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Technical Literature

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Canadian Dairy Herds Respond to Chromium Propionate with More Milk, Better Health and Improved Reproduction

Abstract

Chromium has been shown to impact energy metabolism of dairy cattle during the transition and early lactation period resulting in greater milk yield, improved immune function or better reproductive efficiency.[1 - 11] The results of chromium supplementation can be variable from cow to cow, depending on an animal's hierarchical need for energy. The objective of this field demonstration was to evaluate the effect of chromium supplementation on performance of Canadian dairy cattle. Four dairy herds fed by the same nutritionist were enrolled in the demonstration from June through November 2017, then monitored until July 2018. Herds ranged in size from 175 to 500 cows. All herds were naïve to chromium, and all herds followed an All off/All on protocol. The 500-cow herd was fed KemTRACE® Chromium (KT Cr) to close-up and fresh cows only, and the other 3 herds were fed KT Cr to close-up and lactating cows. Milk production, health events and reproduction were followed through Dairy Comp 305 management software and/or Dairy Herd Improvement (DHI) information. Chromium increased milk yield, improved immune function, reduced negative energy balance and improved reproductive efficiency in all herds resulting in returns on investment ranging from 2.6 to 18:1.

Introduction

Chromium propionate (KemTRACE® Chromium; Kemin Industries) has been approved for use in diets for dairy, beef, swine and broilers in both the U.S. and Canada. Feeding chromium to lactating dairy cows in pre- and post-partum diets has consistently increased milk yield of multiparous cows during early lactation.[1 - 4] The influence of chromium on milk production has been attributed to its effects on energy metabolism reflected through decreased mobilization of non-esterified fatty acids (NEFA) from adipose tissue and increased insulin sensitivity.[2,5] However, the utilization of energy is dictated by the animal, and consequently, the response of lactating cows to chromium supplementation can be variable. In addition to milk yield responses, improvements have been noted in metabolic disorders,[6] immune function[7,8] and reproductive performance.[9 - 11] Therefore, it is important to evaluate the effect of chromium supplementation on performance of lactating dairy cattle under different conditions in various regions of the U.S and Canada.

Materials and Methods

Four field demonstrations were conducted with herds ranging in size from 175 - 500 cows.[12] All 4 herds were fed by the same nutritionist, and all demonstrations were an all-off/all-on design. Herds entered the demonstration from June 2017 through November 2017 and remained on chromium propionate for at least 7 months. KemTRACE® Chromium 0.4% (KT Cr) was included in the diet at 2 g/cow/day to provide 8 mg of elemental Cr/cow/day to all cattle groups. Table 1 provides details on the individual herds and groups of cattle on chromium. Data were collected from Dairy Herd Improvement Association (DHIA) tests and/or Dairy Comp 305. Data on herd performance from the year preceding the demonstration was used for comparison.

Table 1. Herd size and groups receiving KT Cr in the demonstration herds.

Herd	Month Started	Herd Size	Cattle Groups receiving KT Cr
Herd F	June 2017	500 cows	Close-up and fresh cows only
Herd S	July 2017	375 cows	Close-up and all lactating cows
Herd V	September 2017	175 cows	Close-up and all lactating cows
Herd J	November 2017	220 cows	All lactating and dry cows

Results and Discussion

Milk

Milk produced by the demonstration herds on DHIA test day for the 2 months prior to the start of the demonstration and the last 2 months of the demonstration are summarized in Table 2.

Table 2. Summary of milk production prior to the demonstration and at the end of the demonstration (kg).

Herd	2 months prior to Trial start	1 month prior to Trial start	2 months before Trial end	1 month before Trial end	Difference in Average milk
Herd F	40.2	40.2	41.2	42.2	+1.5
Herd S	38.1	38.1	38.1	39.1	+0.5
Herd V	40.2	41.2	44.3	44.3	+3.6
Herd J	39.1	36.0	41.2	40.2	+3.1

As these demonstrations are all-off/all-on demonstrations with no control groups for side by side comparisons, we cannot make statistical comparisons. Nonetheless, 3 of the 4 herds appear to have had an increase in herd milk production due to chromium supplementation.

Transition Events

Herd F and S tracked ketosis events. In Herd F, ketosis incidences decreased from 12 per month during the year prior to the demonstration to 10 per month during the demonstration. Herd S had minimal levels of ketosis before and during the demonstration with the exception of 3 months when freshening's nearly doubled.

Early and Peak Lactation Performance

Key parameters for monitoring early and peak lactation are listed in Table 3. Three of the 4 herds experienced increases in early milk production. Herd F, which only fed chromium to transition animals, had an increase of 2.1 kg in average milk production during week 2 in the multiparous animals. Herds V and J experienced substantial increases, ranging from 2 to 8 kg in milk production, at 2 and 4 weeks for primiparous and multiparous animals. Peak milk increased 4.1 kg in Herds V and J as well.

