The Professional Animal Scientist 32 (2016):375–381; http://dx.doi.org/10.15232/pas.2015-01471
©2016 American Registry of Professional Animal Scientists. All rights reserved.

Case Study: Effect of iron amino acid complex on the performance of lactating dairy cows on a commercial dairy

J. M. DeFrain,[1] PAS, D. H. Kleinschmit, PAS, and D. J. Tomlinson, PAS
Zinpro Corporation, Eden Prairie, MN 55344

ABSTRACT

Lactating Holstein cows (n = 506) were used in a randomized design to determine the effect of supplemental iron on milk SCC, milk yield, and milk composition. Cows were housed in naturally ventilated freestall barns or loose housing with open lot access and milked and fed twice daily. Treatments consisted of a basal TMR (control, CTL) or CTL supplemented with 600 mg/d per cow of Fe as iron AA complex (IRN, Availa-Fe, Zinpro Corp., Eden Prairie, MN). Treatments were randomly assigned among 4 pens [average and (SD) of pen counts were 92 (24), 131 (5), 109 (19), and 17 (5)], fed for 60 d, followed by a 60-d washout phase where all cows received CTL, and fed for a second 60-d treatment period. Assignments to pen were reversed during the second treatment period. Milk yield was recorded and milk samples were collected during the morning milking at d 14, 28, 42, and 56 (+/− 3) during each period. Treatment-by-parity effects were noted for milk yield and yields of milk fat and protein; parity 1 cows fed IRN tended to produce more milk than CTL ($P < 0.10$), whereas parity >2 cows fed CTL yielded more milk fat and protein ($P < 0.05$). Treatment-by-time effects were noted ($P < 0.05$) for all variables except milk protein percentage. These data indicate routine supplementation of IRN in diets for lactating dairy cows cannot be supported.

Key words: dairy cattle, iron, complex

INTRODUCTION

There is limited research available examining the effect of feeding adult dairy cattle supplemental iron. Iron deficiency in adult cattle is rare according to the NRC (2001). Iron requirements for lactating dairy cattle by the NRC (2001) were calculated using data from 6-wk-old calves and pregnant ewes. According to the NRC (2001), calcium and dicalcium phosphate contribute significantly to dietary iron, containing 15,800 and 14,400 mg/kg Fe, respectively. The use of dicalcium phosphate has declined because of the concern of feeding excessive amounts of phosphorus. Soil contamination of forages during harvest is another significant contributor to dietary iron. However, iron found in soil may have limited availability because it is thought to be tightly bound to chelating agents (Hansen and Spears, 2009) and is mostly in the ferric form, which is less available than the ferrous and heme forms (Miret et al., 2003). Availability of soil iron may increase if forages are contaminated before fermentation; however, soil iron was at most 3% bio-accessible based on dialyzable iron concentrations following fermentation for 90 d (Hansen and Spears, 2009).

Supplemental iron has been used to mitigate the negative effects of gossypol found in whole cottonseed. Supplementation with ferric sulfate has been shown to reduce the effects of gossypol found in whole cottonseed because of ferric sulfate forming conjugates with reactive groups on gossypol (Gadelha et al., 2014), an effect observed in vivo by both Santos et al. (2005) in Holstein steers and McCaughey et al. (2005) in lactating Holstein cows. More recent research found multiparous Holstein cows fed 30 mg/kg per day of supplemental Fe as iron AA complex (**IRN**, Availa-Fe, Zinpro Corp., Eden Prairie, MN; dry, prefresh, and lactating diets contained 313, 336, and 282 mg/kg Fe) for 60 d before expected calving reduced milk SCC in the first 63 DIM (Weiss et al., 2010). Although Weiss et al. (2010) found changes in animal performance, feeding supplemental Fe did not affect

[1] Corresponding author: jdefrain@zinpro.com

Table 1. Iron AA complex premix—ingredient and analyzed nutrient composition

Item	Value
Ingredient, %	
Ground corn	64.25
Rice hulls	31.64
Availa-Fe 100[1]	3.11
Oil, animal–vegetable blend	1.00
Analyzed composition	
DM, %	89.1
Ca, %	0.18
P, %	0.20
Mg, %	0.09
K, %	0.36
S, %	0.09
Mn, mg/kg	223
Zn, mg/kg	161
Cu, mg/kg	35
Fe, mg/kg	4,320
Na, %	0.19
Cl, %	0.38
Mo, mg/kg	0.55

[1]10% Fe as iron AA complex, Zinpro Corp. (Eden Prairie, MN).

