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Beat the heat with Chromium Propionate

In many parts of the U.S., heat and humidity inflict tremendous heat stress on dairy cows. On a yearly basis, heat stress can reduce milk production by 10 – 25% and reproductive performance by 15 – 40% depending on the region of the country[1]. Based on the recent update to the Temperature Humidity Index (THI) by the University of Arizona, the new stress threshold where milk yield and reproduction losses begin to become detectable is 68. A cow under mild to moderate heat stress (a THI between 72-79) will begin to show signs that include a more rapid decrease in feed intake, decreased milk production, quick shallow breathing and an abundant amount of sweating. As the temperature humidity index (THI) climbs to 90, the severe stress level, the cow will continue to show a greater decline in milk yield and in her feed intake.

Cows under heat stress will reduce dry matter intake (DMI) by 20 – 25%[2], but this DMI reduction only accounts for ~40 – 50% of the associated milk yield decline[3]. The remaining ~50 – 60% reduction in milk yield is associated with increased maintenance costs (up to 25% increase) and increased insulin effectiveness in peripheral tissues drawing glucose away from the mammary gland[3]. As a result, cows under heat stress enter negative energy balance (NEBAL) regardless of their stage of lactation[4], which can lead to losses in body weight (BW) and body condition score (BCS). Therefore, nutritional strategies that improve glucose production and utilization should mitigate the NEBAL associated with heat stress and allow cows to more closely maintain milk production. Chromium propionate has been shown to increase blood glucose levels[5,6] and alter insulin sensitivity[5] in dairy cattle, and may offer a nutritional benefit to heat-stressed dairy cattle.

Figure 1. Temperature Humidity Index (THI) for lactating dairy cows.
***Revised from Robert J. Collier and Rosemarie B. Zimbleman, The University of Arizona.**

Temperature	% Relative Humidity																				
F	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
75					68	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75
80	68	69	69	70	70	71	72	72	73	73	74	75	75	76	76	77	78	78	79	79	80
85	70	71	72	72	73	74	75	75	76	77	78	78	79	80	81	81	82	83	84	84	85
90	72	73	74	75	76	77	78	79	79	80	81	82	83	84	85	86	86	87	88	89	90
95	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
100	77	78	79	81	82	83	84	85	86	87	88	90	91	92	93	94	95	96	98		
105	79	80	82	83	84	86	87	88	89	91	92	93	95	96	97	99					
110	81	83	84	86	87	89	90	91	93	94	96	97									
115	84	85	87	88	90	92	93	95	96	98											
120	86	88	89	91	93	95	96	98													

- No Stress
- Stress Threshold
- Mild-Moderate Stress
- Moderate-Severe Stress
- Severe Stress

*Presented at the 2013 Western Dairy Management Conference, Reno, NV.

A New Heat Stress Management Approach

A field trial was conducted on a commercial 800-cow Holstein dairy in southeastern Pennsylvania to evaluate the effect of chromium propionate (Cr-Pro) on milk yield by cows (2nd lactation and greater) under heat stress conditions[7]. The Temperature Humidity Index (THI) during this field trial from July through September ranged from the Mild-Moderate level to the Moderate-Severe stress level. Milk production in early lactation cows decreased with prolonged exposure to high ambient air temperatures. However, cows supplemented with Cr-Pro maintained milk production more consistently throughout the trial period (Figure 2).

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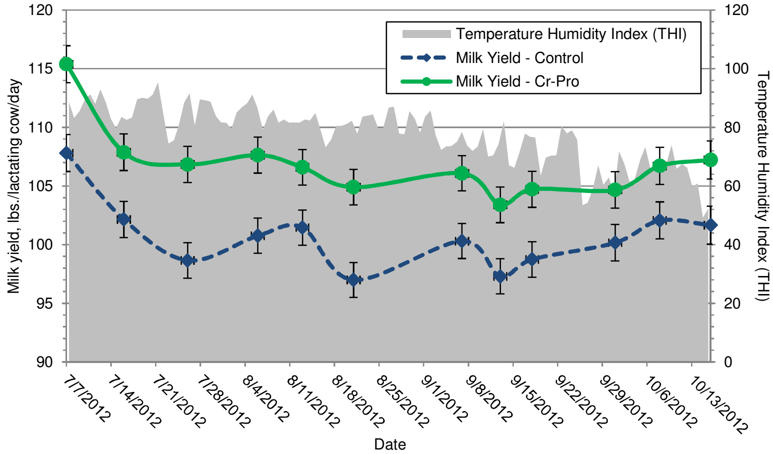
Figure 2. Effect of chromium propionate on milk yield over time[7]



Cows that calved in July only received Cr-Pro supplementation for less than four weeks prior to entering the treatment groups. This was due to Cr-Pro only being added to the pre-fresh diet at the initiation of the trial. As a result, there was no difference in milk yield between treatment groups for cows calving in July (Table 1). In comparison, cows calving in August and September received Cr-Pro a minimum of 5 weeks prior to entering the treatment groups and produced an additional 10.8 and 7.3 lbs. of milk over the control group, respectively (Table 1). These results would suggest that in order to obtain the full benefit to milk production from Cr supplementation, cows should receive Cr-Pro from -21 d pre-fresh through peak production.

Table 1. Effect of month of calving, treatment and days in milk on milk yield[7]

	Days in Milk				Milk yield			
Month of calving	Control	SD	Cr-Pro	SD	Control	SEM	Cr-Pro	SEM
All months	140	78.4	127	66.7	101.8[b]	1.5	107.5[a]	1.5
Pre-trial	131	49.4	131	47.6	106.3[b]	1.3	110.0[a]	1.2
July 2012	63	19.3	63	20.0	107.6	2.5	108.6	2.6
August 2012	48	12.4	47	12.7	97.9[b]	2.8	108.7[a]	2.7
September 2012	32	6.9	31	6.7	95.2[b]	3.6	102.5[a]	3.6

With the 2012 average uniform milk price of $18.97/CWT, the additional 3.6 lbs. of milk with Cr-Pro supplementation during the heat-stressed summer months equates to $66.93 more revenue/cow. At an investment of $4.90/cow, feeding Cr-Pro generates a return on investment (ROI) of 13:1. A customer who invests in supplementing Cr-Pro to pre-fresh and lactating cows should feel confident in their ROI, especially during periods of heat stress.

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