



PRESERVE QUALITY GRADE & SALE WEIGHT

REDUCE RISK OF DARK CUTTERS

IMPROVED BEEF QUALITY

COMBAT HEAT STRESS

HYDRO-LAC[®]





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.

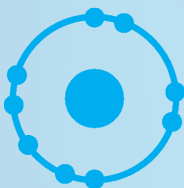
Only patented feed product of its kind!





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[®]



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 Protein, 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.

Hydro-Lac is the first choice to provide cattle specific electrolytes, multiple energy sources, and essential vitamins and nutrients to help cattle cope with heat stress challenges.

Hydro-Lac can help improve performance during periods of stress:

- Encourage water intake
- Improve dry matter intake
- Replenish electrolyte balance
- Re-establish positive energy balance
- Improve carcass quality
- Reduce shrink loss
- Preserve performance
- Support rumen function



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

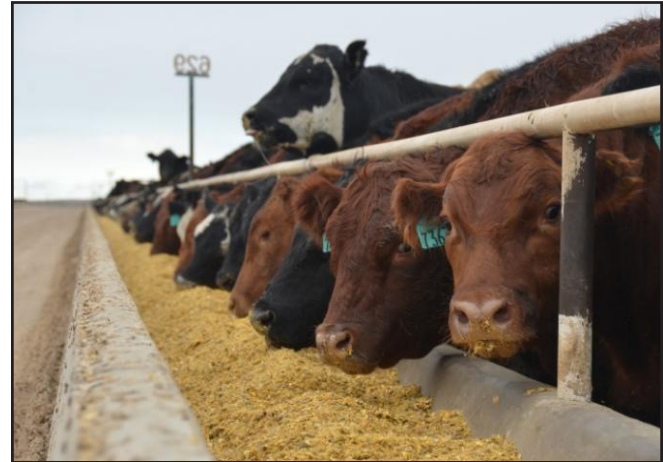
See the THI Chart in the back of this booklet.

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

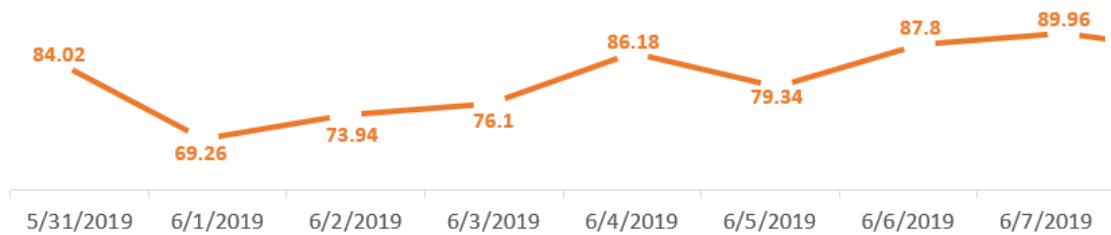
HEAT STRESS

Cattle fed Hydro-Lac during heat stress events keep eating during and after the heat stress event occurs!

