# Using Sequential Feeding of Optaflexx and Zilmax to Improve Performance and Meat Quality in Cull Beef Cows

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## Introduction

Beef cows are culled from herds because of reproductive inefficiency, poor performance, old age, or farm downsizing due to high production costs. The National Market Cow and Bull Beef Quality Audit of 1999 reported that challenges associated with cull cow carcasses are undesirable dressing percentages and meat yields. Since 1999, an increasing number of producers are either selling cows in better physical condition or feeding cows a high concentrate ration for 50 to 100 days prior to harvest. According to the 2007 audit, cow carcasses were heavier and leaner and had more desirable muscle and fat color scores than in 1999. Although these improvements are positive steps toward increasing the value of cull cows, use of growth promoting agents, such as steroid implants and β-adrenergic agonists, can increase muscling and leanness more efficiently than feeding a concentrate ration alone. Currently, there are two β-agonists on the market for use in beef cattle in the United States: Optaflexx (ractopamine hydrochloride; Elanco, Greenfield, IN), a $\beta_1$-agonist, and Zilmax (zilpaterol hydrochloride; Intervet Inc., Millsboro, DE), a $\beta_2$-agonist. These growth promotants have been studied individually and in combination with implants (primarily in young steers and heifers), but no research published to date has investigated feeding a sequence of these growth promoting agents. Therefore, our objective was to investigate effects of feeding Optaflexx for 25 days followed by Zilmax for 20 days plus a 3-day withdrawal on cull cow performance, carcass traits, and meat quality.

## Experimental Procedures

Sixty cull cows were purchased to meet established criteria (primarily of "British" breeding, not pregnant, between 2 and 8 years of age, between 1,000 and 1,300 lb, and having a body condition score between 2 and 4). These cows were placed on a concentrate ration (Table 1) for 82 days and assigned to one of four treatments: (1) Control = fed a concentrate ration for 82 days, (2) Optaflexx = fed a concentrate ration for 57 days then supplemented with Optaflexx for 25 days, (3) Zilmax = fed a concentrate ration for 59 days then supplemented with Zilmax for 20 days plus a 3-day withdrawal, and (4) Optaflexx + Zilmax = fed a concentrate ration for 34 days then supplemented with Optaflexx for 25 days followed by Zilmax for 20 days plus a 3-day withdrawal. On day 0, all cows were implanted with Revalor-200 (Intervet Inc.) per the manufacturer's instructions. There were five cows per pen, creating three replicate pens for each treatment. At the end of feeding, cows were transported to a commercial harvest facility and humanely slaughtered.

Hot carcass weights were recorded at harvest. At 72 hours postmortem, trained university personnel evaluated the following carcass traits: ribeye area; adjusted fat thickness;

percentage kidney, pelvic, and heart fat; yield grade; lean and fat color; and marbling. At 4 days postmortem, carcasses were fabricated, and the wholesale rib, tenderloin, and shoulder clod were retrieved. Longissimus steaks (aged for 21 days), psoas major steaks (aged for 21 days), and infraspinatus steaks (aged for 14 days) were evaluated for tenderness. A portion of the longissimus muscle was enhanced with a 0.1M solution of calcium lactate to a target pump of 10% at 4 days postmortem, and tenderness was evaluated after 14 days of aging. Steaks (1-in. thick) were cooked to an internal temperature of 158°F and chilled overnight at 32°F. Eight 0.5-in. cores were removed parallel to the muscle fiber direction. Warner-Bratzler shear force (WBSF) values were collected on each core by shearing perpendicular to the direction of the muscle fiber.

Data were analyzed as a completely randomized design. For performance traits, the GLM procedure of SAS was used with pen was the experimental unit. Carcass data and tenderness were analyzed by using the MIXED procedure of SAS with animal was the experimental unit. One cow was removed because of sickness, and one cow was removed because she had a negative average daily gain, leaving a total of 58 cows in the data set. Means were separated ($P<0.05$) by using the least significant difference procedure.

