Effects of a Terminal Sorting System with Zilpaterol Hydrochloride on Feedlot Steers

F. Henry Hilscher
Dirk B. Burken
Brandon L. Nuttelman
Galen E. Erickson
Kathy Hanford
Kyle J. Vander Pol
John P. Hutcheson[1]

Summary

Crossbred yearling steers were utilized to evaluate the effects of Zilpaterol hydrochloride (Zilmax®) and terminal sorting 50 days prior to harvest on feedlot performance and carcass characteristics. Four treatments were used: an unsorted group not fed Zilmax (–CON), an unsorted group fed Zilmax, sorting by weight into two market groups and fed Zilmax, or sorting by weight into four market groups and fed Zilmax (4-Sort). Carcass weight was increased in cattle fed Zilmax by 33 lb and was further increased by 9 lb by 4-SORT. Yield grade and marbling score were lower for all cattle fed Zilmax compared to the –CON. Sorting four ways (4-Sort) increased HCW, reduced HCW variation, and decreased the percentage of overweight carcasses compared to not sorting.

Introduction

Zilpaterol hydrochloride (Zilmax) is a ß-adrenergic receptor agonist that increases skeletal muscle mass and reduces body fat content. Studies conducted using feedlot steers fed corn-based diets in the United States have demonstrated feeding Zilmax for the last 20 days prior to slaughter resulted in increased ADG, improved F:G, increased carcass weight, and increased carcass leanness compared to cattle not fed Zilmax. Feeding Zilmax has reduced USDA quality grades compared to cattle not fed Zilmax. However, little research has been conducted on the use of a weight sort in combination with feeding Zilmax for the last 20 days prior to slaughter. Previous research indicates that sorting cattle allows pens of cattle to be fed longer without increasing overweight discounts (*1999 Nebraska Beef Cattle Report*, pp.57-59). Another study showed sorting in combination with feeding Zilmax in the finishing period allowed for an increase in carcass weight without increasing variation in carcass weight, and allowed for cattle to reach an optimum fat endpoint (*2012 Nebraska Beef Cattle Report*, pp.115-118). Therefore, the objectives of this study were to determine the effects of 1) identifying heavy cattle within a pen with one sort or sorting a large group four ways and 2) feeding Zilmax to steers on feedlot performance and carcass traits.

Procedure

Crossbred yearling steers (n = 1,400; 829±64 lb initial BW) were used to evaluate the effects of Zilpaterol hydrochloride (Zilmax) and terminal sorting 50 days prior to harvest on feedlot performance and carcass characteristics. Steers were blocked by arrival group (25 steers/pen, 56 pens) and assigned randomly to pen which received one of four treatments. The four treatments included: 1) an unsorted non- Zilmax fed negative control (-CON); 2) unsorted Zilmax fed positive control (+CON); 3) early weight sort fed Zilmax (1-Sort) with the heaviest 20% identified at day 1 and sorted 50 days from harvest and marketed 14 days prior to –CON and +CON, with the remaining 80% of the pen fed seven das longer than the –CON and +CON; and 4) four-way sort 50 days from harvest fed Zilmax (4-Sort) with steers sorted into a heavy, mid-heavy, mid-light, and light group, marketed -14 days, 0 days, +7 days, and +28 days from the –CON and +CON, respectively (Figure 1). Because the heaviest steers were sorted early, the remaining steers in the sorted treatments were fed longer than the –CON and +CON treatments (Figure 1).

Steers fed Zilmax were fed Zilmax (Zilmax, Merck Animal Health, De Soto, Kan.) at 7.56 g/ton DM for 20 days followed by a three-day withdrawal. Basal diets and supplement

