

HOW TO ASSESS AND HELP MITIGATE THE IMPACT OF HEAT STRESS IN RUMINANTS

CONTEXT

For milk and meat-type ruminants, heat stress can lead to disrupted feeding behavior, an increase in oxidative stress and reduction of productivity and profitability^{1, 3-7, 10-12}.

The rumen, which is a true engine of ruminant performance, is the centerpiece of the cascade of events that can be disrupted by heat stress.

HOW THE RUMEN IS INVOLVED



RUMEN MICROBIOTA
BALANCE

As heat stress creates an imbalance in rumen microbiota, rumen function is impaired and will impact productivity and animal well-being.

>> To know more, see page 4

HEAT STRESS IMPACT ON PERFORMANCE

Heat stress is well known to affect animal performance through production losses. Lallemand Animal Nutrition recommends using equations to predict the actual losses in local conditions.

In addition to the scientifically renowned predictions from Zimbleman RB and Collier RJ (2011)¹² on milk yield losses, Lallemand Animal Nutrition has taken the additional steps to help farmers and nutritionists predict losses for dairy cows (milk yield and milk quality), for dairy sheep and goats (milk yield) and for beef cattle (growth) which can support decisions for preventive programs. Lallemand Animal Nutrition designed a prediction tool based on:

- Consolidation of many published heat stress-related analysis, with experiences in different continents to better predict specific regional losses (7 publications in dairy cows).
- Recordings of temperature and humidity in several strategic regions.

Temperature and humidity are keys to measure heat stress consequences on animal performance.

The negative impacts of heat stress are linked to the temperature and humidity index (THI – table 1) and to the duration of exposure, both in terms of the number of hours per day and the number of consecutive days the animal experiences heat stress.

Depending ruminant production type, thresholds of THI impacting animal can vary.

Temperature	Humidity (%)												
	10	15	20	25	30	35	40	45	50	55	60	65	70
60	15.6	59	59	59	59	59	59	59	59	60	60	60	60
61	16.1	59	59	60	60	60	60	60	60	60	60	60	61
62	16.7	59	60	60	60	61	61	61	61	61	61	61	61
63	17.2	61	61	61	61	61	61	61	62	62	62	62	62
64	17.8	61	61	61	62	62	62	62	62	62	63	63	63
65	18.3	62	62	62	62	62	62	63	63	63	63	63	64
66	18.9	62	62	62	63	63	63	63	64	64	64	64	65
67	19.4	63	63	63	64	64	64	64	64	65	65	65	66
68	20.0	63	63	64	64	64	64	65	65	65	66	66	66
69	20.6	64	64	64	65	65	65	66	66	66	67	67	67
70	21.1	64	64	65	65	66	66	66	67	67	67	68	68
71	21.7	65	65	65	66	66	66	67	67	67	68	68	68
72	22.2	65	65	66	66	67	67	67	68	68	69	69	69
73	22.8	66	66	66	67	67	68	68	68	69	69	70	70
74	23.3	66	67	67	67	68	68	69	69	70	70	70	71
75	23.9	67	67	68	68	68	69	69	70	70	71	71	72
76	24.4	67	68	68	69	69	69	70	71	72	72	73	73
77	25.0	68	68	69	69	70	70	71	71	72	72	73	74
78	25.6	68	69	69	70	70	71	71	72	73	73	74	75
79	26.1	69	69	70	70	71	71	72	73	73	74	74	75
80	26.7	69	70	70	71	72	72	73	73	74	75	75	76
81	27.2	70	70	71	72	72	73	73	74	75	75	76	77
82	27.8	70	71	71	72	73	73	74	75	75	76	77	78
83	28.3	71	71	72	73	73	74	75	75	76	77	78	79
84	28.9	71	72	73	73	74	75	75	76	77	78	78	80
85	29.4	72	72	73	74	75	75	76	77	78	78	79	81
86	30.0	72	73	74	74	75	76	77	78	78	79	80	82
87	30.6	73	73	74	75	76	77	77	78	79	80	81	83

62 is the threshold of THI impact for dairy from practical field studies in Northern Europe⁵

68 is the commonly admitted threshold of THI impact for dairy widely communicated by the scientific community¹²