## Results and Discussion

Weights at the beginning of the feeding period were similar for all treatments. There were no differences in average daily gain, finished weight, hot carcass weight, or dressing percentage among treatments (Table 2).

There also were no differences among treatments for adjusted fat thickness; percentage kidney, pelvic and heart fat; or yield grade (Table 2). However, there was a trend ($P=0.18$) for ribeye areas to be larger in the Zilmax and Optaflexx + Zilmax treatments (Figure 1). In addition, although not significant ($P=0.30$), marbling scores were the lowest in the Optaflexx treatment (Slight$^{60}$) and highest in the Optaflexx + Zilmax treatment (Small$^{00}$, Figure 2). Cows within the Optaflexx + Zilmax treatment also had numerically, although not significantly, more desirable lean color score compared with the other three treatments (Table 2).

Warner-Bratzler shear force values for nonenhanced longissimus steaks were similar for the Control, Optaflexx, and Optaflexx + Zilmax treatments (Figure 3). However, WBSF values for the Zilmax treatment were distinctively higher ($P<0.05$) than those of the other three treatments (Table 3). These data indicate that feeding either no β-agonist or the combination of Optaflexx followed by Zilmax will yield more tender longissimus steaks than feeding Zilmax alone.

There were no differences among treatments for WBSF values of enhanced longissimus steaks, and WBSF values for the enhanced steaks were noticeably lower for the Zilmax treatments compared with nonenhanced steaks (Table 3). Therefore, we conclude that enhancement with calcium lactate is beneficial in improving tenderness.

Infraspinatus steaks from Control cows had higher, less tender ($P<0.05$) WBSF values than steaks from cows in treatments that contained Optaflexx or the combination of Optaflexx and Zilmax (Table 3). We predict that this difference is due to a collagen dilution effect in which the growth promotants increased muscle cell growth and diluted the effects of collagen. Warner-Bratzler shear force values were not different among treatments for steaks from the psoas major muscle.

## Implications

Feeding Zilmax or a combination of Optaflexx + Zilmax had no effect on performance characteristics; however, there was a trend for cows supplemented with Zilmax alone or in combination with Optaflexx to have increased ribeye area measurements. In addition, feeding a sequence of Optaflexx followed by Zilmax can improve longissimus muscle tenderness compared with feeding Zilmax alone and could be beneficial in increasing marbling and lean color scores.

**Table 1. Basic feed ration**

| Ingredient | Dry-matter basis (%) |
| --- | --- |
| Ground sorghum grain | 76.95 |
| Sorghum silage | 20.04 |
| Soybean meal (44%) | 1.61 |
| Minor/supplement[1] | 1.40 |

1 Minor ingredients = urea, calcium, salt; for the Optaflexx and Optaflexx + Zilmax treatments, Optaflexx was added at 0.00044 lb for 25 days; for the Zilmax and Optaflexx + Zilmax treatments, Zilmax was added at 0.00023 lb for 20 days.

**Table 2. Carcass traits of cull beef cows fed β-agonists**

| Item | Control | Optaflexx | Zilmax | Optaflexx + Zilmax | P-value |
| --- | --- | --- | --- | --- | --- |
| Initial weight, lb | 1160 | 1150 | 1149 | 1154 | 0.93 |
| Final weight, lb | 1408 | 1385 | 1426 | 1427 | 0.53 |
| Average daily gain, lb | 3.43 | 3.26 | 3.84 | 3.79 | 0.63 |
| Hot carcass weight, lb | 815 | 820 | 849 | 859 | 0.42 |
| Dressing percentage, % | 59.0 | 59.3 | 59.7 | 60.2 | 0.58 |
| Adjusted fat thickness, in. | 0.35 | 0.37 | 0.34 | 0.38 | 0.92 |
| Kidney, pelvic and heart fat, % | 1.5 | 1.3 | 1.3 | 1.5 | 0.60 |
| Yield grade | 2.6 | 2.6 | 2.2 | 2.5 | 0.46 |
| Lean color[1] | 5.4 | 5.3 | 5.4 | 4.4 | 0.27 |
| Fat color[2] | 2.6 | 2.8 | 2.4 | 2.5 | 0.62 |

