



HYDRO-LAC[®]



***CATTLE'S BEST DEFENSE
FOR STRESS.***

HYDRATION & ENERGY SUPPORT



HYDRO-LAC®

HYDRATION & ENERGY SUPPORT TO COMBAT STRESS

Hydro-Lac is a specially formulated, patented product designed to provide essential nutrients, electrolytes and sugars. These are necessary to maintain body fluid balance during heat stress, post-calving, transportation, and when faced with metabolic disorders.



**NO OTHER PRODUCT ON THE MARKET PROVIDES THE BROAD-SPECTRUM
COMPREHENSIVE APPROACH TO HELP CATTLE COPE WITH STRESS.**

Hydro-Lac provides proprietary energy electrolytes, osmolytes and antioxidant nutrition

- *Pelleted product minimizes ration separation of key nutrients.*
- *Improves rumen function during periods of stress.*
- *Aids in immune response, which is often compromised during periods of elevated stress.*
- *Provides key electrolytes for proper fluid balance.*

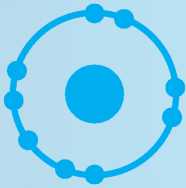
Only patented feed product of its kind!





ENHANCED HYDRATION

Hydro-Lac improves cellular fluid balance¹ through its proprietary electrolytes and osmolytes, ensuring cells are ready and hydrated for heat stress, calving and transportation events where fluid loss is a concern.



ANTIOXIDANT SUPPORT

The research-proven antioxidant properties of Hydro-Lac^{1,2} provide immune system support when cattle need it most. Whether just after calving⁴ or during heat stress³, antioxidants can improve cell repair, reduce inflammation, and ultimately lead to faster recovery to normal production following stress events.



RUMEN & GUT HEALTH

Severe stress can impact the health and integrity of the rumen and lower gut, destroying protective tissues and opening the door for pathogens and toxins to enter the bloodstream⁵. Hydro-Lac's comprehensive nutrients work to protect from the effects of "leaky gut" syndrome associated with heat stress.



BODY TEMPERATURE REGULATION

Field demonstrations have proven cattle fed Hydro-Lac prior to and during heat stress events are better able to regulate their body temperature. This includes the critical internal temperature that affects embryo survival⁷.



SAFE, IMPROVED ENERGY STATUS

Hydro-Lac's comprehensive, proprietary ingredients work together to safely transfer extra energy to cells fast, enabling the animal to better cope with stress. Hydro-Lac minimizes the risk of a negative energy balance, and returns the animal to positive energy balance faster for improved recovery and overall performance after a stress event.^{3,4} Cattle can focus more on what they are supposed to do: milk, gain, or reproduce.⁶



FASTER RECOVERY

Only Hydro-Lac's research-proven, proactive approach to minimizing production losses leads to faster recovery, and helps to combat stressful situations for all cattle at any stage in life. Faster recovery means faster return to normal income and improved return over maintenance costs for your business.

1 Hoffman et al., 2014

2 Kern et al., 2012, 2013

3 Abujamieh et al., 2013

4 Kohls et al., - FAF Report HL1501

5 Lambert et al., 2002

6 Carvalho et al., 2014

7 Kohls - FAF Report HL1301

CATTLE'S BEST DEFENSE FOR STRESS.



Hydro-Lac is formulated to provide energy and electrolytes in ruminant rations. Top-dress, or mix into bunk mix or grain portion of the ration to provide ¼ to ½ pound per head per day during hot weather, or anytime dehydration is a risk. For more specific feeding recommendations, contact your Form-A-Feed representative. Provide fresh, clean water supply at all times.

NUTRIENT ANALYSIS

Crude Protein, min.....	9.50%
Crude Fat, min.....	2.50%
Crude Fiber, max.....	7.00%
Acid Detergent Fiber, max.....	9.00%
Calcium, min.....	1.00%
Calcium, max.....	1.50%
Phosphorous, min.....	0.60%
Salt (NaCl), min	3.90%
Salt (NaCl), max	4.90%
Sodium (Na), min	1.90%
Sodium (Na), max	2.80%
Potassium (K), min	3.70%
Vitamin A, min	100,000 IU/lb.
Vitamin D ₃ , min	20,000 IU/lb.
Vitamin E, min	300 IU/lb.
Vitamin B ₁₂ , min	0.10 mg/lb.
Thiamine, min	400 mg/lb.