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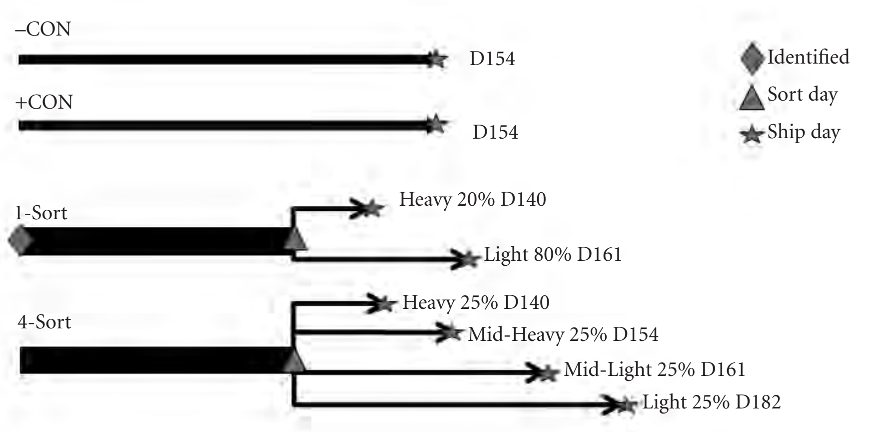

Figure 1. -CON and +CON were randomized into pen and removed on day 154 for harvest. 1-Sort the heaviest 20% were identified on day 1 and sorted 50 days before harvest with the heavy 20% being harvested on day 140 and the light 80% being harvested on day 161. Fifty days before harvest 4-Sort was sorted into a heavy, mid-heavy, mid-light, and light group marketed -14, 0, +7, and +28 days from the –CON and +CON.

Table 1. Basal diet and supplement (finishing ration).

Ingredient	% of diet DM
Basal Diet	
DRC	33.0
HMC	8.0
MDGS	25.0
Sweet Bran®	20.0
Silage	6.0
Wheat straw	3.0
Supplement	5.0
Supplement	
Fine ground corn	2.72
Limestone	1.75
Salt	0.30
Tallow	0.13
Trace mineral	0.05
Rumensin-90	0.02
Tylan-40	0.01
Vitamin A,D,E	0.02

Two supplements were manufactured and fed during the study. One supplement contained Zilmax, and one supplement did not contain any Zilmax. In supplement containing Zilmax, Zilmax replaced find ground corn.

ingredients are presented in Table 1. Steers used in this experiment were sourced from multiple locations in the fall of 2011 and backgrounded during the winter, while some were sourced from auction barns in May of 2012.

On the day of allocation to treatment, all steers were implanted with Revalor-XS®. Prior to the start of the experiment, steers were limit-fed a common diet at 2.0% of BW for five consecutive days and weighed two consecutive days to eliminate variation in body weight due to gut fill. Following the limit-feeding period, steers were assigned randomly to pen and pens were assigned randomly to treatment. The heaviest 20% of steers in each pen in the 1-Sort treatment were identified during weighing and processing on day 0. Cattle were fed *ad libitum* twice daily at 7 and 11 a.m.

Fifty days prior to the target marketing date, the heaviest 20% (five steers/pen) identified on day 0 in the 1-Sort treatment were sorted and moved to a separate pen, and the remaining light 80% were returned to the original pen. Likewise, steers from four pens (100 steers) in the 4-Sort group within a block were individually weighed and sorted with the heaviest 25% (25 steers) sorted into the

Table 2. Performance data for steers fed Zilmax (+CON) or not (-CON) and sorted wo ways (1-SORT) or four ways (4-SORT) and fed Zilmax.

	Treatments					
		Zilmax Fed				
Variable	-CON	+CON	1-SORT	4-SORT	SEM	*P*-value
Pens, n	8	8	8	8		
Steers, n	200	200	200	800		
Average days, n	154	154	157	159		
Live Performance						
Initial BW, lb	824	822	822	824	17.10	0.99
Final BW, lb	1479	1492	1503	1503	18.01	0.11
DMI, lb/day	26.7[a]	26.4[a,b]	26.2[b,c]	26.1[c]	0.4	<0.01
ADG, lb	4.25	4.34	4.34	4.30	0.10	0.78
F:G	6.29	6.09	6.03	6.07	—	0.33

[a,b,c] Means with different superscripts differ ($P < 0.05$).

Table 3. Carcass characteristic data for steers fed Zilmax (+CON) or not (-CON) and sorted two ways (1-SORT) or four ways (4-SORT) and fed Zilmax.