72 is the threshold of THI impact for beef commonly admitted by the scientific community³

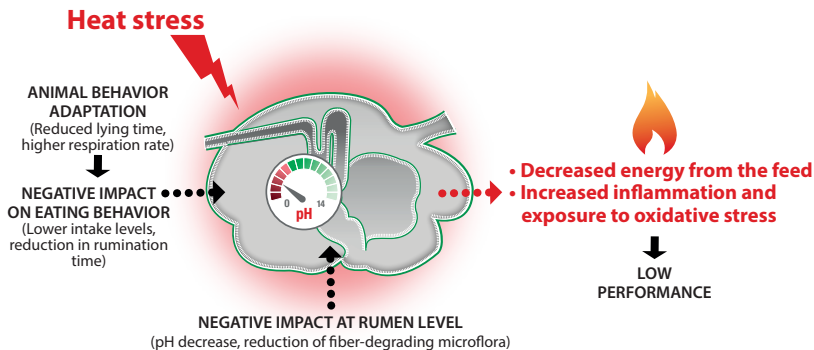


>> Scan for the complete THI table

Table 1 : Extract of temperature and humidity index (THI) table, Multiple equations analysis⁸



○ HOW THE RUMEN IS INVOLVED



○ THE FACTS FROM THE FIELD

Animal observation is key to detecting early signs of heat stress and future impacts on animal performance. The first signs of moderate heat stress include:

- Increased respiration rate
- Reduced feed intake and erratic feeding behavior
- Reduced lying time¹³
- Decreased rumination activity⁴: -1 hour¹³

GOOD TO KNOW!



For each 10-point increase in the THI, rumination could be reduced by 1 hour and milk yield by -2.7kg/cow/day¹⁶

○ LONG TERM IMPACTS



Dairy cows

- Increased somatic cell count¹³
- Decreased immunity by modifying intestinal permeability⁹



Dairy calves

- Heifers from heat stressed dams can have lower future milk production⁶
- Impact on calves' immune systems and Average Daily Gain (ADG)¹



Dairy cows and calves

- Increased locomotion issues¹³
- Decreased fertility: heat stress 21 days before breeding can decrease conception rate by 31%¹⁰
- Increased mortality risk⁷: + 5.6% per 1°C increase above the threshold in dairy cows



Beef cattle

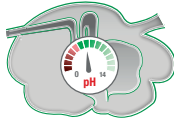
- Increased mortality risk⁷: + 4.6% per 1°C increase above the threshold in beef
- It negatively affects meat pH, color parameters¹¹ and marbling score³



○ NUTRITIONAL SOLUTIONS THAT HELP REDUCE ADVERSE EFFECTS OF HEAT STRESS

WHY RUMEN EFFICIENCY IS KEY DURING HEAT STRESS

During heat stress, rumen function is impaired



The rumen specific yeast *Saccharomyces cerevisiae* CNCM I-1077 **Levucell SC** excels under heat stress

BEHAVIOR (Chewing)^{2,9}

+14%

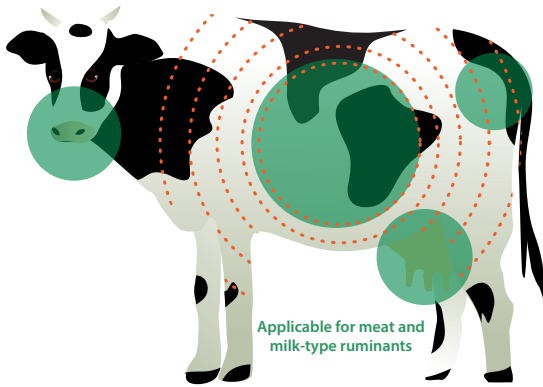
in average chewing time (min/kg of dry matter intake (DMI)) with LEVUCELL SC (P<0.10) (Adapted from M.C. Pedromo and J.P.E. De Santos⁹)



BEHAVIOR (Feed intake)

+13%

in meal duration time (min/d) with LEVUCELL SC (P<0.05)¹⁴



Applicable for meat and milk-type ruminants

ANTIOXIDANT STATUS CAN BE CHALLENGED DURING HEAT STRESS

During heat stress, oxidative stress increases, which can translate into lower immunity, and higher disease occurrence