INGREDIENTS

Cereal Food By-Products, Dextrose, Wheat Middlings, Dehydrated Alfalfa Meal, Molasses Products, Sucrose, Lactose, Salt, Vegetable Fat, Calcium Salts of Long-Chain Fatty Acids, Potassium Chloride, Potassium Carbonate, Dried Bacillus subtilus Fermentation Product, Dried Bacillus Licheniformis Fermentation Product, Dried Aspergillus oryzae Fermentation Extract, Tricalcium Phosphate, Active Dry Yeast, Calcium Lactate, Fructose, Sodium Bicarbonate, Dipotassium Phosphate, Magnesium Sulfate, Monosodium Phosphate, Citric Acid (a preservative), Magnesium Oxide, Glycine, L-Lysine Monohydrochloride, dl-Methionine, Zinc Proteinate, Choline Chloride, Vitamin A Acetate, D-Activated Animal Sterol (source of Vitamin D3), dl-Alpha Tocopheryl Acetate (source of Vitamin E Activity), Folic Acid, Ascorbic Acid, Niacin Supplement, Vitamin B12 Supplement, d-Calcium Pantothenate, Riboflavin Supplement, Pyridoxine Hydrochloride, d-Biotin, Thiamine Mononitrate, Betaine, Sodium Silicate, Sodium Bisulfate, Ethoxyquin (a preservative), Sodium Silico Aluminate, Natural and Artificial Flavors added, Soybean Oil.



HEAT STRESS

High heat and humidity can impact cattle in many ways including milk production, health and reproduction. Proper hydration is an important part of helping the animal to tolerate heat stress. Water is the key component for cattle to maintain rumen fluid and cellular fluid for normal metabolism.

Lactating cows producing 80 pounds of milk per day require 22% more water at 80°F compared to 40°F.

When the air temperature soars, and a dairy herd starts showing signs of heat stress, the first thing many producers do is switch on the fans and mist to cool the cows down. However, fans alone are only effective if the air temperature is lower than a cow's body temperature. Misting and/or running fans helps create an evaporative cooling for the cow's external body surface.

An effective strategy is to prepare your cows so their cooling systems can endure high temperatures and humidity and minimize the many side affects of heat stress. Providing additional electrolytes and energy that encourages feed and water intake during hot weather has shown to aid in fluid balance and minimize dehydration. And that is exactly what Hydro-Lac does.

Effects on Dairy Cow's Body at Varying Temperatures

68° vs. 86°

Water loss
by the body
increases

58%

Water loss
through
respiration
increases

54%

Water loss
through
sweating
increases

176%

Water loss
via urine
increases

26%

Thermal Heat Index

Thermal Heat Index (THI) is an index that combines relative humidity and ambient temperature. When THI index reaches 68, the cattle become heat stressed and production losses begin.

At elevated THI values greater than 80, cattle can experience moderate to severe stress for which dealing with heat stress becomes very difficult. Providing multiple environmental strategies along with Hydro-Lac, has demonstrated that cattle recover faster prior, during and after a heat stress event.

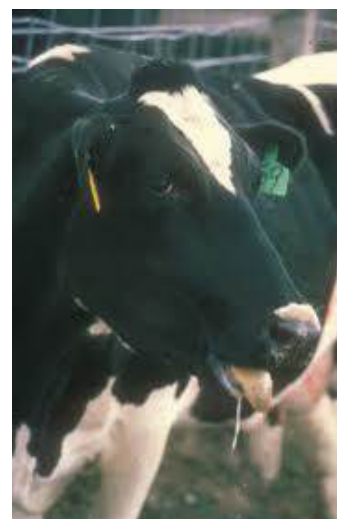
68 THI - production losses

72 - 79 THI - moderate stress

80-89 THI - moderate to severe stress

> 90 THI - severe

See the THI Chart in the back of this booklet.