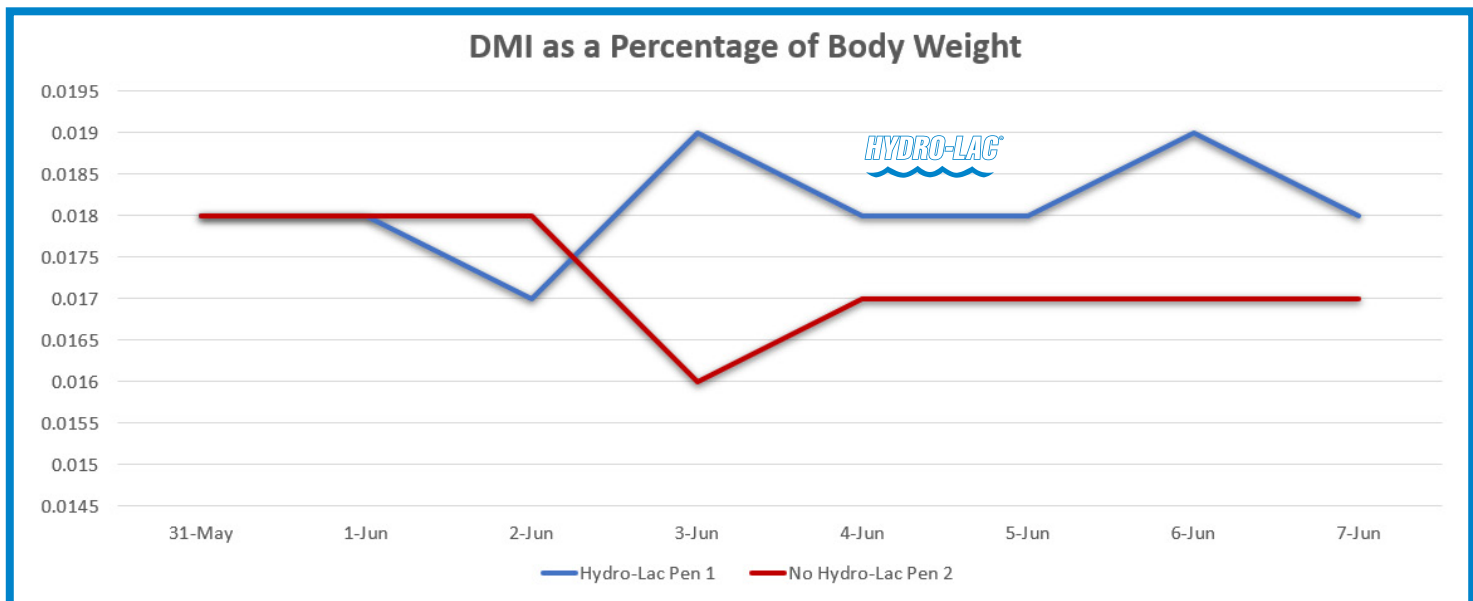
Shown below, a June 2019 MN field demonstration comparison of cattle of similar weights fed Hydro-Lac vs. no Hydro-Lac during the same heat event. Hydro-Lac fed cattle retained dry matter intake throughout the heat event vs. the cattle that did not receive Hydro-Lac prior to the heat stress event.



Temperature in °F



DMI as a Percentage of Body Weight





HYDRO-LAC®

HYDRO-LAC PRESERVES QUALITY GRADE AND SALE WEIGHT!

An easy addition to your pre-harvest management program that can't be compared to any other. It's unique combination of proprietary ingredients, essential nutrients, electrolytes and energy metabolites help preserve meat quality and your bottom line.

RESEARCH SHOWS HYDRO-LAC PROVIDES MORE LIVE WEIGHT AND MAINTAINS HIGHER GRADE WHILE IN THE STRESS OF SHIPMENT.

Hydro-Lac Slaughter Study MCL 0350

May Trial Summary - Average of three trials - Beginning weight stratified

	Head	Feedyard Ave Wt	Pay Wt	Hot Wt	% Yield	% Choice	% Select
Hydro-Lac	148	1198.10	1149.00	747.25	65.03	69.59	27.70
Control	145	1177.50	1129.30	735.07	65.09	58.62	40.69
Hydro-Lac Difference		20.60 lbs.	19.70 lbs.	12.18 lbs.	-0.06	10.97	-12.99

Recap: Live sale: 19.7# x \$1.15 = **\$22.65** | Meat Sale: 12.18# x \$1.85 = **\$22.53**

Grid sale: 747.25# x \$0.20 = 149.45 x 10.97% = \$16.39 + \$22.53 = **\$38.92**

Based on: Choice: \$1.90/lb. Select \$1.70/lb.

