Growth Promotant Options in the Feedlot Have Changed

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Introduction

Estradiol-based anabolic compounds that stimulate growth rate and muscularity of feeder cattle have been available since the 1950's. For a while, diethyl stilbestrol was available for delivery either orally or as an implant. Zeranol (Z) and estradiol (E_2), the latter used in conjunction with either testosterone or progesterone, became mainstays for the decade following removal of DES products. In the 1980's, trenbolone acetate (TBA) became available. Alone, TBA efficacy was less than that of existing implants, however used in conjunction with an estrogenic compound it generated more anabolic potential than had been available previously. Eventually, E_2-TBA implant combinations became available and have been used extensively.

Relatively low cost and an almost guaranteed growth response have made these products pervasive in beef production. Complications can occur including reduced quality grades, excess carcass weight, bullers, and dark cutting beef. New products that vary in dosage and new understanding of how to manage these products now allows us to begin to strategize optimizing implant use in virtually all production scenarios.

Ractopamine represents a new tool to add to our repertoire. The mode of action and method of administration are quite different than the anabolic implants to which we have become so accustomed. As with any new technology, we still have a great deal to learn about how best to use ractopamine in finishing cattle.

Review of Implants

Table 1 depicts implant product, active ingredients, and dosages available today for steers. There is a degree of prioritization, but this format is not meant to infer that a higher dosage represents a better product. The change in our growth promotant options is that we now have the ability to more precisely match potency with production traits. We were familiar with the concept that 36 mg zeranol was low potency; that 20 mg estradiol benzoate 200 mg progesterone was stronger than 36 mg zeranol and that 24 mg TBA 120 mg E_2 was much stronger yet. Having only these choices, we were challenged because of production situations where low potency products provided less anabolic activity than was desirable, but high potency products were too powerful and led to undesirable side effects.

As drug x dose combination increased from 3 to 11 choices, we were presented with the opportunity to make more suitable choices. However, testing all possible combinations of products in the wide range of production circumstances that exist across the country in an effort to define optimums becomes problematic. There are some intuitive conclusions that we can make to simplify this effort, and there are some questions that should be identified.

The first step in simplifying the process is to not be preoccupied with comparing zeranol, estradiol, estradiol benzoate, or trenbolone acetate to one another. The key issues here are the relative amount of biological activity contained in any given implant and whether they are being used in conjunction with any other anabolic compounds.

The next step is to presume that as the amount of compound(s) is increased in an implant that the potency has increased. This at first seems clear, but is complicated by the fact that oftentimes a change in dosage is achieved by a change in the number of pellets rather than a change in active ingredient concentration in the same pellet matrix mass. Additionally, products vary in the matrix composition. A new payout will obviously be generated, but payout per time and duration of payout above the biological thresholds are not well defined (Brandt, 1997) as potency of the implants is increased. The result is that a 50%-dose product does not yield 50% less growth stimulation. Until these variables are more fully defined it seems adequate to presume that a lower dosage of the same active ingredients will give comparable performance to the higher dosage implant but will do so for fewer days.

Table 2 shows initial 70 d performance of steers that received no implant, Revalor-G, or Revalor-S. Implanted steers performed similarly. We did not follow the response longer; few studies have, to determine performance decay curves. One interesting question is how much of this comparable performance for 70 d was due to how the implants payout, how much is due to how the animal responds physiologically to the initial anabolic exposure, and finally, how much is attributable to the fact that steers are not on full feed until halfway through this window of time.

Concepts for Matching Implants to Production Scenarios

When we use implants, we are creating a transient increase in frame size (Loy et al., 1988; Preston, 1978). The extent to which this occurs seems to be a function of the dosages used as well as the duration of exposure. The longer the exposure to implants and the more potent those implants are, the bigger the cattle will be when they reach PYG of 3.0.

A very important aspect to this characteristic is the interaction with diet and frame size. These products work in all sizes of cattle. Increasing exposure and potency to maximize size at slaughter is valuable in small-framed cattle (especially heifers). Increasing exposure and potency allows us to feed higher energy diets to medium-frame size cattle without causing them to fatten prematurely. Conversely, if genetic frame size is very large or diet energy is very low, we still get the ADG response to implants, but we will create problems with carcass weight and/or quality.

When we had only 3 potency options, it was difficult to generate the optimum combination of cattle x diet x implant, especially from a lifetime perspective. Now we have enough tools to do this much better, but we still need to define the parameters best suited to specific potencies. The optimum implant potencies are not yet defined for medium-framed steers gaining 1.8 lb, 2.25, or 2.75 lb per day. I anticipate the industry will find those answers and will learn to adjust potency for heifers, different frame sizes,

and initial flesh. Evaluations from this perspective will be more fruitful than our traditional approach of doing product comparisons in databases that ignore these factors.