Hydro-Lac encourages feed and water intake during hot weather!

HEAT STRESS

Cattle fed Hydro-Lac during heat stress events return to a normal lactation curve faster! The benefits are seen long after Hydro-Lac is fed!

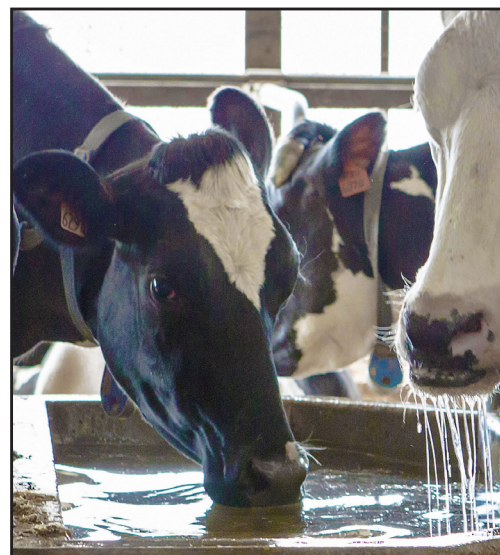
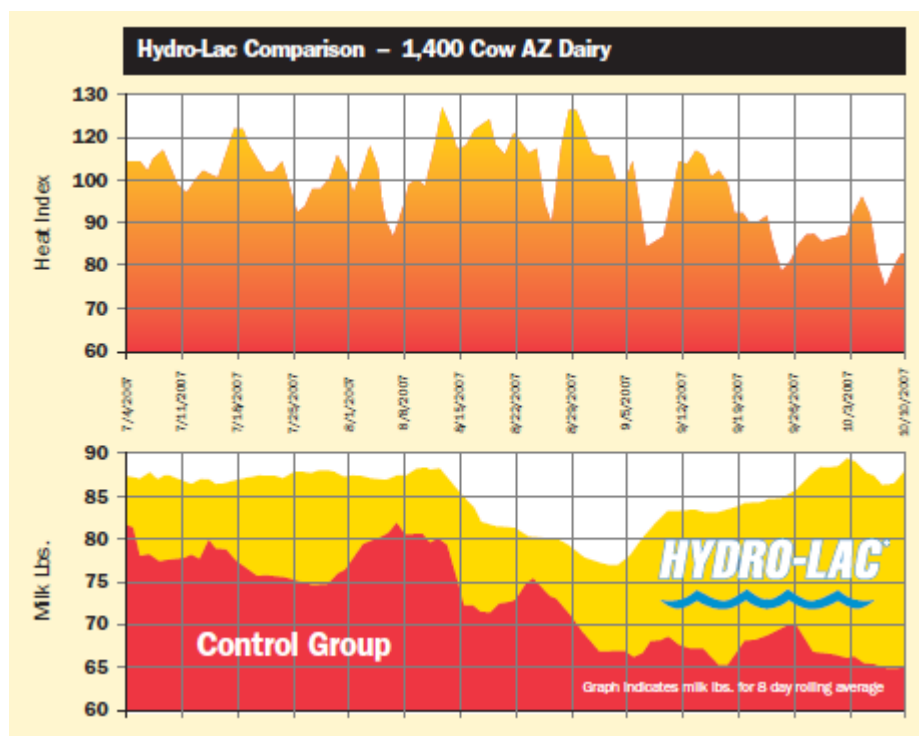
HYDRO-LAC'S FIELD-PROVEN RESULTS

The charts below show results of a 100-day Arizona trial comparing herd mates from a 1,400 cow herd.

The upper graph shows daily Thermal Heat Index (THI) variations during the 100 day trial.

The lower graph compares performance of the Hydro-Lac group to the control group.

