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Dry Matter Intake Decreases Shortly After Initiation of Feeding Zilmax During the Summer

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Introduction

Since Zilmax (zilpaterol hydrochloride, ZIL; Merck Animal Health, Summit, NJ) was first launched in the U.S. in 2007, there have been anecdotal reports of reduction in dry matter intake (DMI) in feedlot cattle after initiation of feeding ZIL. Often, no difference in intake was detected, sometimes a small change was reported, and occasionally a substantial reduction of several pounds was observed. In some instances, intake returned to pre-ZIL levels over time; in other cases, intake remained depressed.

Some studies have reported no effect of zilpaterol on DMI, whereas others have reported a decrease in DMI for cattle fed zilpaterol compared with control cattle; on average, published studies report a 0.3-lb reduction in DMI compared with control cattle fed diets without zilpaterol. The objectives of this study were to evaluate relationships between DMI before and after initiation of ZIL feeding in three commercial feedyards and to determine how this relationship is affected by season, gender, and pre-ZIL DMI.

Experimental Procedures

A database of daily feed deliveries for steers and heifers fed from January 1, 2010, through January 31, 2012, at three commercial feedlots in Kansas (n = 1,515 pens of cattle; Table 1) was used to investigate the prevalence and extent of changes in DMI after initiation of ZIL feeding. Each daily feed delivery was divided by the number of animals in the pen and multiplied by diet DM to estimate per animal daily DMI. Because minor dietary changes were made periodically, each DMI value was adjusted to a common net energy (NE_G) content by multiplying the daily DMI value by its corresponding NE_G content and dividing by the average NE_G content across the entire time period. Pre-ZIL baseline DMI was calculated as the average DMI for the 10-day period immediately prior to initiation of ZIL. Post-ZIL DMI was analyzed using daily DMI for days 2 through 9 after initiation of ZIL feeding and the average DMI within each of four 5-day periods of the 20-day ZIL feeding period. The average DMI across the 18 days prior to the 10-day pre-ZIL baseline was used to compare intake trends prior to initiation of ZIL feeding; the change in intake between the pre-baseline and baseline DMI periods was used as a covariate in the models to correct for any pre-existing trend in DMI.

A mixed model approach was used, which included as fixed effects the main and interaction effects of gender (steer and heifer), feedlot (A, B, and C), season (Fall, Winter, Spring, and Summer), day post-ZIL initiation (2–9), and the pre-ZIL DMI change. Seasons were defined as follows: Fall = September, October, and November; Winter = December, January, and February; Spring = March, April, and May; and Summer = June, July, and August. The data were analyzed with day after ZIL initiation treated as repeated measures using an autoregressive covariance structure because data points observed closer together in time should be assumed to be more closely related than data points farther apart in time. Effects were considered significant if $P < 0.01$ for the type III sums of squares.

Results and Discussion

Of the 1,515 pens of cattle represented in the database, 75% had a numerical decrease in DMI post-ZIL, and 25% had a numerical increase (Figure 1). Season affected the percentage of lots experiencing a decrease in DMI post-ZIL, but there were significant ($P < 0.01$) season × gender, season × feedyard, season × day, and season × period interactions.

Average DMI declined within 1 day after initiation of ZIL feeding (Figure 2); however, this effect was greater on day 2 in the summer and winter than during the spring or fall. The decline in intake eventually plateaued in all seasons (Figure 3); in fall and spring, intake recovered slightly.

Change in intake was greater in summer than other seasons for both steers and heifers (Figure 4); the change in intake was greater in steers than heifers in all seasons but fall.

Feedyard C had a greater decrease in DMI vs. feedyards A and B, but the order of size of decrease between feedyards A and B varied by season (Figure 5). Feedyard A had the smallest decrease in DMI during the spring, fall, and winter and had nearly no change in DMI when started on ZIL in the fall, but feedyard A actually had a greater decrease in intake post-ZIL than feedyard B in the summer (Figure 6).

During the summer months, the percentage of lots that had a decrease in DMI of 2–3 lb and greater than 3 lb were greater (18% and 15%; $P < 0.05$; Figure 7), and the percentage of lots with no decrease was the least (15%; $P < 0.05$), whereas 34% of lots had no decrease in DMI during the fall.