Table 2. Ingredient composition of diets fed to pens used as experimental units[1]

Ingredient, % of DM	Pens 1 and 2	Pens 3 and 4
High-moisture earlage	17.1	17.0
Alfalfa hay	16.1	15.9
Corn silage	11.2	12.0
Sorghum silage	11.1	13.4
Barley silage	7.1	8.9
Corn grain	6.1	5.1
Barley grain	6.0	5.0
Corn distillers, ethanol	6.6	6.6
Soybean meal 47.5% solvent	6.4	6.3
Whole cottonseed	5.1	3.5
Soybean hulls, pelleted	3.35	3.35
Sodium sesquinate	0.92	0.92
Rumolac[2]	0.89	—
Limestone, ground	0.71	0.71
Urea	0.345	0.344
Salt	0.330	0.327
Magnesium oxide	0.184	0.184
Vitamin–trace mineral premix[3]	0.181	0.181
Dynamate[4]	0.176	0.176
Omnigen AF[5]	0.118	0.118

[1]Diets balanced for 24.7 and 23.7 kg of DMI/d for pens 1 and 2, and 3 and 4, respectively.

[2]Ca salts of soy fatty acids, Robt Morgan Inc. (Paris, IL).

[3]800 mg/kg Co; 11,000 mg/kg Cu; 900 mg/kg I; 308 mg/kg Fe; 17,500 mg/kg Mn; 190 mg/kg Se; 50,575 mg/kg Zn; 5,339,950 IU/kg vitamin A; 1,281,466 IU/kg vitamin D, and 14,893 IU/kg vitamin E.

[4]Feed-grade mineral consisting of the sulfate form of potassium and magnesium (18% K, 11% Mg, 22% S), The Mosaic Co. (Plymouth, MN).

[5]Mixture of active dried *Saccharomyces cerevisiae*, dried *Trichoderma longibrachiatum* fermentation product, niacin, vitamin B_{12}, riboflavin-5-phosphate, D-calcium pantothenate, choline chloride, biotin, thiamine monohydrate, pyridoxine hydrochloride, menadione dimethylpyrimidinol bisulfate, folic acid, calcium aluminosilicate, sodium aluminosilicate, diatomaceous earth, calcium carbonate, rice hulls, and mineral oil; Omnigen Research LLC (Corvallis, OR).

any measure of Fe status. The objective of the current study was to assess the effect of IRN on milk SCC, milk yield, and milk composition on a commercial dairy.

MATERIALS AND METHODS

The experiment was conducted using 582 lactating, multiparous Holstein cows on a commercial dairy in central Kansas. Cows were housed in naturally ventilated barns with deep-bedded manure compost freestalls. Cows were milked and fed twice daily, and pen (n = 4) was used as the experimental unit. Orts were removed once daily, and amount of TMR offered was adjusted to ensure a 3% feed refusal. Treatments consisted of a basal TMR (control, **CTL**) or CTL plus 600 mg of Fe/d as IRN, which was incorporated into a premix (Table 1), mixed, and delivered as a component of the TMR. The amount of IRN fed was based off of that used by Weiss et al. (2010). The amount of premix added was adjusted daily based on the number of cows in the pen. The experiment consisted of two 60-d periods separated by a 60-d washout phase where no cows were fed IRN. Period length was set to 60 d because the half-life of red blood cells in circulation was considered to be 8.5 wk (Landaw, 1991), hypothesizing the effect of supplemental iron may be associated with aerobic metabolism and immune function. In addition, using a 60-d period length minimized the number of cows removed from the experiment because of dry-off.

Ingredient and nutrient composition of the TMR fed to each pen is shown in Tables 2 and 3. During the first period, pens 3 and 4 received IRN and pens 1 and 2 were fed CTL. After the 60-d washout phase, pens 1 and 2 received IRN, and pens 3 and 4 received CTL. Samples of TMR were collected (at approximately d −7, 30, and 60 during each period) and analyzed via wet chemistry methods by Dairyland Laboratories Inc. (Acadia, WI). Samples were dried at 55°C in a forced-air oven and allowed to air equilibrate before being ground to pass a 1-mm screen (Brinkmann ultracentrifuge mill, Brinkmann Instruments Co., Westbury, NY) and analyzed for CP using a LECO-628 combustion ana-

Download English Version:

https://daneshyari.com/en/article/10161716

Download Persian Version:

https://daneshyari.com/article/10161716

Daneshyari.com