

Beef steers implanted with short, medium and long-acting anabolic compounds grazing natural pasture and finished in feedlot

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Received 27 July 1987; accepted 22 March 1988

Two studies involving 270 yearling steers were conducted to compare four growth promotants (three estrogenic and one androgenic). These represented short, medium and long-acting compounds and were implanted into steers that were grazing natural pasture and were finished in a feedlot. The response (ADG) to the different treatments during the pasture phase of both trials was varied and inconclusive. None of these responses were significantly different from control values and ranged from -6,6% (single implant of Revalor mid-way through the pasture phase, Trial 2) to 13,2% (two implants of Ralgro mid-way through the pasture phase, Trial 1). However, significant gains were recorded during the feedlot phases of both trials and improved gains over control values of up to 30,8% ($P < 0,01$) were recorded for steers implanted with Revalor (Trial 1).

Twee proewe, wat 270 jaaroud osse ingesluit het, is uitgevoer om vier groeistimulante (drie estrogenies en een androgenies) met mekaar te vergelyk. Die osse wat aanvanklik op veld gewei het en daarna in 'n voerkraal afgerond is, is met die onderskeie stimulant wat verteenwoordigend was van kort-, medium- en langwerkende tipes, geïmplanteer. Die reaksie (GDT) op die onderskeie behandelings gedurende die veldfase van beide proewe het geen besliste neiging getoon nie. Geen van die verskille het betekenisvol van kontrolewaardes verskil nie en hierdie verskille het van -6,6% (enkel implantering van Revalor halfpad gedurende die veldfase, Proef 2) tot 13,2% (twee implanterings van Ralgro in die begin en halfpad gedurende die veldfase, Proef 1) gevarieer. Betekenisvolle massatoenames is egter gedurende die voerkraalfases by beide proewe waargeneem en hierdie toenames was tot so hoog as 30,8% ($P < 0,01$) bo kontrolewaardes vir osse wat met Revalor (Proef 1) geïmplanteer is.

Keywords: Anabolic growth stimulants, natural rangeland, feedlotting, growth, carcass finishing

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Introduction

Efficient implanting of beef steers in feedlot with anabolic compounds to increase growth rate and feed conversion rate is well established (Wyatt, 1983; Schanbacher, 1984; Unrah, 1986). Whilst some research has been done in other countries on the use of these compounds in beef steers grazing natural pasture (Roche, 1983; Keane & Sherington, 1985; Mason, Rudder & Burrow, 1986), their use in steers grazing natural pasture in this country is not well documented. Furthermore, a number of growth-promoting compounds have been developed and they are known to have distinctly different modes of action.

The objectives of these two studies were to compare four growth promotants (three estrogenic and one androgenic). These represented short, medium and long-acting compounds and were implanted into steers which were kept on natural pasture and finished in a feedlot.

Experimental procedure

A list of the implants used in either or both of the experiments, illustrating the amount of hormone and length of action, is summarized in Table 1.

Experiment 1

On 14 November 1984, 150 long yearling Brahman-cross steers were randomly allocated to one of the following five treatments:

Table 1 Implants used in Experiments 1 and 2

Type	Length	Hormone
Compudose Plus	Long	45 mg estradiol-17 beta
Revalor	Medium	140 mg trenbolone acetate 28 mg estradiol-17 beta
Revalor	Short	140 mg trenbolone acetate 20 mg estradiol-17 beta
Synovex-S	Short	20 mg estradiol benzoate 200 mg progesterone
Ralgro	Short	36 mg zeranol

- 1: Control
- 2: Single implant of long-acting Compudose at the start of the experiment.
- 3: Three implants of Synovex-S, one at the start of the experiment, one mid-way through the pasture phase (20 February 1985) and one at the start of the feedlot phase (8 May 1985).
- 4: Same as for 3, but using short-acting Revalor.
- 5: Same as for 3, but using Ralgro.