1 Scale: 1 = pale red, 7 = dark red.
2 Scale: 1 = bleached white, 5 = canary yellow.

**Table 3. Muscle tenderness of cull cows fed β-agonists**

| Item | Control | Optaflexx | Zilmax | Optaflexx + Zilmax | P-value |
|---|---|---|---|---|---|
| Longissimus WBSF, lb | 9.76[a] | 8.75[a] | 12.41[b] | 10.42[a] | 0.03 |
| Enhanced longissimus WBSF, lb | 8.97 | 8.73 | 9.59 | 9.48 | 0.60 |
| Infraspinatus WSBF, lb | 9.72[b] | 8.36[a] | 8.73[ab] | 8.42[a] | 0.04 |
| Tenderloin WBSF, lb | 6.46 | 6.49 | 6.66 | 6.13 | 0.12 |

[ab] Within a row, means without a common superscript letter differ ($P<0.05$).

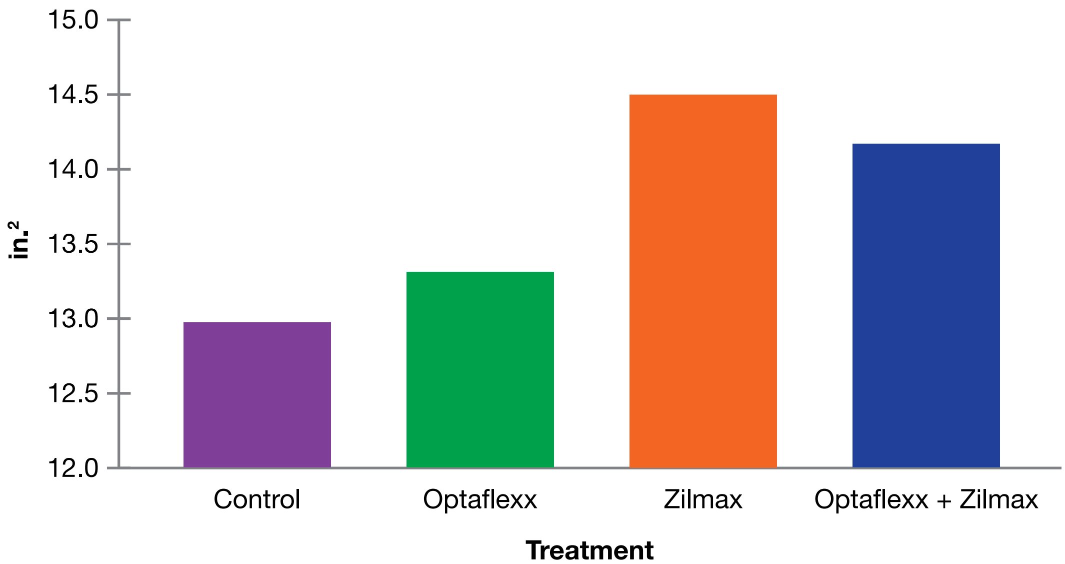


**Figure 1. Ribeye area measurement of cull cows fed β-agonists.**

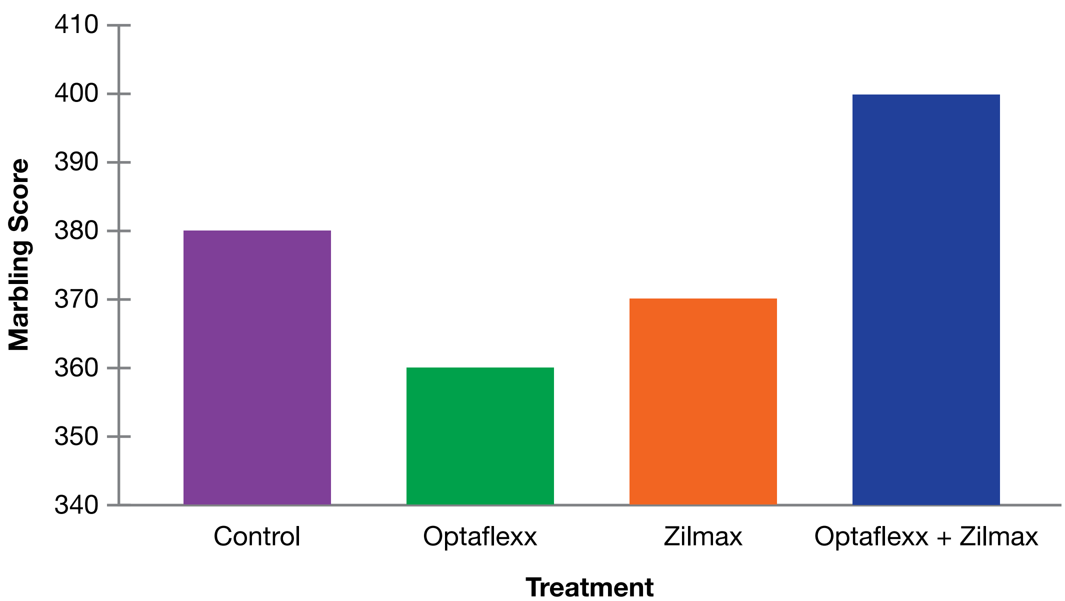


**Figure 2. Marbling scores of cull cows fed β-agonists.**
Marbling Score: 300 = slight$^{00}$, 400 = small$^{00}$, etc.

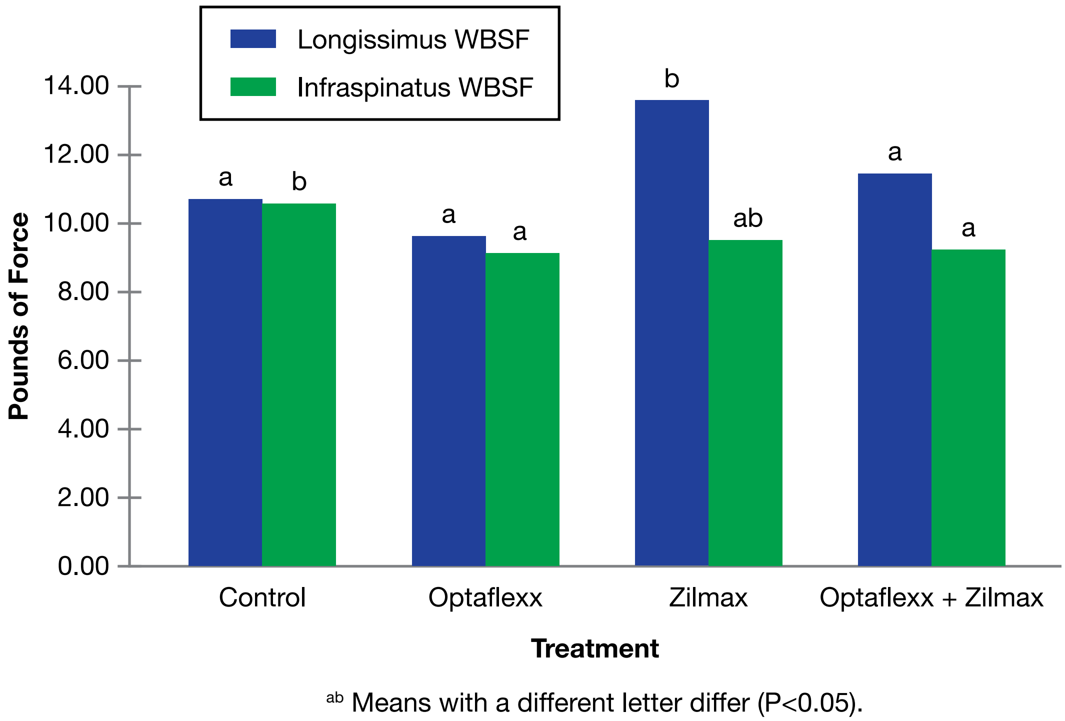


**Figure 3. Warner-Bratzler shear force values of selected nonenhanced muscles from cull cows fed β-agonists.**