Feedlot Slaughter Study MCL 0350

August Trial Summary - Means Table: Gross Average Comparison - Beginning weight stratified

Treatment	Head	Feedyard Ave Wt	Pay Wt	Hot Wt	% Yield	% Choice	% Select
Hydro-Lac	244	1083	1050	678	64.53	63.08	29.36
Control	161	1071	1038	660	63.48	54.66	39.13
Hydro-Lac Difference		12 lbs.	12 lbs.	18 lbs.	1.05	8.42	-9.77

Recap: Live sale: 12# x \$1.15 = **\$13.80** | Meat Sale: 18# x \$1.85 = **\$33.30**

Grid sale: 678# x \$0.20 = 135.60 x 8.42% = \$11.41 + \$33.30 = **\$44.71**

Based on: Choice: \$1.90/lb. Select \$1.70/lb.

NW Iowa Feedlot

July Field Demonstration

	Head	First Wt*	Feedyard Wt	Pay Wt	Hot Wt	% Yield	% Choice	% Select
Hydro-Lac	82	1232	1256	1229	781	63.56	81.50	18.50
Control	82	1236	1246	1223	780.80	63.83	73.20	26.80
Hydro-Lac Difference		4 lbs.	10+4 = 14 lbs.	6 lbs.	0 lbs	0.27	8.30	

Recap: Live feedyard sale: 14.0# x \$1.15 = **\$16.01** | Live Sale at Packer: 6.0# x \$1.15 = **\$6.90**

Grid sale: 781# x \$0.20 = 156.20 x 8.3% = \$12.96 + \$6.90 = **\$19.86**

Based on: Choice: \$1.90/lb. Select \$1.70/lb.

*Cattle weighed 10 days pre-sale.

NW Iowa Feedlot

June Field Demonstration

	Head	First Wt*	Feedyard Wt	Pay Wt	% Yield
Hydro-Lac	39	1272	1321	1287	63.54
Control	40	1250	1287	1261	64.10
Hydro-Lac Difference		22 lbs.	34-22 = 12 lbs.	26-22 = 4 lbs.	-0.60

Recap: Live feedyard sale: 12.0# x \$1.15 = **\$13.80** | Live Sale at Packer: 4.0# x \$1.15 = **\$4.60**

*Cattle weighed 10 days pre-sale.



PRE-HARVEST KEY ECONOMICS

Preserve pounds sold

- 6-10 lbs. Carcass Weight
- 10-15 lbs. Live Weight

Shift-up in quality grades in all classes of cattle

- Preservation of marbling during transit/holding
- Reduced risk of no-roll carcasses grid deductions
- Increased opportunity for grid premiums

Reduced risk of dark cutters

- Due to proven preservation of muscle glycogen
- Proven shelf-live and flavor enhancement

Enhances beef quality aspects of beta-agonist programs

High R.O.I., especially when Choice/Select Spread widens



Pre-Harvest Applications:

Flexible researched application rates to fit marketing windows and scenarios:

- Original Short-term:
 - 1.0 lb/hd/day for two days prior to harvest
- Modified short-day:
 - 0.5 lb/hd/day for 5-7 days pre-harvest (100 lbs. per 5-6000 lb. self-feeder batch)
- Long-day (with or without a beta-agonist)
 - 0.25 - 0.33 lb/hd/day for 14-42 days pre-harvest (50 lbs. per 5-6000 lb. self-feeder batch)



HYDRO-LAC[®]

**PROVEN
QUALITY BEEF**

*Improved energy preservation
and fuel for stressful periods.*

*Improved shelf life and
reduced oxidative stress.*

Effects of Hydro-Lac Inclusion Pre-harvest on Glycolytic Potential and Sensory Attributes of Beef

