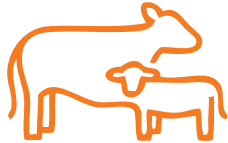


TECHNICAL BULLETIN

April 2016



SYNOVEX[®] ONE-FEEDLOT Implants in Feedlot Steers: Phase IIIB Studies in Nebraska and Texas

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Summary

- Two Phase IIIB studies^{1,2} were conducted in feedlot steers to compare the effects of SYNOVEX[®] ONE-FEEDLOT (SYNOVEX ONE), Revalor[®]-XS, and SYNOVEX PLUS[®] implanted 160 and 200 days prior to harvest on growth performance and carcass characteristics.
- In the Nebraska study, 10 pens of 8 feedlot beef steers were each implanted with Revalor-XS, SYNOVEX PLUS, or SYNOVEX ONE 160 days prior to harvest, and in the Texas study, 10 pens of 10 feedlot steers were each implanted with Revalor-XS, SYNOVEX PLUS or SYNOVEX ONE 200 days prior to harvest. Growth performance was measured at selected intervals and overall during the treatment period and carcasses were evaluated in local commercial harvest plants.
- Growth performance during the treatment period did not differ among the treatment groups. However, there were differences among treatments during intermediate intervals. In the Nebraska study, average daily gain (ADG) and gain efficiency (GE) for the first 49 days were less for SYNOVEX ONE than for SYNOVEX PLUS and Revalor-XS. In the Texas study, ADG and GE for the first 75 days were less for SYNOVEX ONE than for SYNOVEX PLUS but not Revalor-XS. In contrast, ADG and GE during days 49 to 98 in the Nebraska study and days 75 to 140 in the Texas study for SYNOVEX ONE was greater than for SYNOVEX PLUS but not Revalor-XS. Also, in the Texas study, ADG and GE during the period from 140 days to final were less for SYNOVEX PLUS than for SYNOVEX ONE and Revalor-XS which did not differ from each other.
- Carcass characteristics associated with leanness or carcass quality were not differentially affected by treatment in either study.

Few beef cattle management practices are more cost-effective or provide a higher return on investment (ROI) than growth promoting implants. Because cattle feedlots operate on narrow profit margins, costs of production are critically important and the ROI for implants is greater than for any other technology. Of the variety of implants used routinely in the commercial feedlot

industry, most have a duration ranging from 60 to 120 days and typical programs include re-implantation. Although re-implantation is sometimes combined with other prophylactic treatments and vaccinations, it is associated with additional costs of handling and possible loss of performance. Thus, use of a single implant that maintains production benefits over an entire finishing

period can be of significant value to the producer compared to re-implant strategies. Revalor-XS is a long-acting implant with duration of approximately 200 days. The duration of activity of SYNOVEX PLUS® has been extended to 200 days with the use of a new long-acting coating (SYNOVEX® ONE-FEEDLOT). This bulletin compares the growth performance and carcass responses of feedlot steers implanted with SYNOVEX ONE-FEEDLOT (SYNOVEX ONE) with those of steers implanted with Revalor-XS and SYNOVEX PLUS for 160 and 200 days before harvest.^{1,2}

Experiment Design

In the Nebraska study, a randomized block design consisting of 10 blocks of 24 cattle and 3 treatment groups was used. In the Texas study, a randomized block design consisting of 10 blocks of 30 cattle and 3 treatment groups was used. The 3 treatment groups, administered 160 and 200 days prior to slaughter for the Nebraska and Texas study, respectively, were:

- Revalor-XS implant containing 200 mg TBA and 20 mg estradiol;
- SYNOVEX PLUS implant containing 200 mg TBA and 20 mg estradiol (in the form of 28 mg estradiol benzoate);
- SYNOVEX ONE implant containing 200 mg TBA and 20 mg estradiol (in the form of 28 mg estradiol benzoate) coated with a polymer to extend duration of release.

After the completion of the growth performance phase of each study, the

animals were harvested at commercial beef processing facilities and carcass data were obtained.

Animals were of typical breeds for each location and were housed in pens that were outdoors and naturally lighted and ventilated. Animals were fed ad libitum a ration typical of the area once daily. No other growth promoters or feed additives (ionophores, in-feed antibiotics, etc.) were fed during the study.

In the Nebraska study, animals were weighed on days -1, 0 (the mean of days -1 and 0 = initial weight), 49, 98, 160, and 161 (the mean of days 160 and 161 = final weight). In the Texas study, animals were weighed on days -2, 0 (the mean of days -2 and 0 = initial weight), 75, 140, 199 and 200 (the mean of days 199 and 200 = final weight). In both studies, feed offered was measured daily and feed refused was weighed on intermediate and final weigh days. Carcass data were measured at harvest and Warner-Bratzler shear force values were determined after 14 days of aging.