As pre-ZIL DMI increased, the percentage of lots with a decrease in post-ZIL DMI increased from 62% for lots with less than 17 lb to 82% for lots consuming greater than 23 lb ($P < 0.01$; Figure 8). The average dosage of ZIL consumed per animal with an average DMI of 16, 18, 20, 22, and 24 lb was calculated to be 61, 68, 76, 84, and 91 mg per head daily, respectively, which may be related to the differences in decrease in DMI. In lots started on ZIL during the summer months greater pre-ZIL DMI resulted in a linear ($P < 0.05$) increase in the percentage of lots with >3 lb and 2–3 lb and a linear decrease in the percentage of lots with no decrease in DMI (Figure 9). Of those lots with greater than 23 lb pre-ZIL DMI, 27% had DMI decrease of greater than 3 lb. Lots with greater pre-ZIL intake had a greater likelihood of having a decrease in DMI, and the size of the decrease was also greater.

The likelihood of lots exhibiting decreased DMI after initiation of ZIL feeding is greatest during the summer and least during the fall. Lots with greater DMI have greater likelihood to experience a decrease in DMI, and the decrease is greater. Increasing dosage of ZIL consumed may contribute to the DMI decrease, but the increased occurrence of DMI decrease during the summer may indicate presence of an additional physiological mechanism. Some feedlots modify feeding time of day when pens are switched from the common finishing diet to the finisher containing ZIL; this may also contribute to perturbation in previously normal intake patterns, especially affecting cattle with greater DMI pre-ZIL, but isolating feeding time from intake and ZIL inclusion was impossible in the present analysis.

Implications

Because DMI of cattle fed ZIL declines during the summer months and for cattle consuming greater DMI prior to feeding ZIL, performance and quality grade projections should be adjusted accordingly.

Table 1. Description of the data used in the analysis for daily dry matter feed deliveries for cattle fed in 3 commercial Kansas feedlots from January 1, 2010, through January 31, 2012

	Number of pens	Average	Standard deviation	Min	Max
Feedlot					
A	679	---	---	---	---
B	414	---	---	---	---
C	422	---	---	---	---
Season					
Summer	399	---	---	---	---
Fall	420	---	---	---	---
Winter	338	---	---	---	---
Spring	358	---	---	---	---
Gender					
Steers	523	---	---	---	---
Heifers	992	---	---	---	---
Initial BW on zilpaterol, kg	---	1,138	79.9	873	1,412
Days on feed upon initiation of zilpaterol feeding	---	132	29.2	74	283
Dry matter intake prior to initiation of zilpaterol, kg	---	21.0	3.21	14.2	45.25
Number of animals in each pen	---	134	64.7	50	447

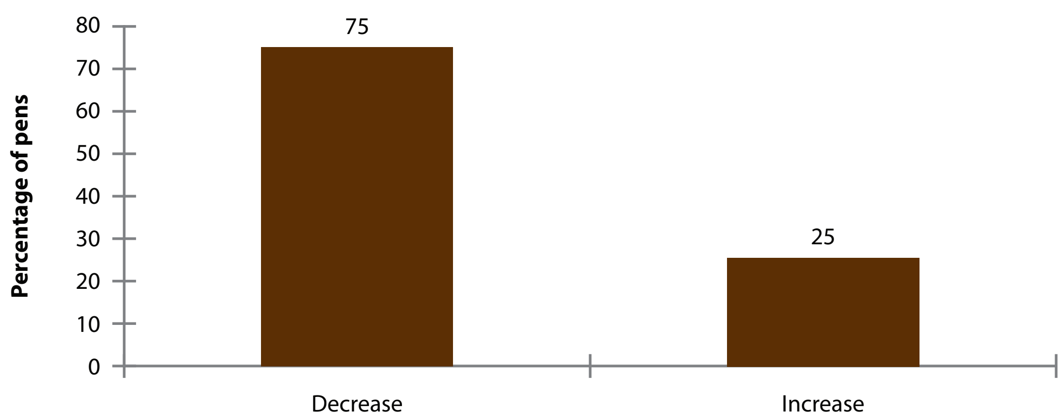

Figure 1. Percentage of pens with either a numerical increase or decrease in dry matter intake after initiation of zilpaterol feeding.