	Treatment					
		Zilmax Fed				
Variable	-CON	+CON	1-SORT	4-SORT	SEM	*P*-value
HCW, lb	915[c]	948[b]	954[a]	957[a]	10.69	<0.01
Change in HCW, lb[2]	—	33.0	39	42	—	—
HCW C.V[1]	7.0[a]	6.7[a]	6.2[a]	4.1[b]	—	<0.01
HCW Std. Dev, lb	64.0[a]	63.6[a]	58.5[a]	39.5[b]	—	<0.01
HCW Over 1000 lb, %	9.79[a]	17.61[b,c]	22.34[c]	13.64[a,b]	5.70	<0.01
HCW Over 1050 lb, %	1.97[a,b]	4.42[a]	1.99[a,b]	1.38[b]	2.68	0.05
Dressing Percent	61.8[a]	63.5[b]	63.5[b]	63.6[b]	0.2	<0.01
12th Rib Fat, in.	0.63	0.60	0.60	0.59	0.02	0.10
LM Area, in.^{2}	13.5[a]	14.7[b]	14.8[b,c]	14.9[c]	0.2	<0.01
Calculated Yield Grade	3.6[a]	3.3[b]	3.2[b]	3.2[b]	0.1	<0.01
Marbling Score[3]	515	494	491	487	16	0.06

[1]HCW = hot carcass weight; C.V. = coefficient of variation and is calculated by dividing the standard deviation by the mean and is expressed as a percentage.
[2]Change in HCW is the difference between the HCW in each treatment and -CON.
[3]Marbling Score 500 = Modest, 400 = Small, 300 = Slight.
[a,b,c]Means within a row with different superscripts differ ($P < 0.05$).

Table 4. Yield and quality grade for steers fed Zilmax (+CON) or not (-CON) and sorted two ways (1-SORT) or four ways (4-SORT) and fed Zilmax.

	Treatment[2]					
		Zilmax Fed				
Variable	-CON	+CON	1-SORT	4-SORT	SEM	*P*-value
USDA Yield Grade[1]						
1	0.43[a]	2.17[a,b]	5.37[b]	4.20[b]	1.42	0.05
2	15.08[a]	30.73[b]	31.64[b]	31.96[b]	5.02	<0.01
3	58.22	54.77	50.11	49.52	5.28	0.13
4	22.58[a]	10.94[b]	11.03[b]	12.94[b]	2.59	<0.01
5	2.66[a]	0.44[a,b]	0.44[a,b]	0.11[b]	0.67	0.01
USDA Quality Grade[2]						
Prime	4.19	2.75	2.31	3.12	1.40	0.71
High Choice	50.08[a]	40.92[a,b]	41.34[a,b]	37.30[b]	5.65	0.02
Low Choice	38.22	41.15	44.11	40.86	4.23	0.69
Select	6.71[a]	14.06[b,c]	11.23[a,b]	17.32[c]	3.08	<0.01

[1]The Yield Grade (YG) and Quality Grade (QG) values represent the proportion of carcasses within each group that received each YG or QG.
[2]All numbers are expressed as percentages.
[a,b,c] Means within a row with different superscripts differ ($P < 0.05$).

heavy group, the next heaviest 25% (25 steers) into the mid-heavy group, the next heaviest 25% (25 steers) into the mid-light group, and the lightest 25% (25 steers) into the light group. All replicates within block were managed the same and weighed and sorted on the same day. Intake was determined by using the pen average before sort and pen average after sort for individual animals. Within a block, the heaviest 20% of steers in the 1-Sort and heavy group in 4-Sort sorted treatments were weighed by pen and harvested 14 days before the –CON and +CON. The mid-heavy 4-Sort group, the –CON, and the +CON were weighed by pen and shipped for harvest on day 154. The remaining 80% of the 1-Sort treatment and the mid-light 4-Sort group were weighed by pen and shipped for harvest seven days after the –CON and +CON. Lastly, the light 4-Sort group were weighed by pen and shipped for harvest 28 days after the –CON and +CON. On the day of shipping cattle were pen weighed to determine final body weight before shipping. Steers were harvested at a commercial abattoir the following morning. Liver scores and HCW were collected on the day of slaughter. After a 48-hour chill, marbling score, 12^{th} rib fat depth, KPH fat, and LM area were recorded. Yield grade was calculated using the yield grade equation (Boggs and Merkel, 1993) where yield grade = 2.50 + (2.5 x fat thickness, in) – (0.32 x LM area, in^2) + (0.2 x KPH, %) + (0.0038 x HCW, lb). Dressing percentage was calculated using the HCW and final BW shrunk 4%.