Results

Body weights

In the Nebraska study, body weights of SYNOVEX ONE-implanted animals on day 49, were lower ($P \leq 0.05$) than those of Revalor-XS-implanted and SYNOVEX PLUS-implanted animals (Figure 1). By the end of the study, body weights did not differ among

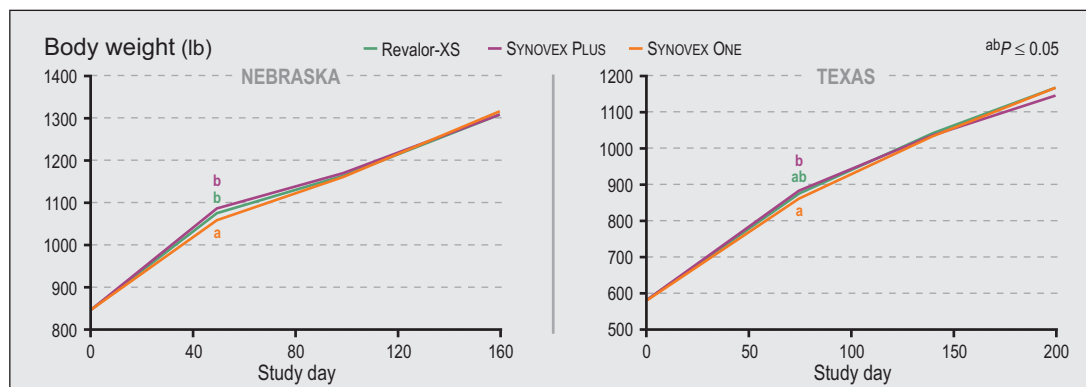


Figure 1 – Body weights (lb) recorded in Nebraska and Texas studies.

treatment groups. In the Texas study, body weights of SYNOVEX ONE-implanted animals on day 75 were lower ($P \leq 0.05$) than those of SYNOVEX PLUS-implanted animals but not Revalor-XS-implanted animals.

Growth performance

In both the Nebraska and Texas studies, there were no differences in final average daily gain (ADG), feed intake, or gain efficiency (GE) among the 3 treatments (Figures 2 and 3). Feed efficiency data were not analyzed. However, ADG and GE differed during intermediate intervals (Figures 4 and 5). In the Nebraska study (Figure 4), ADG and GE during the first 49 days for SYNOVEX ONE were less ($P \leq 0.05$) than for Revalor-XS and SYNOVEX PLUS and for SYNOVEX PLUS GE but not ADG

was greater ($P \leq 0.05$) than for Revalor-XS. During the interval from day 49 to 98, ADG and GE for SYNOVEX ONE were greater ($P \leq 0.05$) than for SYNOVEX PLUS but not Revalor-XS.

In the Texas study (Figure 5), ADG and GE during the first 75 days, for SYNOVEX ONE were less ($P \leq 0.05$) than for SYNOVEX PLUS but not Revalor-XS, and values for Revalor-XS did not differ from those of SYNOVEX PLUS. During the interval from day 75 to 140, ADG was greater ($P \leq 0.05$) for SYNOVEX ONE than for SYNOVEX PLUS but not Revalor-XS, which did not differ from SYNOVEX PLUS. During the interval from day 140 to final, both ADG and GE were greater ($P \leq 0.05$) for SYNOVEX ONE and Revalor-XS than for SYNOVEX PLUS but did not differ from each other.

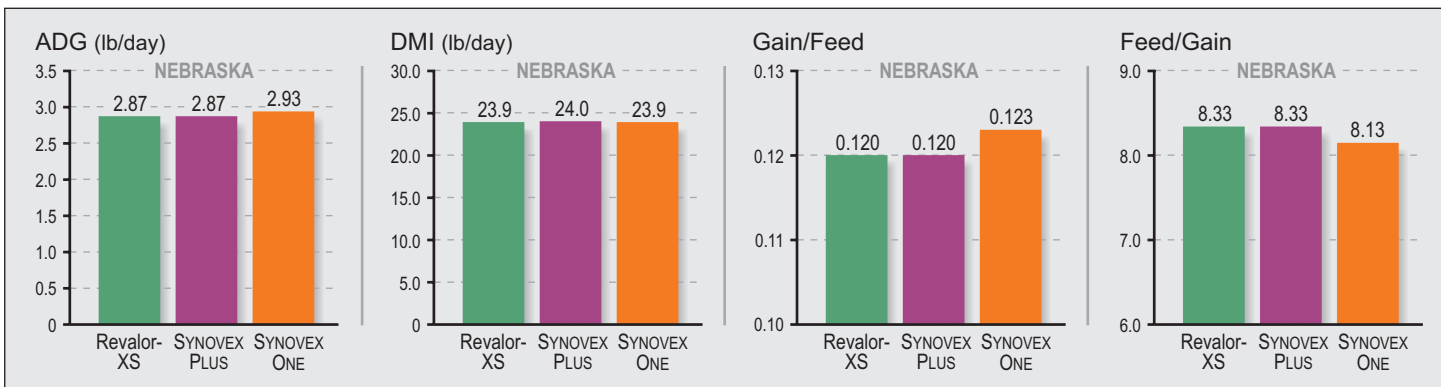


Figure 2 – Performance results from Nebraska study.