Figure 6. Determination of glycolytic potential of animals within treatments

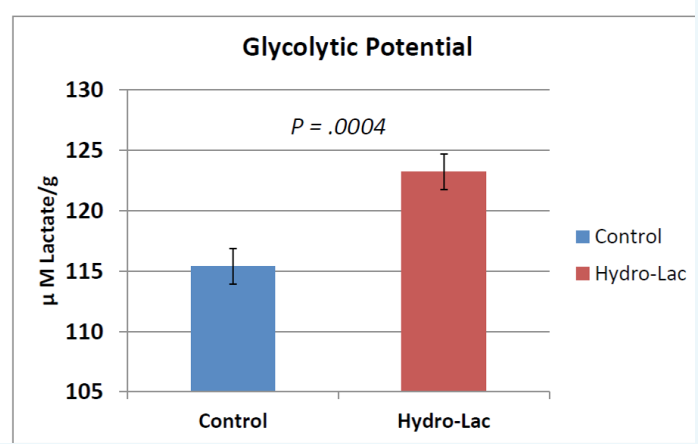
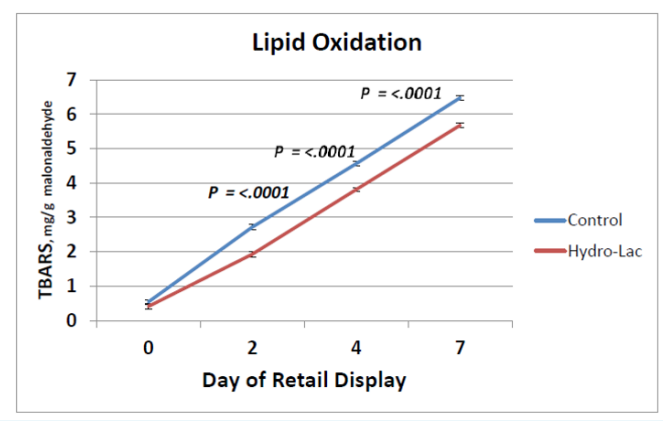


Figure 16. Lipid oxidation as measured by TBARS of retail over-wrapped patties stored at 36 °F under retail display lighting.

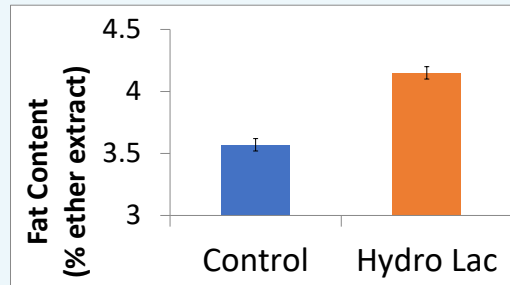


Kern, et. al. 2011, 2013, Hydro-Lac treatment 1 lb/hd x 2 days prior to harvest



Marbling preservation and juicy, more flavorful beef.

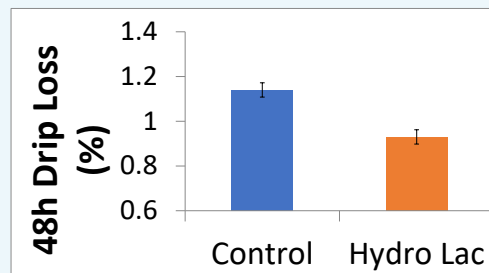
Least Squared Means of Fat Content (% Ether Extraction) of Steaks
Means with Different Superscripts Differ ($P>0.05$)



Hoffman, et. al. 2012

Reduced drip loss and improved shrink.

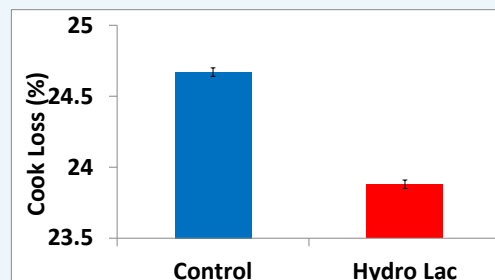
Least Squared Means of 48h Drip Loss (%) of Steaks
Means with Different Superscripts Differ ($P>0.05$)



Hoffman, et. al. 2012

Reduced tissue shrink and improved hydration.