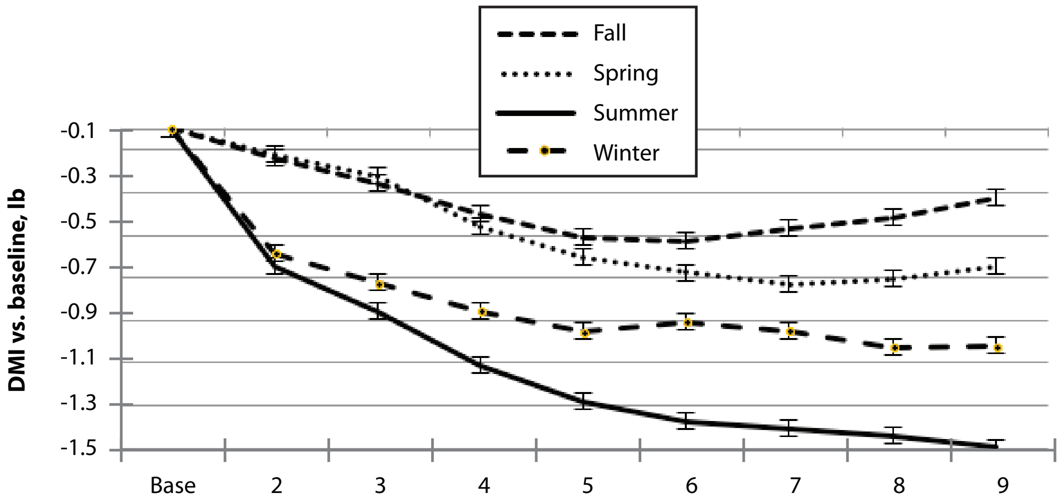

Figure 2. Mean change in daily dry matter intake (DMI) after initiation of zilpaterol feeding by day after initiation of zilpaterol feeding and season when zilpaterol feeding was initiated (season × day, $P < 0.01$). Error bars = largest SEM across season within each day.

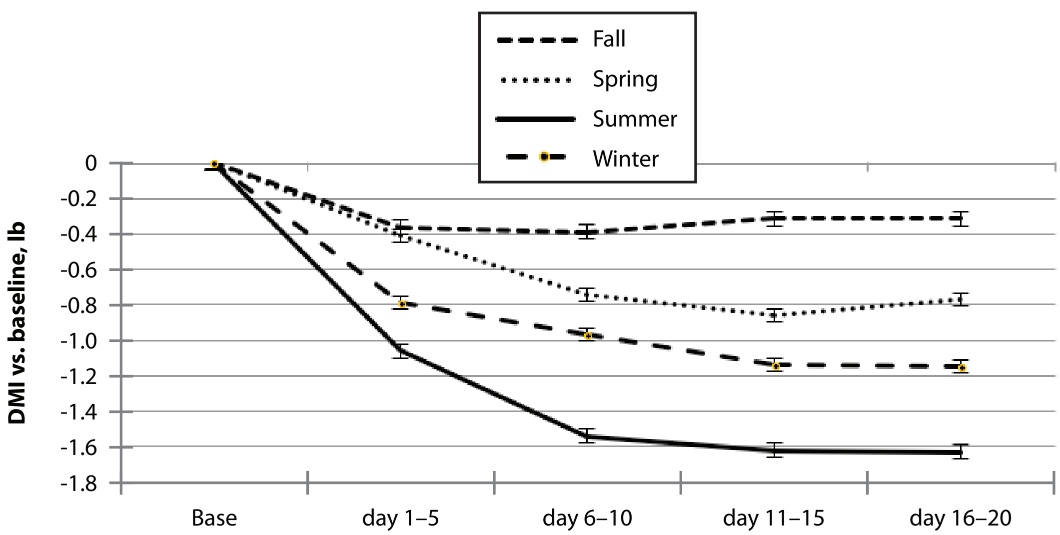

Figure 3. Mean change in daily dry matter intake (DMI) after initiation of zilpaterol feeding by 5-day period and by season when zilpaterol feeding was initiated (season × period $P < 0.01$). Error bars indicate largest SEM within period across seasons.