Table 3. Summary of close-up, early, and peak lactation performance for all 4 herds (kg).

	Herd F		Herd S		Herd V		Herd J	
Item	Before	End	Before	End	Before	End	Before	End
2-week milk, Lact = 1	31.9	31.9	28.8	28.8	31.9	34.0	26.8	33.0
2-week milk, Lact ≥ 2	44.3	46.4	46.4	46.4	43.3	48.4	43.3	47.4
4-week milk, Lact = 1	38.1	37.1	31.9	31.9	37.1	39.1	31.9	37.1
4-week milk, Lact ≥ 2	51.5	52.5	49.4	48.4	43.3	51.5	47.4	53.6
Peak milk, Lact =1	40.2	40.2	36.0	35.0	40.2	44.3	37.1	41.2
Peak milk, Lact ≥ 2	55.6	56.6	51.5	50.5	52.5	56.6	53.6	57.7

Reproduction and Milk Quality

Herds V and J tested for somatic cell count (SCC) with DHIA. Both herds had low SCC before the demonstration, and by the end the herds had a further reduction in SCC of at least 23,000 cells/mL down to totals of 89,000 and 122,000 cells/mL for Herds V and J, respectively.

All herds except J experienced a reduction in the percent of cows open past 150 Days in Milk (DIM) during the demonstration by 3 – 5 %. Before the demonstration, Herd J had 6% of its cows still open past 150 DIM, this increased to 9% during the demonstration.

The greatest change in 21-day pregnancy rate (21-d PR) was seen in Herd S where 21-d PR increased from 18 – 22% during the 12-month demonstration.

Returns

The returns from KT Cr use in each herd are displayed in Table 4. The additional milk income from using KT Cr ranged from $114 – 824 cow/year. The decreased ketosis events in Herd F represented a savings to the herd of $9,120/year. The value of an improved 21-d PR in Herd S was $118 cow/year.

Table 4. Returns from increased milk production, decreased ketosis and improved reproduction in demonstration herds

Returns	Herd F	Herd S	Herd V	Herd J
Average milk[1]	$343[2] cow/yr.	$114[3] cow/yr.	$824[4] cow/yr.	$709[5] cow/yr.
Ketosis[2]	$9120[6] herd/yr.	-	-	-
Reproduction[3]	-	$118[7]/cow/yr.	-	-

[1]Milk price in June 2018 was $77.37 per hectoliter or $0.7511/kg (CDN), and 1 CDN dollar = 0.7587 USD.
[2]Herd F increased average milk/cow/day by 1.5 kg × 305 days × $0.75 kg = $343 cow/year increased income.
[3]Herd S increased average milk/cow/day by 0.5 kg × 305 days × $0.75 kg = $114 cow/year increased income.
[4]Herd V increased average milk/cow/day by 3.6 kg × 305 days × $0.75 kg = $824 cow/year increased income.
[5]Herd J increased average milk/cow/day by 3.1 kg × 305 days × $0.75 kg = $709 cow/year increased income.
[6]Herd F experienced 24 fewer ketosis cases in 12 months. McArt et al. (2015) estimated the cost of 1 case of ketosis to be $289 (USD) or $380 (CDN). 24 cases of ketosis × $380 = $9,120 herd/yr (CDN).
[7]Herd S increased 21-d PR from 18 to 22% during the demonstration. Extrapolating from M.W. Overton's work[7] on the value of improved reproductive performance, this improvement in pregnancy rate is worth $118 cow/yr(CDN).

Summary

KemTRACE® Chromium is a highly bioavailable, organic source of chromium that helps improve glucose utilization for increased cellular energy and function. In this demonstration involving 4 Canadian herds, the herds responded with more milk production in early lactation, fewer transition events and/or improved reproductive efficiency.

Herd F was fed chromium propionate during the transition period only. This resulted in a decrease in ketosis valued at $9,120 per year. The return on investment (ROI) for decreasing ketosis incidence in Herd F was 3.1:1. This decrease in ketosis may be indicative of better early lactation health in general in this herd, which may have resulted in greater overall milk production.

Herd S was fed chromium propionate to close-up and all lactating cows. The primary response was improved reproductive performance. The ROI in Herd S for increasing the 21-d PR from 18 to 22 % was 2.6:1.

Herd V was fed chromium propionate to close-up and all lactating cows. The main response this herd had to chromium was increased milk production. The ROI for increasing average milk production/cow/day by 3.6 kg in Herd V was 18:1.

Herd J was fed chromium propionate to all lactating and dry cows. The primary response was increased milk production. The ROI in Herd J for increasing average milk production/cow/day by 3.1 kg was 13.9:1.

Feeding chromium in all 4 demonstration herds resulted in a positive ROI ranging from 2.6 to 18:1.

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