Cook Loss (%) of Steaks ($P<0.01$)

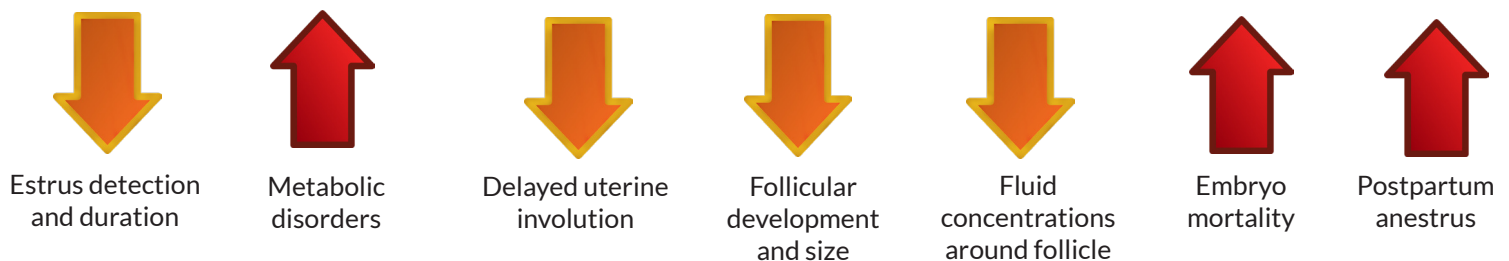


Hoffman, et. al. 2012

REPRODUCTION

Heat stress can decrease reproduction efficiency and cause infertility, and result in major economic losses. The increase in body temperature affects the reproductive tract and the 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

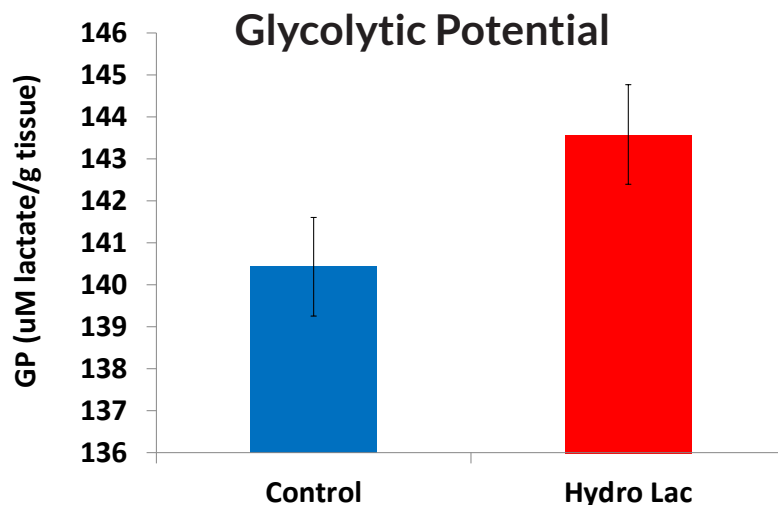


Glucose plays an important role in reproduction

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 beef cattle determined an increase in glycolytic potential as shown below.



Hoffman et al., 2012 (P = 0.20), Hydro-Lac treatment 0.25# for 22 days pre-harvest
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



HYDRO-LAC®

**BREEDING
SUCCESS**

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. Use the chart below for reference and contact your Form-A-Feed representative for specific feeding recommendations for your operation.

	<p>Hydro-Lac For Breeding</p>	<ul style="list-style-type: none"> • 7-14 Days Prior Onset of Shot program • 0.25-0.50#/hd thru 14 days post-breeding
	<p>Hydro-Lac For Transport Stress</p>	<ul style="list-style-type: none"> • 2-5 days prior to pasture turnout • 0.25-0.50#/hd/day
	<p>Free Choice at all times</p>	<ul style="list-style-type: none"> • Bovine Stress Lic w/Stealth5 OR • PowerPro Bio-Mineral w/ Stealth5

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.