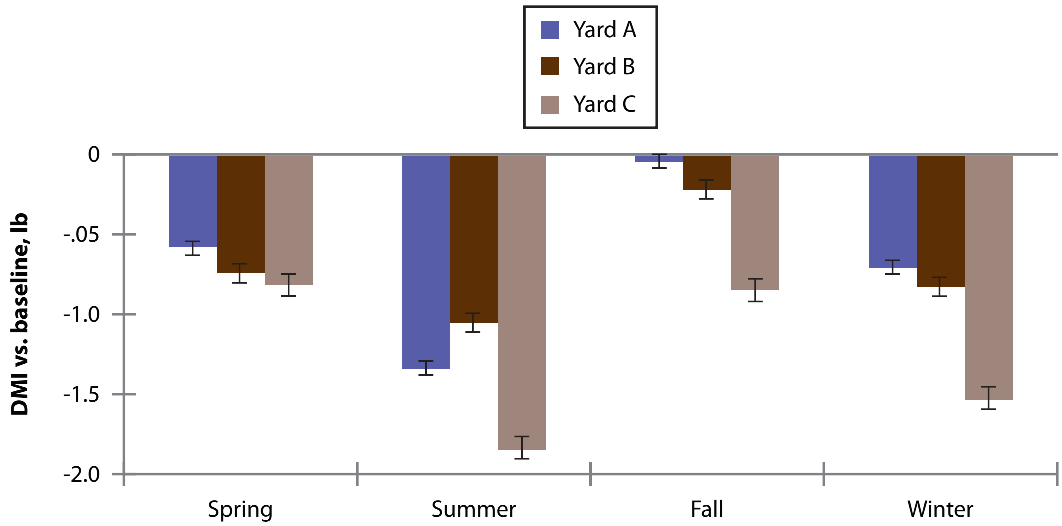

Figure 6. Mean change in daily dry matter intake after initiation of zilpaterol feeding by season and feedyard (season × period, $P < 0.01$). Error bars indicate the largest SEM for each feedyard among the four seasons.

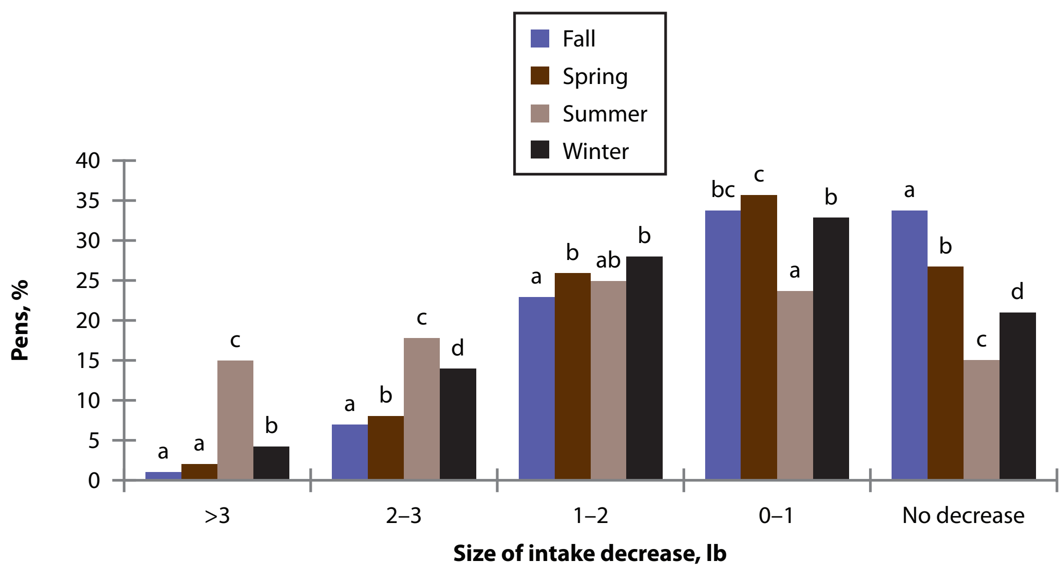

Figure 7. Percentage of pens with a decrease in DMI after initiation of zilpaterol feeding by size of decrease and season (season × size of decrease, $P < 0.01$). Means (bars) without a common letter differ, $P < 0.05$.