Experiment 2

On 5 December 1984, 120 long yearling Brahman-cross steers were randomly allocated to one of the following six treatments:

- 1: Control
- 2: Single implant of long-acting Compudose Plus at the start of the experiment
- 3: Three implants of short-acting Revalor, one at the start of the experiment, one mid-way through the pasture phase (20 February 1985) and one at the start of the feedlot phase (8 May 1985).
- 4: Two implants of short-acting Revalor, one mid-way through the pasture phase and one at the start of the feedlot phase.
- 5: Single implant of short-acting Revalor at the start of the feedlot phase
- 6: Single implant of medium-acting Revalor at the start of the experiment and a single implant of short-acting Revalor at the start of the feedlot phase.

During the pasture phase of both these trials the cattle had free access to a mineral supplement and from 1 March 1985 to a protein/mineral supplement (48% crude protein). To eliminate the confounding effect of gut fill at weighing, feed and water were withheld from all the cattle for at least 16 h prior to recording their mass.

A commercially available complete diet for beef cattle (12% crude protein) was used during the feedlot phase of both trials. All data from three animals in Experiment 2 were excluded from the trial analysis, because one died due to lightning and two were removed from the feeding pens due to a *Pasteurellosis* infection. Cattle were slaughtered in two groups, all those in Experiment 1 in one batch, and those in Experiment 2 in another. During the slaughter process cold carcass masses were obtained from all the animals while the carcasses from both experiments were graded by a qualified grader. Since the

cattle were in the process of cutting their permanent incisors and for the purpose of interpreting the degree of finish (grade) as influenced by treatment, the 'top grades' were regarded as grades SA and PB, 'too lean' as grades A1 and B1, and 'too fat' as grades A2 and B2.

Standard statistical procedures were used to analyse the results.

Results and Discussion

Experiment 1

Although not significant, all implanted treatments showed minor improvements in live body mass gains over control values during the pasture phase, ranging from 3,6% (3,3 kg Synovex-S) to 13,2% (12,1 kg, Ralgro) (Table 2). However, during the feedlot phase of this trial, remarkable gains were recorded, especially for those steers implanted with Revalor (30,8%; $P < 0,01$) and Synovex-S (26,8%; $P < 0,01$) (Table 2). In a feedlot study by Schanbacher & Brethour (1983) where the same compounds were evaluated, the greatest responses were obtained with Revalor (25,8% improvement in daily gain over control values) followed by Compudose (18,4%), Synovex-S (16,8%) and Ralgro (12,7%).

The total cumulative gain for the steers over the trial revealed gains over the Control, ranging from 10,1% (Compudose and Ralgro) to 19,2% (Revalor). In real terms this meant an improvement of 37,1 kg live body mass over the entire trial period for the steers implanted with Revalor over the Control (Table 2). However, it should be emphasized that most of the total gains for all the implanted cattle were recorded during the feedlot phase (total average gain for four treatments

Table 2 Mean live body mass changes of steers on veld and in feedlot implanted with four different anabolic compounds

	Control	Compudose	Synovex-S	Revalor	Ralgro	Significance
Number of animals	30	30	30	30	30	
Mean body mass (kg/animal)						
Veld phase						
— Start	224,3±4,1	224,0±4,1	224,5±4,1	224,0±4,1	224,3±4,1	NS
— End	316,1±3,1	324,5±3,1	319,6±3,1	321,7±3,1	328,2±3,1	NS
— Gain	91,8±3,1	100,5±3,1	95,1±3,1	97,7±3,1	103,9±3,1	NS
— Index	100	109,5	103,6	106,4	113,2	
Feedlot phase						
— Start	316,1±3,1	324,5±3,1	319,6±3,1	321,7±3,1	328,2±3,1	NS
— End	417,5±4,4	436,8±4,4	448,2±4,4	454,3±4,4	437,0±4,4	LSD (5%) = 12,4 (1%) = 16,3
— Gain	101,4±3,8	112,3±3,8	128,6±3,8	132,6±3,8	108,8±3,8	LSD (5%) = 10,6 (1%) = 14,0
— Index	100	110,7	126,8	130,8	107,3	
Total cumulative gain	193,2±3,4	212,8±3,4	223,7±3,4	230,3±3,4	212,7±3,4	LSD (5%) = 8,9 (1%) = 11,7
Index (total gain)	100	110,1	115,8	119,2	110,1	
Carcass	239,1±2,7	251,0±2,7	257,8±2,7	259,0±2,7	249,6±2,7	LSD (5%) = 7,5 (1%) = 9,1
Mean slaughter percentage	57,2±0,3	57,4±0,3	57,5±0,3	57,0±0,3	57,1±0,3	NS
Grading						
— Top grades (%)	76,7	90	86,7	86,7	93,3	
— Too lean (%)	23,3	3,3	—	10,0	—	
— Too fat (%)	—	6,7	13,3	3,3	6,7	