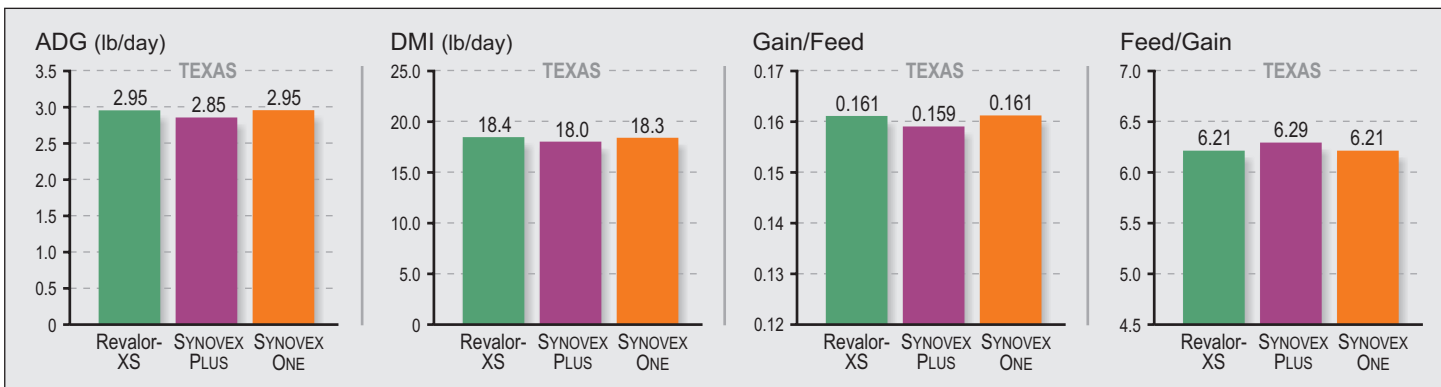


Figure 3 – Performance results from Texas study.

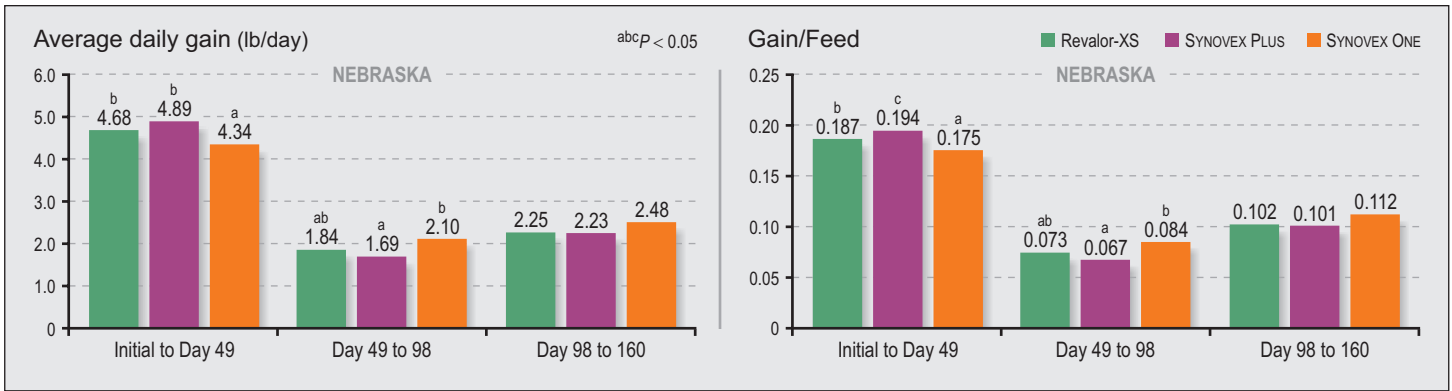


Figure 4 – Performance results from Nebraska study.

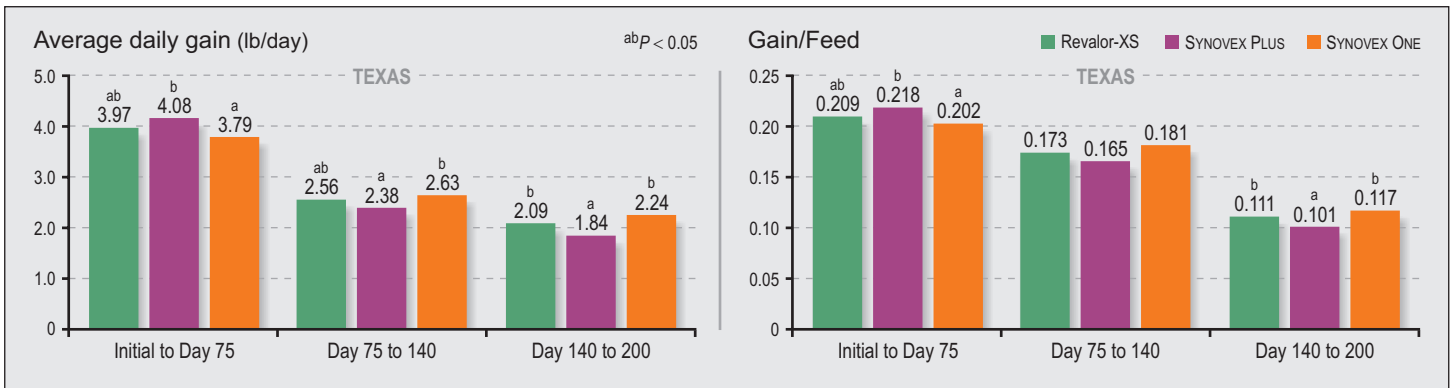


Figure 5 – Performance results from Texas study.