Antioxidant solutions to help strengthen antioxidant status



RUMEN pH

+ 0.34 pH UNITS

on average with Levucell SC¹⁴



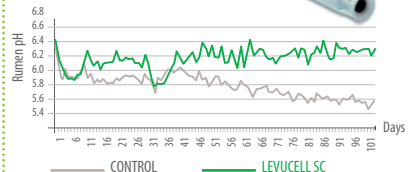
RUMEN PH

HELPS REDUCE THE RISKS OF SUB-ACUTE RUMINAL ACIDOSIS (SARA)

by reducing levels of inflammation biomarkers in the blood¹⁴



INFLAMMATION BIOMARKERS



Effect of LEVUCELL SC on rumen pH variation under heat stress conditions, Italy, 2015

FEED EFFICIENCY, MEAT PRODUCTION



GROWTH

UP TO +10%

The average daily gain (ADG) is improved by 50g/day, and the carcass weight by 5Kg (fattening period - 70 days - with high grain diet¹⁴)

FEED EFFICIENCY, MILK PRODUCTION



MILK YIELD

UP TO +2.0 kg/d

Feed efficiency is improved by + 7.6%, and + 130g energy corrected milk/kg DMI (P<0.05) (adapted from M.C. Pedromo and J.P.E. De Santos⁹)

GROWTH AND MILK QUALITY

+ 12%

of low level of somatic cell count¹⁴



MILK QUALITY

+ 5.8 Kg of gain

after 28 days of supplementation¹⁴



GROWTH

○ LALLEMAND PROGRAM UNDER HEAT STRESS



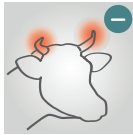
FEED EFFICIENCY



RUMEN MICROBIOTA BALANCE



EATING BEHAVIOR



HORNS INFLAMMATION



INFLAMMATION BIOMARKERS

RUMEN SPECIFIC LIVE YEAST: LEVUCCELL SC^{9,14}

- Helps stabilize rumen microbiota with higher rumen pH
- Helps alleviate heat stress impacts on feeding behavior
- Helps reduce the level of inflammation
- Improves feed efficiency

ANTIOXIDANT STATUS: MELOFEED^{14,15}

- Helps maintain the antioxidant status of the animal
- Rich in superoxide dismutase
- Helps reduce inflammatory marker levels in an animal's blood and joint fluid
- MELOFEED, fed with organic Se, helps maintain:
 - weight gain of meat type ruminants during heat stress
 - body condition score in dairy ruminants
- MELOFEED, alone or in combination with organic trace minerals, improves milk quality by reducing somatic cell count

ANTIOXIDANT STATUS: ALKOSEL^{14, 15}

- Helps maintain the antioxidant status of the animal
- Provides highly bioavailable selenium

○ LALLEMAND RECOMMENDED FEEDING RATES DURING HEAT STRESS

Up to 20.10⁹ cfu per day (during challenged period like heat stress)

A maximum of 0.2 mg of Se per kg of DM* (equivalent to 100mg of ALKOSEL 2000 per kg of DMI)

≥ 50 to 100 mg per animal per day

Levucell SC
Rumen Specific Yeast

alkosel¹
The Premium Source of Bioavailable Selenium

melofeed²
NATURAL SOURCE OF POWERFUL ANTIOXIDANTS

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- Internal audits.
- Lallemand Animal Nutrition internal data: trials LEVUCCELL SC Italy 2015, LEVUCCELL SC Texas TAMU 2015, ALKOSEL+ MELOFEED beef France 2014 and dairy goats France 2014.
- MELOFEED Internal dossier from scientific publications and internal trials.
- Lallemand Animal Nutrition internal data: Rumen Efficiency Investigation program compiled results from 506 audits, representing 68.500 dairy cows in 300 farms, 28 countries.

* can vary depending on local regulation.

EU approved (E1711, 4b1711) for use in calves, dairy cows, beef cattle, lambs, dairy ewes, dairy goats (and rearing), camels and horses. Not all products are available in all markets nor associated claims allowed in all regions.

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