approximately 120 kg) which lasted only 74 days, compared to total average gains on veld of approximately 99 kg over 176 days for the veld phase (Table 2).

If assumed that there was no difference in carcass mass at the start of the experiment (mean live body mass ranged between 224,0 kg and 224,5 kg for the five treatment groups) (Table 2), there was a significant improvement ($P < 0,01$) in carcass mass for the steers receiving the respective implants over the Control (range 10,5 kg for Ralagro to 19,9 kg for Revalor) (Table 2).

Experiment 2

Unlike the objective of the first experiment where four different anabolic compounds were compared, the aim of this trial was to compare short, medium, and long-acting compounds as well as to compare different times of implantation. Although not significant, the long-acting implant (Compudose) showed the greatest live body mass gain during the veld phase of the experiment (6,2 kg, 8,0% over Control) (Table 3). Furthermore, the use of Revalor during the veld phase had a variable and sometimes depressing effect on live body mass gains

(Treatments A,B & D) (Table 3). The reason for this phenomenon is unknown and it may be due to biological variation.

During the feedlot phase of the trial all the animals receiving the Revalor implants (Treatments A,B,C, & D) (Table 3) gained significantly more in live body mass than those receiving no implant or Compudose ($P < 0,01$). The improvements in live body mass gains due to Revalor were consistent and ranged from 20,5% to 24,1% for the four treatment groups (Table 3). Notwithstanding the inconsistent performance of the steers receiving Revalor implants over the pasture phase of the trial, these animals gained significantly ($P < 0,05$) more in body mass over the trial period when compared with those steers receiving no implants (Table 3).

Similarly to the results recorded in Experiment 1, the steers receiving the Revalor implants (three out of the four groups — Treatments B,C, & D) (Table 3) had carcasses weighing significantly ($P < 0,05$) heavier at slaughter. These differences ranged from 10,5 kg (Treatment B) to 14,2 kg (Treatment D) above that for the Control. This conclusion is based on the assumption that there was no significant difference in initial carcass

Table 3 Mean live body mass changes of steers on veld and in feedlot implanted with short, medium and long-acting anabolic compounds

	Revalor Treatments						Significance
	Control	Compudose	A	B	C	D	
Number of animals	20	20	19	18	20	20	
Mean body mass (kg/animal)							
Veld phase							NS
— Start	198,0±4,0	198,0±4,0	196,8±4,1	199,7±4,2	196,7±4,0	196,8±4,0	
— End	275,8±3,9	282,0±3,9	269,7±4,0	272,4±4,1	276,2±3,9	279,6±3,9	LSD (5%) = 11,0 (1%) = 14,5
— Gain	77,8±4,0	84,0±4,0	72,9±4,1	72,7±4,2	79,5±4,0	82,8±4,0	LSD (5%) = 11,3 (1%) = 15,0
— Index	100	108,0	93,7	93,4	102,2	106,4	
Feedlot phase							
— End	374,8±4,7	384,8±4,7	388,9±4,8	393,7±4,9	397,2±4,7	399,1±4,7	LSD (5%) = 13,2 (1%) = 17,4
— Gain	98,5±3,8	102,3±3,8	120,2±3,9	118,7±4,0	122,2±3,8	120,6±3,8	LSD (5%) = 10,8 (1%) = 14,3
— Index	100	103,9	122,0	120,5	124,1	122,4	
Total cumulative gain	176,8±4,9	186,8±4,9	192,1±5,1	194,0±5,2	200,5±4,9	202,3±4,9	LSD (5%) = 13,9 (1%) = 18,4
Index (total gain)	100	105,7	108,7	109,7	113,4	114,4	
Carcass	215,7±3,4	217,1±3,4	220,7±3,5	226,2±3,6	227,5±3,4	229,9±3,4	LSD (5%) = 9,7 (1%) = 12,8
Mean slaughter percentage	57,5±0,5	56,4±0,5	56,6±0,5	57,5±0,5	57,2±0,5	57,5±0,5	LSD (5%) = 1,3 (1%) = 1,7
Grading							
— Top grades (%)	85,0	70,0	63,2	66,7	75,0	70,0	
— Too lean (%)	10,0	25,0	36,8	33,3	25,0	30,0	
— Too fat (%)	5,0	5,0	—	—	—	—	