HYDRO-FLEXX

Hydro-Lac[®] + Optaflexx[®] for Pre-Harvest Management

Combining the high impact ingredients found in Hydro-Lac and Optaflexx provides optimum results:

- Increase in pounds sold and dressing percent: *Field observations indicate a 0.25 - 0.50 percentage point increase in yield.*
- Marbling and quality grade preservation, including 4 percentage point increase in cattle grading Choice/Prime compared to those fed only a beta-agonist⁴.
- Patented Hydro-Lac technology to manage increased susceptibility to heat stress associated with beta-agonists

Feeding rate: 0.50 pounds of Hydro-Flexx for 28 days pre-harvest provides 300 mg ractopamine HCl per head daily.

Elanco



(Ractopamine HCl)

- Increase in pounds sold: *14-20 lb. carcass weight, 17-22 lb. live weight*
- Improved feed efficiency 12-18%.
- Increase in ribeye area.
- Slight reduction in marbling score.



- Increase in pounds sold¹: *6-10 lb. carcass weight, 10-15 lb. live weight*
- Preservation of marbling and maintenance of quality grade², enhances the opportunity for grid premiums.
- Prove to preserve muscle glycogen³, which reduces the risk of dark cutters.

¹Commercial feedyard data, 2007, ²Hoffman et al. 2012, ³Kern et al. 2011, ⁴Form-A-Feed HF1201 Research, 2012



HYDRO-LAC®



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

“I always weigh my cattle locally before shipping. I have experienced shrink as low as 1% on a 160-mile haul to Dakota City, NE when using the Hydro-Lac program. I have used Hydro-Lac on all my cattle I ship for the last eight years.”

- David Schumacher

“In warm weather, it’s a no brainer! It just makes good sense. Hydro-Lac is a tool that should be in everybody’s cattle feeding toolbox.” - Ron Nykamp

“During the hot summer months prior to finished beef steers being harvested I was impressed with how the animals seemed a lot more comfortable and they keep coming up to the bunk eating. Our rate of gain didn’t drop off like it has in the past.” - Ted Prom

“We used Hydro-Lac on our outside lot cattle and they never skipped a beat on feed intake during hot days.” - Chad Sprenger



TEMPERATURE HUMIDITY INDEX

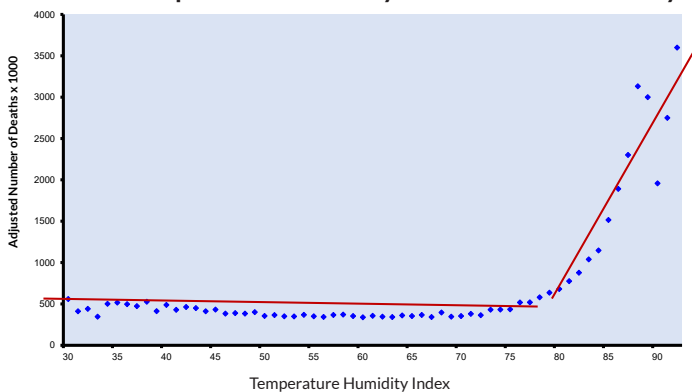
Temperature Humidity Index (THI) is an index that combines ambient temperature and relative humidity. The THI is frequently used as a measure of heat stress in cattle. Once the THI reaches 68, production losses will begin to occur if heat abatement strategies have not been implemented.

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	75	76	76	77	77	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	80	81	82	83	84	85	86	86	87	88	89
90	32.0	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	86	87	88	89	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	84	85	85	86	87	88	89	90	91	92
94	34.5	74	75	76	77	78	79	80	81	82	83	84	85	86	86	87	88	89	90	91	92	93
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	84	85	86	87	88	89	90	91	92	93	94	95
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100	38.0	77	78	79	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	98	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
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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
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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

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

How Temperature Humidity Index Affects Mortality



Vitali et al. 2009, JDS 92:3781-3790

A study comparing THI to mortality clearly shows that mortality rates increase upward when THI reaches 79.6°F. This research also showed increasing mortality for the duration of a heat wave.



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