The yellow portion shows the performance advantage among those being fed Hydro-Lac during the trial. **This advantage represented about 12 lbs. of milk persistency per cow daily!**

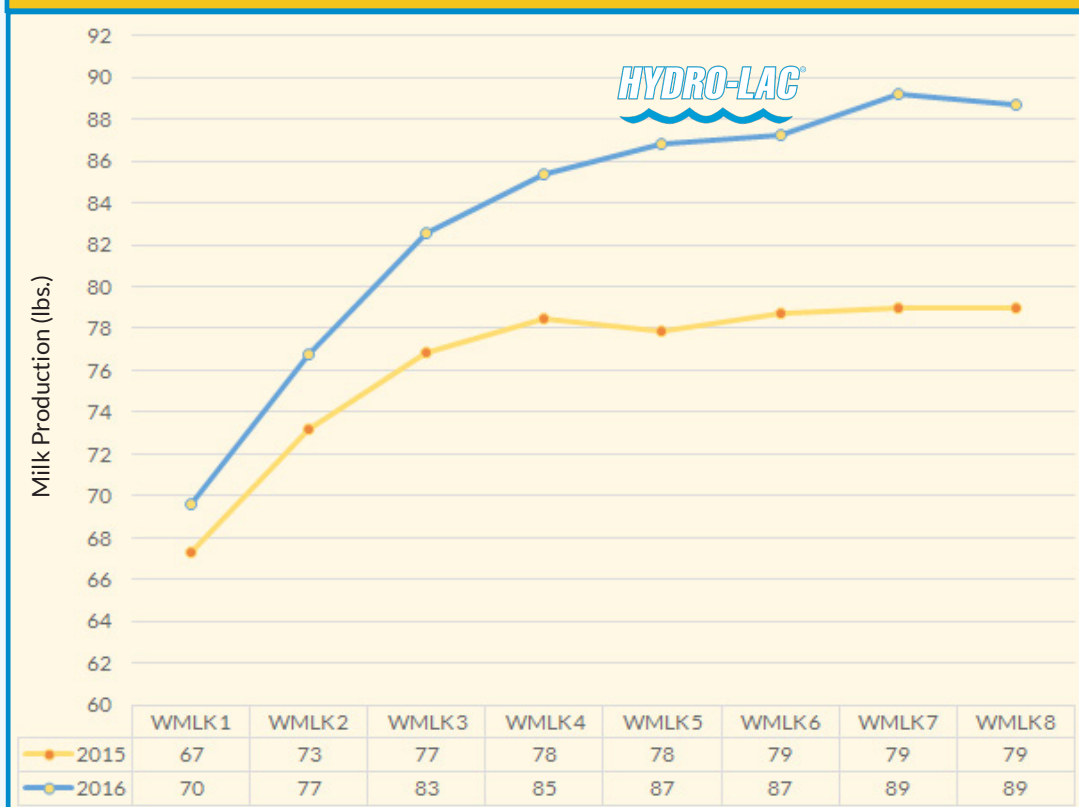


**HYDRO-LAC KEEPS COWS
COOL AND PERSISTENT!**

FRESH PERIOD STRESS

Returning fresh cows to positive energy balance as fast as you can after calving is the end goal of any transition program. Hydro-Lac helps tissues preserve glucose and keeps fluid in the cells. It has antioxidant immune support properties, and quick sources of energy for the cow to metabolize during this stressful time. This leads to a more hydrated cow and an opportunity for higher dry matter intake. This small investment for 14-21 days can be worth over 2,800 lbs. of milk over their lactation.

HYDRO-LAC® FED TO FRESH COWS LEADS TO INCREASED MILK PRODUCTION



On July 20th, 2016, a 450-cow milk herd in central Minnesota started feeding Hydro-Lac to their fresh pen only. Cows entered this pen right after birth and were moved out of the pen between day 14 to 30. Nothing was changed in the diet except for the addition of .33 lbs. of Hydro-Lac. We compared all cows that calved from July 20 to Sept. 30th for both 2015 and 2016.



The dairy recorded a 7 lb. increase of milk at week 4.

Based on data summaries^{1,2}, for every 1 lb. of milk increase at week 4, there is the potential to increase overall milk production by 405 lbs. over the entire course of the lactation.

These cows have the potential of milking over 2,837 lbs. of milk more than the cows that calved during the same time in 2015.