A: Three implants (short acting) — start of experiment, mid veld phase and start of feedlot phase

B: Two implants (short acting) — mid veld phase and start of feedlot phase

C: Single implant (short acting) — start of feedlot phase

D: Two implants: one medium acting — start of experiment, one short acting — start of feedlot phase

mass at the start of the experiment (live body mass at the start of the experiment ranged between 196,7 kg and 199,7 kg for all six treatments) (Table 3).

General conclusions

The results recorded in these trials clearly indicated that implants combining androgenic and estrogenic activity (Revalor) produced the greatest possible gains when they were evaluated under feedlot conditions. Both Unruh (1986) and Schanbacher (1984) in their review articles came to the same conclusion and suggested that, because of the different modes of action on growth by androgen and estrogen-like compounds, and when administered together, that they provided an additive effect on growth. Furthermore, although trenbolone acetate is a synthetic analog of testosterone, laboratory tests have shown it to be 8–10 times more active anabolically (Trenkle, 1987).

Although Revalor outperformed all the other implants under feedlot conditions, the same tendency was not evident under natural rangeland conditions. It should be emphasized that in no way did any of the anabolic compounds enhance the growth and performance of the steers on rangeland anywhere near that which was recorded in feedlot. Therefore, it seems that the justification for implanting anabolic compounds into cattle grazing poor to average quality rangeland, especially when using the short-acting compounds, is questionable. It is not known what the effect would be on treated animals grazing high quality cultivated pastures that would ensure daily gains of approximately 1 kg, and this certainly justifies further research.

Mean slaughter percentage was not affected by any of the treatments from either experiment and ranged between 57,0% and 57,5% (Trial 1) (Table 2) and 56,4% and 57,5% (Trial 2) (Table 3). Similarly, de Bruyn, Galloway & Naudé (1984) found average dressing percentages not influenced in a study comprising four treatments, while Keane & Sherington (1985) came to the same conclusions in four experiments which involved 296 steers.

Interpreting the degree of finish (grading) at the time of slaughter may prove more difficult since conflicting conclusions may be made from the results for both experiments (Tables 2 & 3). For example, in Experiment 1, only 76,7% of the steers in the Control group had reached the desired degree of finish while, on average, 89,2% of the steers from the four treatment groups had reached the desired top grades at the time of slaughter. On the other hand, in Experiment 2, it would appear that, on average, the steers that were implanted with growth stimulants had not reached the desired degree of finish at slaughter (weighted average 69,1%), while 85% of the Control cattle had reached the desired top grades

(Table 3). From the literature it would appear that, especially in the case of combination implants, when these are administered to steers, the production of lean meat or N retention would increase and fat deposition would decrease (Unruh, 1986). Therefore, the findings recorded in Trial 2 may be more relevant than those recorded in Trial 1. A possible reason for the inconsistent results recorded in Trial 1 may be maturity differences in the livestock used for the experiment.

From an economic point of view, there is no doubt that the use of anabolic compounds, because of their ability to enhance daily gains in feedlot systems (also feed conversion ratios — de Bruyn, *et al.* (1984)), is highly justifiable. For example, should the residual effects at the start of the feedlot phases for those animals that received the Revalor implants during the pasture phases of both experiments be ignored, the average weighted improvement in gain over control values was 23,7 kg live mass at an approximate cost of R6 per implant. Therefore, as far as these trials are concerned, a single implant of short-acting Revalor (140 mg trenbolone acetate + 20 mg estradiol – 17 beta) at the start of the feedlot phase may be recommended for the beef production system described.

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