The new products also justify re-evaluating whether we should discriminate against feeder cattle that were previously implanted. Mader (1997) reviewed data indicating that successive use of the same implant results in diminishing response to implants. He also reported that this could be overcome by increasing the potency of subsequent implants. Mader (1997) discusses several reasons why these responses may occur, and those factors have not been elucidate in research since that time. My simplistic scenario is that if initial exposure causes an increase in frame size, re-implanting with the same product would only sustain this alteration. Take two 700 lb steers of similar flesh, one that was previously implanted and the other was not. For this to occur, the non-implanted steer would have to either be larger framed or older than the implanted steer. In this model, if I administer a common implant to each steer, the previously-implanted steer would likely not gain as efficiently.

This was a problem when we had limited potency selections. Once implanting started, the progression had to move forward too fast. Today we can work in smaller increments of potency and in doing so, allow sectors of beef production to realize benefits. To confirm this, we did a lifetime implant strategy evaluation. The work was done with a single-year calf crop from two ranches. The increasing potency of strategies and the progression of potency within each strategy are depicted in Table 3. Feedlot finishing phase performance and carcass traits are shown in Table 4. At the time the research was conducted, our potency options were much less than we have available today. Even so, this experiment demonstrated that our perceptions of potency, even when extended over a lifetime strategy, do result in anticipated responses in size and efficiency. The study also demonstrates that by building potency within a strategy, finishing phase production efficiencies can be maintained.

Ractopamine – The New Tool

The mode of action of ractopamine is completely different than that of the steroids currently used in implants. To contrast the two, I suggest reviews by Thomson (2001) on implants and Johnson (2004) on β-agonists. Recent, as yet unpublished, research will demonstrate that ractopamine will cause an increase in carcass weight in cattle exposed to higher potency implants. It will be some time before we know if the magnitude of implant exposure has any effect on the magnitude of response to ractopamine. Virtually any class of cattle will respond to implants. As with these other considerations, it will take time and experience before we know how ractopamine interacts with cattle quality or maturity. While there is still a great deal to learn about ractopamine, there are some things that we do know. Most notably is that under "normal" circumstances we can add an additional 15 lb of lean tissue to the carcass by using this product. To date, the data suggests that this can be done without generating adverse outcomes, making it a powerful tool for improving the efficiency of beef production.

Summary

We now have more tools than ever before for relatively low cost enhancement of the efficiency of beef production. While the long list may at first review seem to complicate our decision making processes, I see it as simplifying the process. The benefits of these new tools is not that they increase rate or efficiency of gain. Their value is in that we can better control dose, which offers two important strengths. One is allowing us to take advantage of their effects in the entire production system, and the other is that we can sustain efficient production while having minimal effects on carcass quality.

The addition of ractopamine brings the first truly novel new tool in nearly 20 years. One cannot help but be optimistic that it will develop as another effective means of enhancing our ability to produce beef.

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Table 1. Implant formulations currently approved for use in steers

	Implant	Active Ingredients	mg (*)	Original Label
Ascending Potency	A	Zeranol	36‡	Ralgro
	B	Estradiol benzate Progesterone	10 (7) 100	Synovex C
	C	Zeranol	72‡	Ralgro Magnum
	D	Trenbolone Acetate (TBA)	140	Finaplix S
	E	Estradiol benzate Progesterone	20 (14) 200	Synovex S
	F	Estradiol	43.9	Encore
	G	Estradiol TBA	8 40	Revalor-G
	H	Estradiol TBA	16 80	Revalor IS
	I	Estradiol benzoate TBA	14 (10) 100	Synovex Choice
	J	Estradiol TBA	24 120	Revalor S
	K	Estradiol TBA	20 200	Synovex Plus

*Estradiol equivalent, mg
‡As zeranol

Table 2. Initial growth response to implants differeing only in potency

	Implant		
	None	Revalor G	Revalor S
Initial BW	703	706	706
D 70 BW	851	866	863
ADG	3.46[a]	3.76[b]	3.72[b]
DMI	20.00	20.12	20.27
F/G	5.83[a]	5.40[b]	5.48[b]

[a,b] Means differ ($P < 0.05$)
Pritchard, 1998 unpublished

Table 3. Implant use by production phase

	Treatment			
Production phase	1	2	3	4
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Suckling	None	Ralgro	Ralgro	Synovex C
Backgrounding	None	Ralgro	Ralgro	Revalor-g
Finishing				
Initial	None	Ralgro	Ralgro	Synovex-S
D 70 Re-implant	None	Magnum	Magnum/ Component TS	Revalor-s

Table 4. Finishing phase steer performance and carcass traits

	TRT				
	1	2	3	4	SEM
Final BW*	1120[a]	1198[b]	1206[b]	1230[c]	5.3
ADG*	2.99[a]	3.44[b]	3.57[bc]	3.61[c]	0.037
DMI*	21.98[a]	23.37[b]	23.98[b]	23.35[b]	0.123
F/G	7.36[a]	6.80[b]	6.73[b]	6.47[c]	0.058
Dress %	61.7[a]	62.1[a]	61.9[a]	62.9[b]	0.17
HCW	700[a]	742[b]	752[bc]	768[c]	2.2
Marbling[‡]	5.68[a]	5.54[ab]	5.38[b]	5.38[b]	0.095

* 2 vs 3 ($P < 0.10$)
[a,b,c] Means differ ($P < 0.05$)
[‡]5.00 = small[0]; 4.00 = select[0]