This equates to an additional \$510 dollars of revenue per cow over the course of the lactation by feeding Hydro-Lac in the fresh cow ration.

¹Kohls, D. et al., - FAF Report HL1501

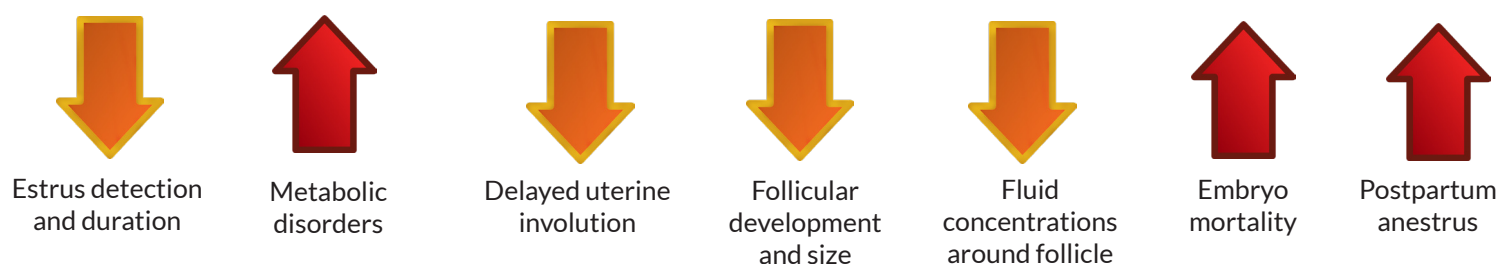
²Kinches, T., Form-A-Feed Professional Dairy Conference 2017

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REPRODUCTION

Heat stress can decrease reproduction efficiency and cause infertility, and result in major economic losses to a dairy operation. The increase in body temperature affects the reproductive tract and early embryo development. The chart below clearly shows the effects on reproduction and its negative impact on reproductive responses. Hydro-Lac's proprietary formulation and cellular level cooling effect has shown to be beneficial for reproductive efficiency.

Heat Stress and Reproduction



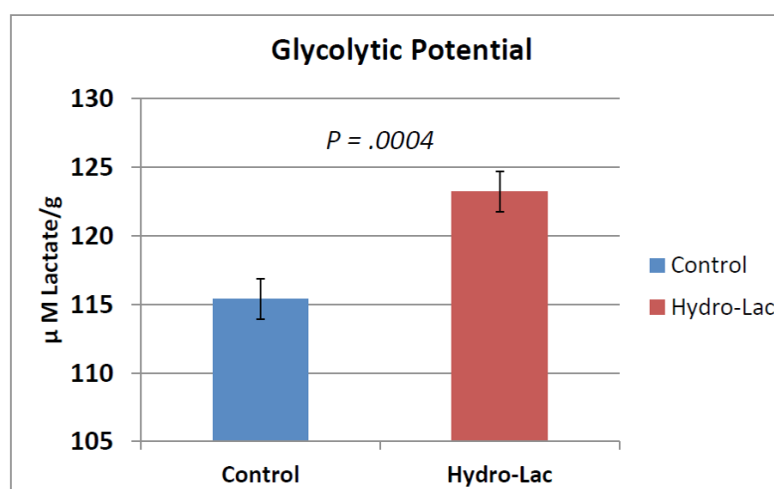
Glucose plays an important role in reproduction

Research studies have shown that glucose can help improve embryo development. Glucose is a major energy substrate for the developing conceptus in ruminants¹. It improves fertilization rate, embryo survival rate, and reduces early embryonic death related to transport stress, body condition change and dietary shift.² In cattle, advanced up-regulation of glucose transporters in the endometrium may contribute to increased embryonic development³, and glucose increases dramatically within the uterine lumen during pregnancy.⁴

Hydro-Lac and Glucose

In a Hydro-Lac treatment study, Hydro-Lac fed to Holstein cattle determined an increase in glycolytic potential as shown below.