Data were analyzed as a randomized block design using the Glimmix procedure of SAS (SAS Institute, Inc., Cary, N.C.). Steers were blocked by arrival group and pen was the experimental unit. The model included the fixed effect of treatment, with block as a random effect. For the –CON, +CON and 1-SORT, replication consisted of a pen of 25 steers. However, for the 4-Sort, replication consisted of four pens or 100 steers each. To account for this difference in treatment size, standard deviation and coefficient of variation were calculated on each pen and a log transformation was done to test variability of the standard deviation and coefficient of variation.

Results

Due to the weight sort, steers in the 1-Sort and 4-Sort treatments were fed an average of three days and five days longer than the control treatments, respectively (Table 2). Steers in the 4-Sort treatment had lower DMI ($P < 0.01$) compared to the unsorted treatments, but were not different compared to 1-Sort treatments. Although not different ($P = 0.11$), Zilmax fed treatments tended to have heavier final BW when compared to the –CON. Similarly, there were increases in ADG and numerical improvements in the F:G ratio.

Carcasses from +CON steers were 33 lb heavier ($P < 0.01$) than –CON (Table 3). Carcasses from steers in 1-Sort and 4-Sort were 39 and 42 lb heavier ($P < 0.01$) than -CON. Carcass weight standard deviation (SD) were not different ($P > 0.95$) between +CON and –CON, while carcass weight SD of 4-Sort was reduced ($P<0.01$) compared to the unsorted controls. All steers fed Zilmax had a greater percentage of carcasses over 1,000 lb than –CON ($P < 0.01$). Although not different ($P = 0.16$), the percentage of carcasses over 1,000 lb was reduced by 22% for 4-Sort compared to +CON. The percentage of carcasses over 1,050 lb was significantly lower ($P < 0.01$) for 4-Sort compared to +CON. Thus, sorting four ways was effective at reducing the percentage of overweight carcasses at 1,000 lb and 1,050 lb compared to an unsorted Zilmax fed control. Fat depth was lower ($P < 0.05$) in +CON than –CON, but did not differ between Zilmax fed treatments. *Longissimus* muscle area was greater ($P < 0.01$) in +CON than -CON, and 4-Sort had increased ($P = 0.05$) LM area compared to +CON. Marbling score was lower numerically for +CON, 1-Sort, and 4-Sort compared to –CON.

The percentage of USDA Yield Grade 1 and 2 carcasses was greater ($P < 0.01$) for 4-Sort compared to the –CON. Because of this shift, the percentage of USDA Yield Grade 4 and 5 carcasses was reduced ($P < 0.01$) for 4-Sort cattle compared to the –CON (Table 4). There was a reduction ($P < 0.01$) in USDA High Choice for 4-Sort compared to –CON. There was an increase ($P < 0.01$) in the percent of 4-Sort carcasses that graded USDA Select compared to –CON. Zilpaterol hydrochloride increased hot carcass weight, and when used in combination with a 4 way weight sort to identify heavy carcasses, there was an increase in HCW while decreasing HCW variation. This allowed for cattle to reach an optimum market endpoint, which in turn allows for a potential increase in profits by increasing total saleable weight while avoiding overweight discounts.

[1]F. Henry Hilscher, graduate student; Dirk B. Burken, research technician; Brandon L. Nuttelman, former research technician; Galen E. Erickson, professor; Kathy Hanford, assistant professor, University of Nebraska–Lincoln Department of Animal Science, Lincoln, Neb.; Kyle J. Vander Pol, formerly with Merck Animal Health; John P. Hutcheson, Merck Animal Health, Summit, N.J.