Carcass characteristics

No carcass characteristics differed among treatments. There were no treatment effects on hot carcass weights (Figure 6), dressing percentage (Figure 7), ribeye area (Figure 8), yield grade (Figure 9), Warner-Bratzler shear force at 14 days of aging (Figure 10), marbling score (Figure 11), % KPH fat (Figure 12), or 12th rib fat thickness (Figure

13). Warner Bratzler shear force values were well within the range of tenderness (<4.5 kg, or 9.9 lb). In addition, greater than 89.6% of the Nebraska carcasses graded choice or better and the percentages did not differ among treatment groups for both Nebraska and Texas (Figure 14).

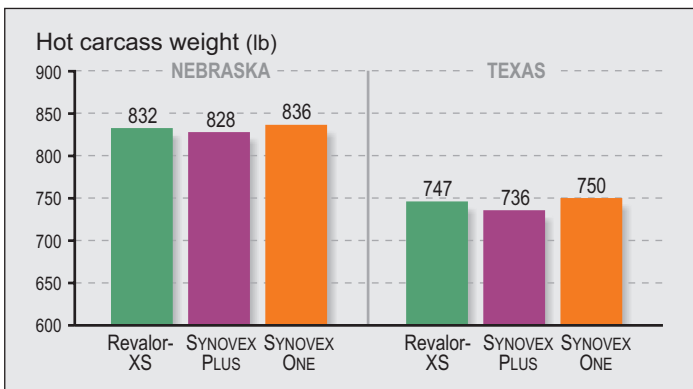


Figure 6 – Hot carcass weights from Nebraska and Texas studies.

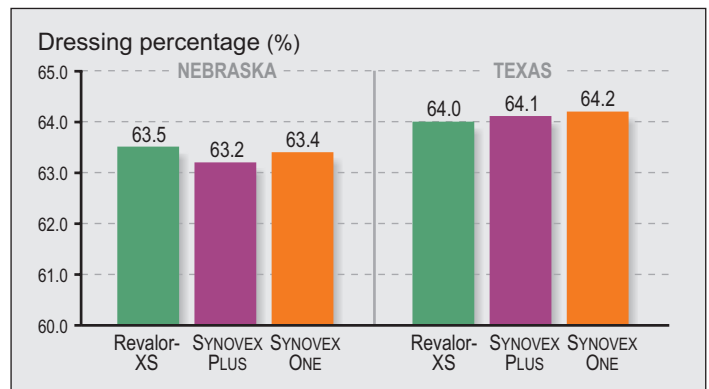


Figure 7 – Dressing percentages from Nebraska and Texas studies.

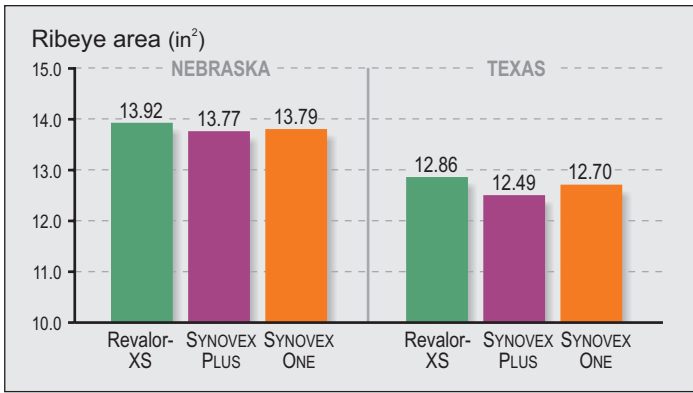


Figure 8 – Ribeye areas from Nebraska and Texas studies.

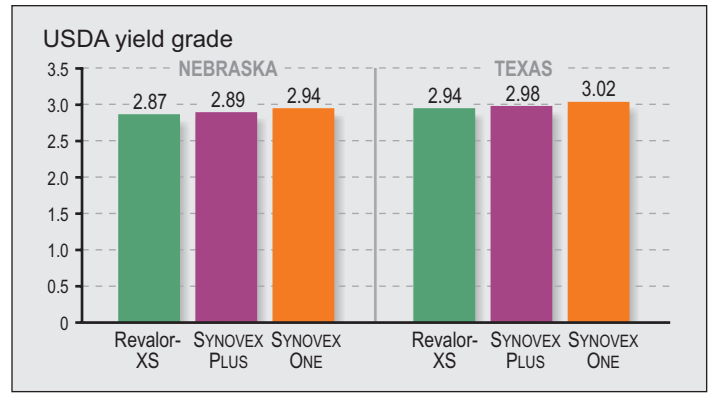


Figure 9 – Yield grades from Nebraska and Texas studies.