Figure 6. Determination of glycolytic potential of animals within treatments



Kern, et. al. 2011, 2013, Hydro-Lac treatment
1 lb/hd x 2 days prior to harvest



1 Bazer, et. al. 2011

2 Bridges, et. al., Nutritional Challenges for Embryo Survival in Cattle, MN Nutrition Conf 2014

3 Forde, et. al. 2009, 2011

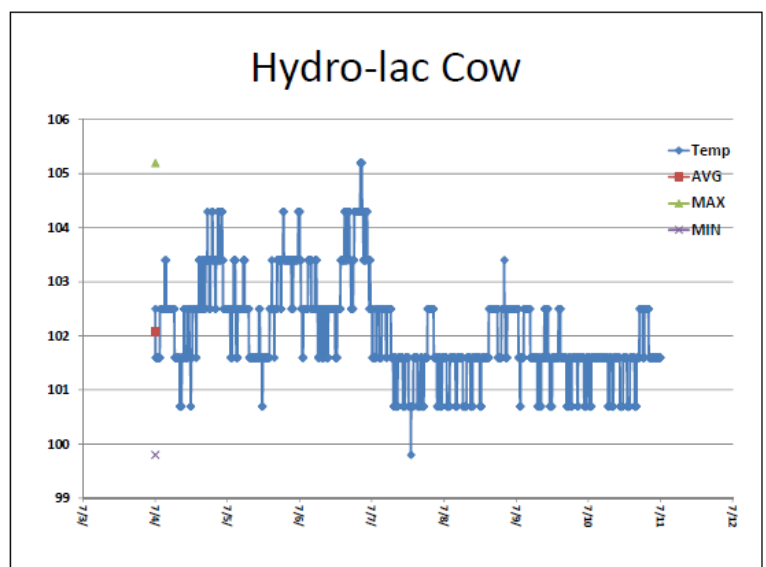
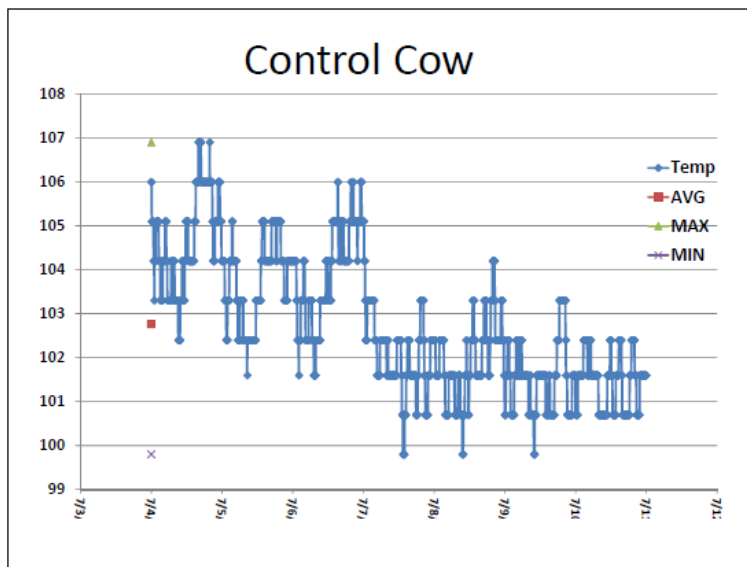
4 Gao, et. al. 2009

REPRODUCTION

Pregnant cows are susceptible to early embryonic death when body temperatures rise above normal - 102.2°F.¹

Heat stress raises internal temperature, which negatively affects reproduction. Cattle fed Hydro-Lac have lower average body temperature than control group cattle.

A field demonstration was performed at a Minnesota dairy with excellent heat abatement in place during a heat wave in July of 2012. The Hydro-Lac group received 0.5# of Hydro-Lac starting 1 day before loggers were installed on July 3rd.



Hydro-Lac Research Updates, August 2014

Hydro-Lac Cows:

- Had a lower average body temperature
- Had a lower maximum body temperature
- Spent 100 minutes/day more at less than 103°F
- Had 3% higher DMI relative to their previous 7d avg
- Showed greater ability to recover from heat based on DMI and Temperature Data



Producers have seen success in feeding Hydro-Lac to heifers for AI synchronization 7-14 days prior to onset of shot program and 14 days post-breeding. Contact your Form-A-Feed representative for specific feeding recommendations for your operation.