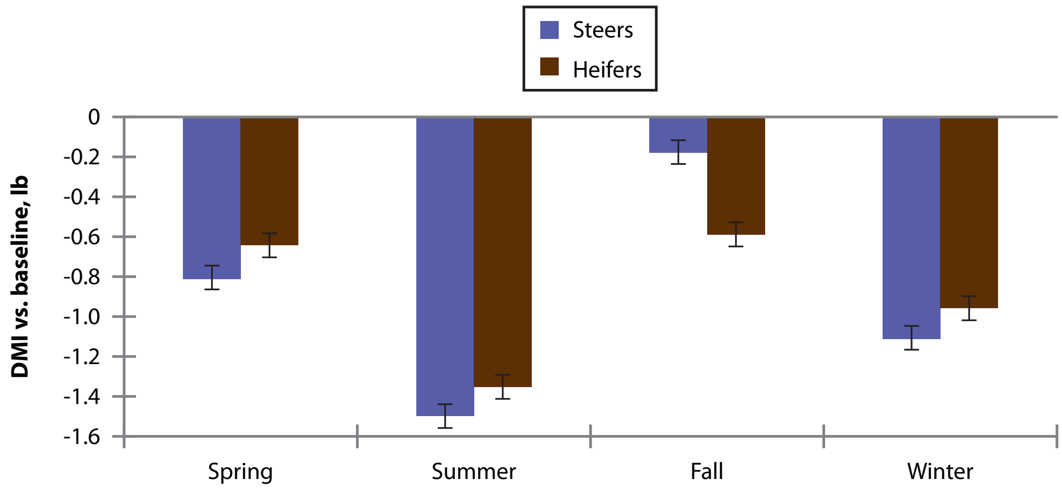

Figure 4. Mean change in daily dry matter intake (DMI) after initiation of zilpaterol feeding for steers and heifers by season when zilpaterol feeding was initiated (gender × season, $P < 0.01$). Error bars indicate the largest SEM within gender across season.

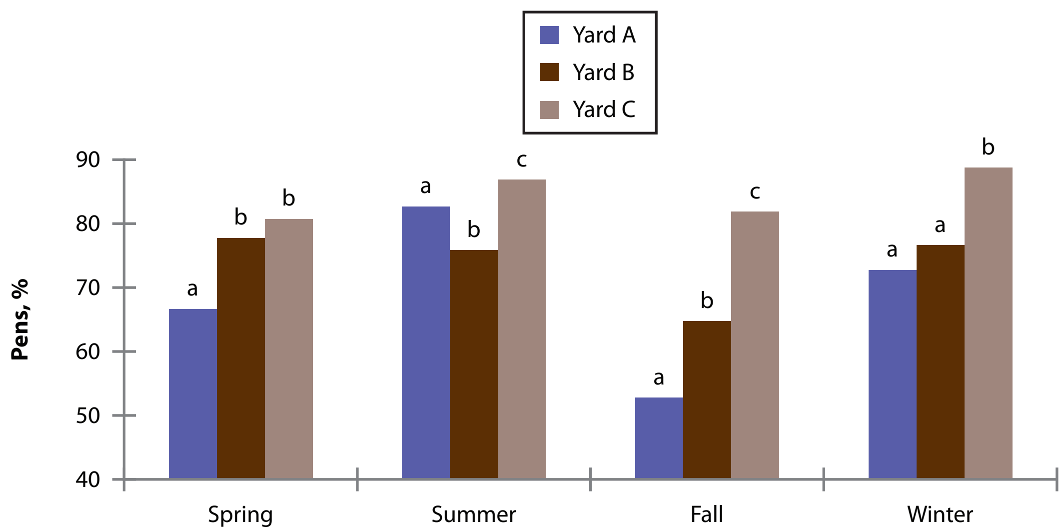

Figure 5. Percentage of pens with a numerical decrease in dry matter intake after initiation of zilpaterol feeding by feedyard and season when zilpaterol feeding was initiated (season × feedyard, $P < 0.01$; means (bars) without a common letter differ, $P < 0.05$.