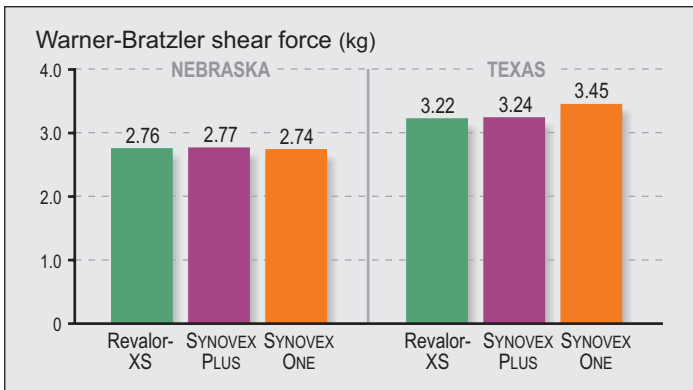


Figure 10 – Warner-Bratzler shear force values from Nebraska and Texas studies.

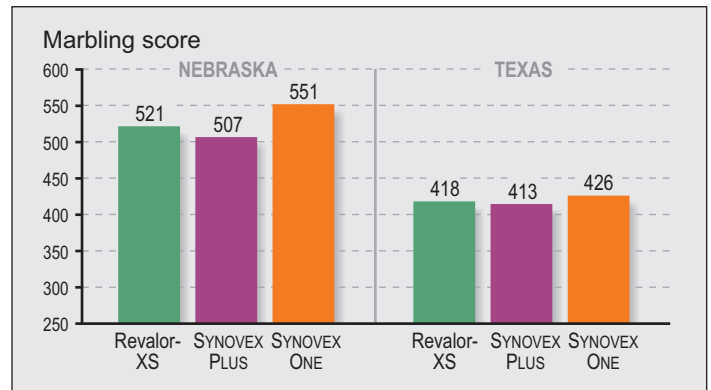


Figure 11 – Marbling scores from Nebraska and Texas studies.

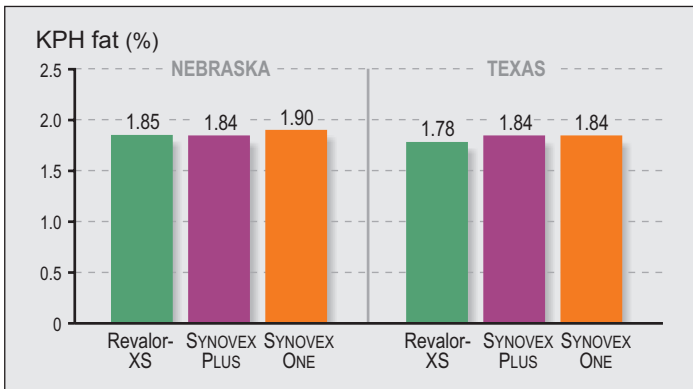


Figure 12 – KPH fat from Nebraska and Texas studies.

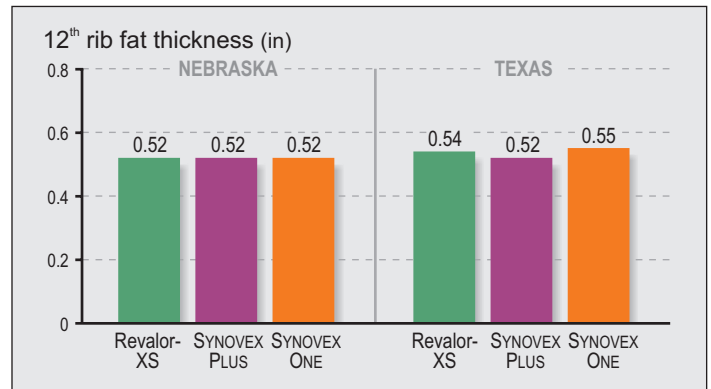


Figure 13 – 12th rib fat thickness from Nebraska and Texas studies.

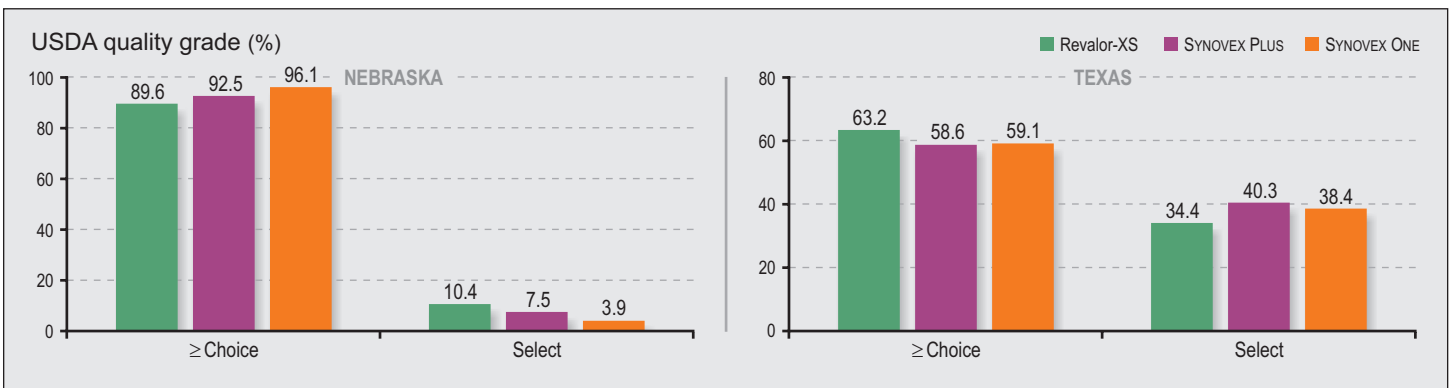


Figure 14 – USDA quality grade results from Nebraska and Texas studies.