Hydro-Lac works by providing essential nutrients, electrolytes and sugars necessary to enhance hydration and maintain body fluid balance during stressful situations. Field demonstrations have proven cattle fed Hydro-Lac prior to and during heat stress events are better able to regulate their body temperature. This includes the critical internal temperature that affects embryo survival⁵.

¹ Hansen, P. J. 2007

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“Our experiences with Hydro-Lac have been phenomenal.”

“Our cows show good heats even when it’s hot out and settle better than a few years ago when we weren’t using it. Our veterinarian has told us we continually have his best herd health every month. Our cows even in the summer heat are rarely seen with their tongues hanging out and panting when compared to when we weren’t using Hydro-Lac. Very pleased with this product and glad our nutritionist recommended it to us!”

- Courtney Herman, Peosta, IA

“Excellent product! We’ve been using it for 3 years now, and we notice less of a drop in production on really hot days, and the cows don’t crowd as much as they used to. They seem to stay more comfortable through the dog days of summer!” - Jennifer Brandes, New Ulm, MN

“Hydro-Lac is an integral part of our pre- and post-fresh diets. We initially started in summer, but saw a drop in performance when we pulled the product in the fall. We have now been feeding it straight through for 5 years.” - Pat Troendle, Lanesboro, MN

“Hydro-Lac keeps the cows producing more milk during the summer heat!” - Michael Kolb, Paynesville, MN







TEMPERATURE HUMIDITY INDEX

Temperature Humidity Index (THI) is an index that combines ambient temperature and relative humidity. The THI is frequently used as a measure of heat stress in cattle. Once the THI reaches 68, production losses will begin to occur if heat abatement strategies have not been implemented.