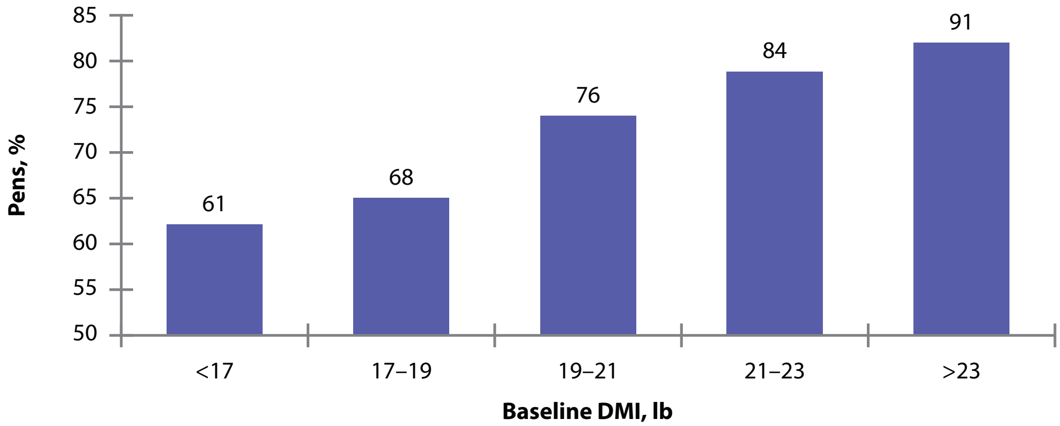

Figure 8. Percentage of pens with a decrease in dry matter intake (DMI) after initiation of zilpaterol feeding by baseline (pre-zilpaterol) DMI. (Effect of pre-zilpaterol DMI, $P < 0.01$). Baseline DMI = mean DMI for the 10 days immediately prior to initiation of zilpaterol feeding. Shown above each column is the zilpaterol intake corresponding to DMI of 16, 18, 20, 22, and 24 lb.

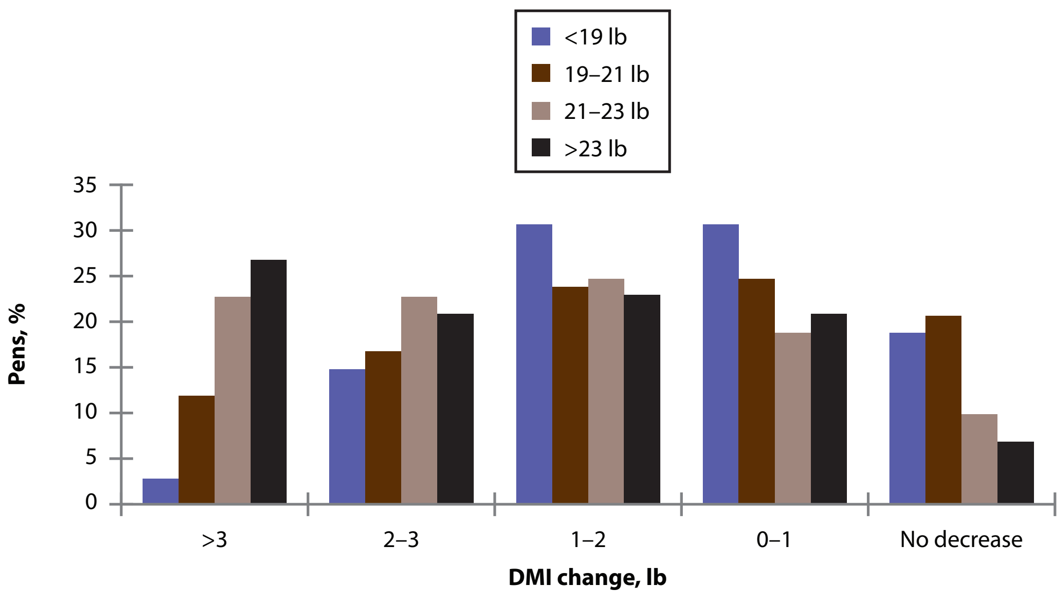

Figure 9. Percentage of pens started on zilpaterol during summer months (June, July, and August) with a decrease in dry matter intake (DMI) after initiation of zilpaterol feeding by size of decrease and baseline DMI (size of decrease × baseline DMI, $P < 0.01$).