Economic Return on Investment

The slight differences in growth performance and carcass characteristics would not be expected to substantially affect economic return in either study.

Conclusions

Use of the 200-day SYNOVEX ONE implant resulted in growth performance and carcass qualities not different from Revalor-XS or SYNOVEX PLUS over both 160-day and 200-day growth periods.

- **Growth performance** - ADG and feed efficiency did not differ among treatment groups during the duration of the study. However, ADG and GE for SYNOVEX ONE were lower than those of SYNOVEX PLUS during the first third of each study and were higher or trended higher than those of SYNOVEX PLUS during the second (both locations) and last third (Texas) of the study.
- **Carcass characteristics** - No characteristics differed among treatment groups.

Table 1 – Nebraska: Growth performance data for steers implanted with Revalor-XS, SYNOVEX Plus, and SYNOVEX ONE 161 days prior to harvest, least squares means \pm SEM.

	Treatment Group			P value
	Revalor-XS	SYNOVEX PLUS	SYNOVEX ONE	
Body Weight (lb)				0.0054 ¹
Initial	847 \pm 15.9	847 \pm 15.9	846 \pm 15.9	
Day 49	1076 ^b \pm 16.6	1087 ^b \pm 16.6	1059 ^a \pm 16.6	
Day 98	1167 \pm 18.0	1169 \pm 18.0	1162 \pm 18.0	
Final	1309 \pm 20.2	1310 \pm 20.2	1318 \pm 20.2	
Final (adj.) ²	1313 \pm 20.6	1307 \pm 20.6	1318 \pm 20.6	
ADG (lb/d)				
Initial to Day 49	4.68 ^b \pm 0.10	4.89 ^b \pm 0.10	4.34 ^a \pm 0.10	
Day 49 to Day 98	1.84 ^{ab} \pm 0.14	1.69 ^a \pm 0.14	2.10 ^b \pm 0.14	
Day 98 to final	2.25 \pm 0.13	2.23 \pm 0.13	2.48 \pm 0.13	
Day 98 to final (adj.) ²	2.32 \pm 0.13	2.18 \pm 0.13	2.49 \pm 0.13	
Initial to final	2.87 \pm 0.08	2.87 \pm 0.08	2.93 \pm 0.08	
Initial to final (adj.) ²	2.89 \pm 0.08	2.86 \pm 0.08	2.93 \pm 0.08	
DMI³ (lb/d)				
Initial to Day 49	25.1 \pm 0.43	25.3 \pm 0.26	24.9 \pm 0.14	0.3853
Day 49 to Day 98	25.1 \pm 0.33	25.2 \pm 0.33	25.1 \pm 0.33	0.9820
Day 98 to final	22.0 \pm 0.38	22.0 \pm 0.38	22.0 \pm 0.38	0.9992
Initial to final	23.9 \pm 0.27	24.0 \pm 0.27	23.9 \pm 0.27	0.9401
ADG/DMI				
Initial to Day 49	0.187 ^b \pm 0.0034	0.194 ^c \pm 0.0034	0.175 ^a \pm 0.0034	< 0.0001
Day 49 to Day 98	0.073 ^{ab} \pm 0.0053	0.067 ^a \pm 0.0053	0.084 ^b \pm 0.0053	0.0336
Day 98 to final	0.102 \pm 0.0050	0.101 \pm 0.0050	0.112 \pm 0.0050	0.1969
Day 98 to final (adj.) ²	0.105 \pm 0.0055	0.099 \pm 0.0055	0.113 \pm 0.0055	0.1261
Initial to final	0.120 \pm 0.0023	0.120 \pm 0.0023	0.123 \pm 0.0023	0.4931
Initial to final (adj.)	0.121 \pm 0.0027	0.119 \pm 0.0027	0.123 \pm 0.0027	0.4696
DMI/ADG⁴				
Initial to Day 49	5.35	5.16	5.71	
Day 49 to 98	13.70	14.93	11.91	
Day 98 to final	9.80	9.90	8.93	
Day 98 to final (adj.) ²	9.52	10.10	8.85	
Initial to final	8.33	8.33	8.13	
Initial to final (adj.) ²	8.26	8.40	8.13	

abc Least squares means that do not share common superscripts within a row are different ($P < 0.05$).

¹ Treatment by day of study

² Adjusted for hot carcass weight

³ DMI = dry matter feed intake

⁴ Presented as the reciprocal of the ADG/DMI least squares means

Table 2 – Texas: Growth performance data for steers implanted with Revalor-XS, SYNOVEX PLUS, and SYNOVEX ONE 200 days prior to harvest, least squares means \pm SEM.