Temperature		% Relative Humidity																				
°F	°C	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
72	22.0	64	65	65	65	66	66	67	67	67	68	68	69	69	69	70	70	70	71	71	72	72
73	23.0	65	65	66	66	66	67	67	68	68	68	69	69	70	70	71	71	71	72	72	73	73
74	23.5	65	66	66	67	67	67	68	68	69	69	70	70	70	71	71	72	72	73	73	74	74
75	24.0	66	66	67	67	68	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75
76	24.5	66	67	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75	76	76
77	25.0	67	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75	76	76	77
78	25.5	67	68	68	69	69	70	70	71	71	72	73	73	74	74	75	75	76	76	77	77	78
79	26.0	67	68	69	69	70	70	71	71	72	73	73	74	74	75	76	76	77	77	78	78	79
80	26.5	68	69	69	70	70	71	72	72	73	73	74	75	75	76	76	77	78	78	79	79	80
81	27.0	68	69	70	70	71	72	72	73	73	74	75	75	76	77	77	78	78	79	80	80	81
82	28.0	69	69	70	71	71	72	73	73	74	75	75	76	77	77	78	79	79	80	81	81	82
83	28.5	69	70	71	71	72	73	73	74	75	75	76	77	78	78	79	80	80	81	82	82	83
84	29.0	70	70	71	72	73	73	74	75	75	76	77	78	78	79	80	80	81	82	83	83	84
85	29.5	70	71	72	72	73	74	75	75	76	77	78	78	79	80	81	81	82	83	84	84	85
86	30.0	71	71	72	73	74	74	75	76	77	78	78	79	80	81	81	82	83	84	84	85	86
87	30.5	71	72	73	73	74	75	76	77	77	78	79	80	81	81	82	83	84	85	85	86	87
88	31.0	72	72	73	74	75	76	76	77	78	79	80	81	81	82	83	84	85	86	86	87	88
89	31.5	72	73	74	75	75	76	77	78	79	80	81	82	83	84	85	86	86	87	88	89	90
90	32.0	72	73	74	75	76	77	78	79	79	80	81	82	83	84	85	86	86	87	88	89	90
91	33.0	73	74	75	76	76	77	78	79	80	81	82	83	84	85	86	86	87	88	89	90	91
92	33.5	73	74	75	76	77	78	79	80	81	82	83	84	85	85	86	87	88	89	90	91	92
93	34.0	74	75	76	77	78	79	80	80	81	82	83	85	85	86	87	88	89	90	91	92	93
94	34.5	74	75	76	77	78	79	80	81	82	83	84	86	86	87	88	89	90	91	92	93	94
95	35.0	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
96	35.5	75	76	77	78	79	80	81	82	83	85	86	87	88	89	90	91	92	93	94	95	96
97	36.0	76	77	78	79	80	81	82	83	84	85	86	87	88	89	91	92	93	94	95	96	97
98	36.5	76	77	78	80	80	82	83	83	85	86	87	88	89	90	91	92	93	94	95	96	98
99	37.0	76	78	79	80	81	82	83	84	85	87	88	89	90	91	92	93	94	95	96	98	99
100	38.0	77	78	79	81	82	83	84	85	86	87	88	90	91	92	93	94	95	96	98	99	100
101	38.5	77	79	80	81	82	83	84	86	87	88	89	90	92	93	94	95	96	98	99	100	101
102	39.0	78	79	80	82	83	84	85	86	87	89	90	91	92	94	95	96	97	98	100	101	102
103	39.5	78	79	81	82	83	84	86	87	88	89	91	92	93	94	96	97	98	99	101	102	103
104	40.0	79	80	81	83	84	85	86	88	89	90	91	93	94	95	96	98	99	100	101	103	104
105	40.5	79	80	82	83	84	86	87	88	89	91	92	93	95	96	97	99	100	101	102	103	105
106	41.0	80	81	82	84	85	87	88	89	90	91	93	94	95	97	98	99	101	102	103	104	106
107	41.5	80	81	83	84	85	87	88	89	91	92	94	95	96	98	99	100	102	103	104	106	107
108	42.0	81	82	83	85	86	88	89	90	92	93	94	96	97	98	100	101	103	104	105	107	108
109	43.0	81	82	84	85	87	89	89	91	92	94	95	96	98	99	101	102	103	105	106	108	109
110	43.5	81	83	84	86	87	89	90	91	93	94	96	97	99	100	101	103	104	106	107	109	110
111	44.0	82	83	85	86	88	90	91	92	94	95	96	98	99	101	102	104	105	107	108	110	111
112	44.5	82	84	85	87	88	90	91	93	94	96	97	99	100	102	103	105	106	108	109	111	112
113	45.0	83	84	86	87	89	91	92	93	95	96	98	99	101	102	104	105	107	108	110	111	113
114	45.5	83	85	86	88	89	92	92	94	96	97	99	100	102	103	105	106	108	109	111	112	114
115	46.0	84	85	87	88	90	92	93	95	96	98	99	101	102	104	106	107	109	110	112	113	115
116	46.5	84	86	87	89	90	93	94	95	97	98	100	102	103	105	106	108	110	111	113	114	116
117	47.0	85	86	88	89	91	93	94	96	98	99	101	102	104	106	107	109	111	112	114	115	117
118	48.0	85	87	88	90	92	94	95	97	98	100	102	103	105	106	108	110	111	113	115	116	118
119	48.5	85	87	89	90	92	94	96	97	99	101	102	104	106	107	109	111	112	114	116	117	119
120	49.0	86	88	89	91	93	95	96	98	100	101	103	105	106	108	110	111	113	115	117	118	120

Burgos and Collier 2011

	<u>Stress Threshold:</u> Respiration rate exceeds 60 BPM. Reproduction losses detectable. Rectal Temperature exceeds 38.5°C (101.3°F).		<u>Mild-Moderate Stress:</u> Respiration Rate Exceeds 75 BPM. Rectal Temperature exceeds 39°C (102.2°F).		<u>Moderate-Severe Stress:</u> Respiration Rate Exceeds 85 BPM Rectal Temperature exceeds 40 °C (104°F).		<u>Severe Stress:</u> Respiration Rate 120-140 BPM. Rectal Temperature exceeds 41 °C (106°F).
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BOVINE HYDRATION PELLETS

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