS vs CSSF, $P < .10$.

[e]Linear effect on CSSS, CSSSF, and CSSFSF, $P < .01$.

[f]CSS, CSSF vs CSSS, CSSSF, CSSFSF, $P < .05$.

[g]CSS vs CSSF, $P < .05$.

[h]CSS, CSSF vs CSSS, CSSSF, CSSFSF, $P < .10$

[i]Linear effect on CSSS, CSSSF, and CSSFSF, $P < .05$.

Table 2. Influence of implant programs on carcass characteristics of calf-fed Holstein steers.

	Implant treatments[a]						
Item	NI	CSS	CSSF	CSSS	CSSSF	CSSFSF	SEM
Days on test	315	290.5	287.2	293.0	290.7	290.8	3.5
Hip height, cm							
Initial	97.3	98.8	98.0	98.1	97.6	97.7	.4
56 d[b]	108.7	110.5	111.1	110.9	109.7	110.0	.5
112 d	118.1	117.9	118.9	118.3	117.9	118.3	.4
168 d[c]	126.6	127.1	127.3	126.3	126.7	126.2	.3
224 d[c]	129.1	129.4	130.0	128.9	128.6	129.1	.4
Carcass wt, kg[d]	315.0	321.3	321.1	325.1	320.3	320.9	2.4
Dressing percentage[e]	62.5	62.7	61.9	63.1	62.2	61.4	.4
Liver abscesses, %	7.6	14.3	4.8	0	9.5	0	5.8
KPH fat, %[f]	1.91	1.97	1.83	2.11	2.11	2.01	.13
Fat thickness, cm[d]	.73	.69	.61	.63	.64	.52	.05
Marbling score, degree[bcgh]	5.31	4.95	4.50	4.27	4.31	4.36	.18
Longissimus area, cm^2[ck]	76.7	75.7	76.7	78.1	76.2	80.2	1.1
Choice, %	82.2	81.0	64.3	66.3	79.6	72.2	8.5
Prelim yield grade[c]	2.82	2.84	2.78	2.71	2.71	2.53	.09
Retail yield, %[ijl]	52.02	51.88	52.19	52.21	52.06	52.80	.20

[a]**NI** = No implants, **CSS** = Synovex-C (d 0) + Synovex-S (d 98) + Synovex-S (d 196), **CSSF** = Synovex-C (d 0) + Synovex-S (d 98) + Synovex-S and Finaplix (d 196), **CSSS** = Synovex-C (d 0) + Synovex-S (d 70) + Synovex-S (d 140) + Synovex-S (d 210), **CSSSF** = Synovex-C (d 0) + Synovex-S (d 70) + Synovex-S (d 140) + Synovex-S and Finaplix (d 210), **CSSFSF** = Synovex-C (d 0) + Synovex-S (d 70) + Synovex-Plus (d 140) + Synovex-S and Finaplix (d 210).

[b]NI vs CSS, CSSF, CSSS, CSSSF, CSSFSF, $P < .01$.

[c]CSS, CSSF vs CSSS, CSSSF, CSSFSF, $P < .05$.

[d]NI vs CSS, CSSF, CSSS, CSSSF, CSSFSF, $P < .05$.

[e]Lineal effect on CSSS, CSSSF, and CSSFSF, $P < .01$.

[f]Kidney, pelvic, and heart fat as percentage of carcass weight.

[g]Coded: minimum slight = 3, minimum small = 4, etc.

[h]CSS vs CSSF, $P < .10$.

[i]CSS, CSSF vs CSSS, CSSSF, CSSFSF, $P < .10$.

[j]Lineal effect on CSSS, CSSSF, and CSSFSF, $P < .10$.

[k]Quadratic effect on CSSS, CSSSF, and CSSFSF, $P < .05$.

[L]Quadratic effect on CSSS, CSSSF, and CSSFSF, $P < .10$.