	Treatment Group			P value
	Revalor-XS	SYNOVEX PLUS	SYNOVEX ONE	
Body Weight (lb)				0.0005 ¹
Initial	577 \pm 13.9	577 \pm 13.9	579 \pm 13.9	
Day 75	874 \pm 15.1 ^{ab}	882 \pm 15.1 ^b	863 \pm 15.1 ^a	
Day 140	1041 \pm 16.3	1037 \pm 16.3	1034 \pm 16.3	
Final	1166 \pm 16.9	1147 \pm 16.9	1169 \pm 16.9	
Final (adj.) ^{2,3}	1165 \pm 17.6	1148 \pm 17.6	1172 \pm 17.6	
ADG (lb/d)				
Initial to Day 75	3.97 \pm 0.07 ^{ab}	4.08 \pm 0.07 ^b	3.79 \pm 0.07 ^a	
Day 75 to Day 140	2.56 \pm 0.07 ^{ab}	2.38 \pm 0.07 ^a	2.63 \pm 0.07 ^b	
Initial to Day 140	3.31 \pm 0.06	3.29 \pm 0.06	3.25 \pm 0.06	
Day 140 to final	2.09 \pm 0.06 ^b	1.84 \pm 0.06 ^a	2.24 \pm 0.06 ^b	
Day 140 to final (adj.) ^{2,3}	2.07 \pm 0.10 ^{ab}	1.85 \pm 0.10 ^a	2.29 \pm 0.10 ^b	
Initial to final	2.95 \pm 0.05	2.85 \pm 0.05	2.95 \pm 0.05	
Initial to final (adj.) ^{2,3}	2.94 \pm 0.05	2.86 \pm 0.05	2.97 \pm 0.05	
DMI⁴ (lb/d)				
Initial to Day 75	19.0 \pm 0.24	18.8 \pm 0.24	18.8 \pm 0.24	0.7803
Day 75 to Day 140	14.8 \pm 0.31	14.5 \pm 0.33	14.6 \pm 0.20	0.7414
Initial to Day 140	18.1 \pm 0.24	17.9 \pm 0.24	17.9 \pm 0.24	0.8031
Day 140 to final	18.6 \pm 0.42	18.0 \pm 0.39	18.8 \pm 0.20	0.2503
Initial to final	18.4 \pm 0.33	18.0 \pm 0.27	18.3 \pm 0.11	0.6814
ADG/DMI				
Initial to Day 75	0.209 \pm 0.0029 ^{ab}	0.218 \pm 0.0047 ^b	0.202 \pm 0.0022 ^a	0.0200
Day 75 to Day 140	0.173 \pm 0.0051	0.165 \pm 0.0051	0.181 \pm 0.0051	0.0951
Initial to Day 140	0.183 \pm 0.0024	0.186 \pm 0.0024	0.182 \pm 0.0024	0.5226
Day 140 to final	0.111 \pm 0.0027 ^b	0.101 \pm 0.0027 ^a	0.117 \pm 0.0027 ^b	0.0007
Day 140 to final (adj.) ²	0.109 \pm 0.0048	0.101 \pm 0.0048	0.118 \pm 0.0048	0.0515
Initial to final	0.161 \pm 0.0018	0.159 \pm 0.0018	0.161 \pm 0.0018	0.5448
Initial to final (adj.) ²	0.160 \pm 0.0019	0.159 \pm 0.0019	0.162 \pm 0.0019	0.5212
DMI/ADG⁵				
Initial to Day 75	4.79	4.59	4.95	
Day 75 to 140	5.78	6.06	5.53	
Initial to Day 140	5.46	5.38	5.50	
Day 140 to final	9.01	9.90	8.55	
Day 140 to final (adj.) ²	9.17	9.90	8.48	
Initial to final	6.21	6.29	6.21	
Initial to final (adj.) ²	6.25	6.29	6.17	

abc Least squares means that do not share common superscripts within a row are different ($P < 0.05$).

¹ Treatment by day of study

² Adjusted for hot carcass weight

³ Treatment by day of study $P = 0.0035$

⁴ DMI = dry matter feed intake

⁵ Presented as the reciprocal of the ADG/DMI least squares means

Table 3 – Nebraska: Carcass composition for steers implanted with Revalor-XS, SYNOVEX PLUS, and SYNOVEX ONE 161 days prior to harvest, pen least squares means \pm SEM.¹

	Treatment Group			P value
	Revalor-XS	SYNOVEX PLUS	SYNOVEX ONE	
Hot carcass weight (lb)	832 \pm 8.3	828 \pm 8.3	836 \pm 8.3	0.7493
Dressing percent (%)	63.5 \pm 0.30	63.2 \pm 0.30	63.4 \pm 0.30	0.7024
Rib eye area (in ²)	13.92 \pm 0.096	13.77 \pm 0.218	13.79 \pm 0.140	0.5889
Yield grade	2.87 \pm 0.087	2.89 \pm 0.087	2.94 \pm 0.087	0.8575
14-d WBSF ² (kg)	2.76 \pm 0.096	2.77 \pm 0.096	2.74 \pm 0.096	0.9603
KPH fat (%)	1.85 \pm 0.038	1.84 \pm 0.038	1.90 \pm 0.038	0.5318
Backfat thickness (in)	0.52 \pm 0.022	0.52 \pm 0.022	0.52 \pm 0.022	0.9947
Marbling score ³	521 \pm 15.8	507 \pm 15.8	551 \pm 15.8	0.1519
Quality grade				
% Prime	7.8 \pm 3.47	6.3 \pm 2.08	14.3 \pm 5.13	0.2800
% Choice	81.8 \pm 3.81	86.3 \pm 3.93	81.2 \pm 5.66	0.7149
% Choice + Prime	89.6 \pm 3.64	92.5 \pm 3.33	96.1 \pm 1.93	0.3060
% Select	10.4 \pm 3.64	7.5 \pm 3.33	3.9 \pm 1.93	0.3060
Color score ^{1,4}				
% score = 4	2.5 (5.27)	0.0 (0.00)	1.3 (3.95)	
% score = 5	16.3 (15.65)	23.8 (14.97)	33.8 (15.33)	
% score = 6	80.0 (19.72)	76.3 (14.97)	63.8 (13.39)	
% score = 7	1.3 (3.95)	0.0 (0.00)	1.3 (3.95)	
% Normal livers	70 \pm 6.3	54 \pm 7.1	68 \pm 5.1	0.1482

¹ Color Scores were not analyzed; summary statistics of mean and (standard deviation) are presented.

² 14-d WBSF = Warner-Bratzler shear force after 14-days of aging

³ Marbling scores of 400 to 499 = small marbling, 500 to 599 = modest marbling, 600 to 699 = moderate marbling

⁴ Color is scored on a 9-point scale where 1 = light pink and 9 = dark maroon

Table 4 – Texas: Carcass composition for steers implanted with Revalor-XS, SYNOVEX PLUS, and SYNOVEX ONE 200 days prior to harvest, least squares means \pm SEM.^{1,2}

	Treatment Group			P value
	Revalor-XS	SYNOVEX PLUS	SYNOVEX ONE	
Hot carcass weight (lb)	747 \pm 6.6	736 \pm 6.6	750 \pm 6.6	0.3108
Dressing percent (%)	64.0 \pm 0.23	64.1 \pm 0.23	64.2 \pm 0.23	0.9097
Rib eye area (in ²)	12.86 \pm 0.134	12.49 \pm 0.134	12.70 \pm 0.134	0.1734
Yield grade	2.94 \pm 0.120	2.98 \pm 0.120	3.02 \pm 0.120	0.8310
14-d WBSF (kg) ³	3.22 \pm 0.172	3.24 \pm 0.172	3.45 \pm 0.172	0.5940
KPH fat (%)	1.78 \pm 0.032	1.84 \pm 0.032	1.84 \pm 0.032	0.2664
Backfat thickness (in)	0.54 \pm 0.029	0.52 \pm 0.029	0.55 \pm 0.029	0.8021
Marbling score ⁴	418 \pm 5.7	413 \pm 11.3	426 \pm 6.2	0.4503
Quality grade				
% Prime ¹	1.0 (3.16)	0.0 (0.00)	1.0 (3.16)	
% Choice	62.2 \pm 3.81	58.6 \pm 5.76	58.1 \pm 4.15	0.6436
% Choice + Prime	63.2 \pm 3.72	58.6 \pm 5.54	59.1 \pm 3.82	0.6171
% Select	34.4 \pm 5.95	40.3 \pm 5.00	38.4 \pm 4.09	0.6790
Color score ^{2,5}				
% score = 4	3.0 (6.75)	1.1 (3.51)	0.0 (0.00)	
% score = 5	19.0 (17.29)	29.6 (18.39)	25.0 (9.61)	
% score = 6	74.0 (18.38)	65.2 (17.98)	67.6 (12.07)	
% score = 7	2.0 (4.22)	4.1 (5.32)	4.2 (5.46)	
% score = 8	1.0 (3.16)	0.0 (0.00)	2.2 (4.69)	
% score = 9	1.0 (3.16)	0.0 (0.00)	1.0 (3.16)	
% Normal livers	40.9 \pm 5.14	47.9 \pm 6.22	39.7 \pm 4.21	0.5191

¹ % prime was not analyzed; summary statistics of mean and (standard deviation) are presented.

² Color scores were not analyzed; summary statistics of mean and (standard deviation) are presented.

³ 14-d WBSF = Warner-Bratzler shear force after 14-days of aging.

⁴ Marbling scores of 300 to 399 = slight marbling, 400 to 499 = small marbling, 500 to 599 = modest marbling.

⁵ Color is scored on a 9-point scale where 1 = light pink and 9 = dark maroon

Do not use Synovex products in veal calves. Refer to label for complete directions for use, precautions, and warnings.

References

1. Data on file, Study No. 1332R-60-10-810, Zoetis Inc.
2. Data on file, Study No. 1332R-60-10-811, Zoetis Inc.



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