



# Heat Stress and Summer Management

Heat stress negatively affects both animal welfare and production. The heat stress an animal experiences is a combination of temperature, humidity, solar radiation and air flow. It is important to provide shade, fresh clean water and optimal nutrition to help support livestock during times of heat stress.

## Heat Stress in New Zealand

While New Zealand may not have the extreme temperatures seen in other parts of the world, the high relative humidity means that heat stress occurs at much lower temperatures than other areas.

- Average NZ humidity in February is ~ 80%
- Cows will begin to experience heat stress at 22°C
- Mild-moderate heat stress will occur at 24°C
- Moderate - Severe heat stress will occur at 29°C

Yellow = stress threshold

Orange = mild-moderate stress

Red = moderate – severe stress

Purple = severe stress

Temperature		% Relative Humidity																		
°F	°C	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
72	22.0	64	65	65	65	66	66	67	67	67	68	68	69	69	69	70	70	70	71	71
73	23.0	65	65	66	66	66	67	67	68	68	68	69	69	70	70	71	71	71	72	72
74	23.5	65	66	66	67	67	67	68	68	69	69	70	70	70	71	71	72	72	73	73
75	24.0	66	66	67	67	68	68	68	69	69	70	70	71	71	72	72	73	73	74	74
76	24.5	66	67	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75
77	25.0	67	67	68	68	69	69	70	70	71	71	72	72	73	73	74	74	75	75	76
78	25.5	67	68	68	69	69	70	70	71	71	72	73	73	74	74	75	75	76	76	77
79	26.0	67	68	69	69	70	70	71	71	72	73	73	74	74	75	76	76	77	77	78
80	26.5	68	69	69	70	70	71	72	72	73	73	74	75	75	76	76	77	78	78	79
81	27.0	68	69	70	70	71	72	72	73	73	74	75	75	76	77	77	78	78	79	80
82	28.0	69	69	70	71	71	72	73	73	74	75	75	76	77	77	78	79	79	80	81
83	28.5	69	70	71	71	72	73	73	74	75	75	76	77	78	78	79	80	80	81	82
84	29.0	70	70	71	72	73	73	74	75	75	76	77	78	78	79	80	80	81	82	83
85	29.5	70	71	72	72	73	74	75	75	76	77	78	78	79	80	81	81	82	83	84
86	30.0	71	71	72	73	74	74	75	76	77	78	78	79	80	81	81	82	83	84	84
87	30.5	71	72	73	73	74	75	76	77	77	78	79	80	81	81	82	83	84	85	85
88	31.0	72	72	73	74	75	76	76	77	78	79	80	81	81	82	83	84	85	86	86
89	31.5	72	73	74	75	75	76	77	78	79	80	80	81	82	83	84	85	86	86	87
90	32.0	72	73	74	75	76	77	78	79	79	80	81	82	83	84	85	86	86	87	88
91	33.0	73	74	75	76	76	77	78	79	80	81	82	83	84	85	86	86	87	88	89
92	33.5	73	74	75	76	77	78	79	80	81	82	83	84	85	85	86	87	88	89	90
93	34.0	74	75	76	77	78	79	80	80	81	82	83	85	85	86	87	88	89	90	91
94	34.5	74	75	76	77	78	79	80	81	82	83	84	86	86	87	88	89	90	91	92
95	35.0	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
96	35.5	75	76	77	78	79	80	81	82	83	85	86	87	88	89	90	91	92	93	94
97	36.0	76	77	78	79	80	81	82	83	84	85	86	87	88	89	91	92	93	94	95
98	36.5	76	77	78	80	80	82	83	83	85	86	87	88	89	90	91	92	93	94	95
99	37.0	76	78	79	80	81	82	83	84	85	87	88	89	90	91	92	93	94	95	96
100	38.0	77	78	79	81	82	83	84	85	86	87	88	90	91	92	93	94	95	96	98
101	38.5	77	79	80	81	82	83	84	86	87	88	89	90	92	93	94	95	96	98	99
102	39.0	78	79	80	82	83	84	85	86	87	89	90	91	92	94	95	96	97	98	100
103	39.5	78	79	81	82	83	84	86	87	88	89	91	92	93	94	96	97	98	99	101
104	40.0	79	80	81	83	84	85	86	88	89	90	91	93	94	95	96	98	99	100	101
105	40.5	80	80	82	83	84	86	87	88	89	91	92	93	95	96	97	99	100	101	102
106	41.0	80	81	82	84	85	87	88	89	90	91	93	94	95	97	98	99	101	102	103
107	41.5	80	81	83	84	85	87	88	89	91	92	94	95	96	98	99	100	102	103	104

## Heat Stress Impact on Milk Production

Practical Examples of Heat Stress	NZ 80% Relative Humidity	Lost Milk Production (per hour exposed)	Lost Milk Production (per cow per day)
Stress Threshold (THI 72-79)	22°C - 23°C	-14.4 cents.cow.hr	-\$0.57 (4hrs)
Mild-Moderate Stress (THI 72-79)	24°C - 28°C	-15.4 cents.cow.hr	-\$1.38 (9hrs)
Moderate - Severe Stress (THI 80-89)	29°C - 35°C	-16.0 cents.cow.hr	-\$1.92 (12 hrs)
Severe Stress (THI 90-99)	36°C +	Severe = not measured	

\*Assuming \$6 payout and 8.5% solids



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# Heat Stress and Summer Management

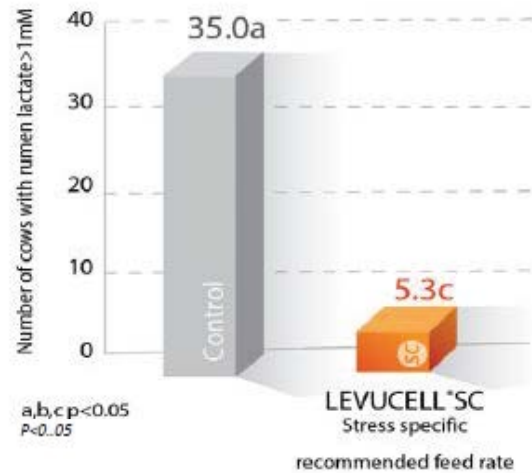
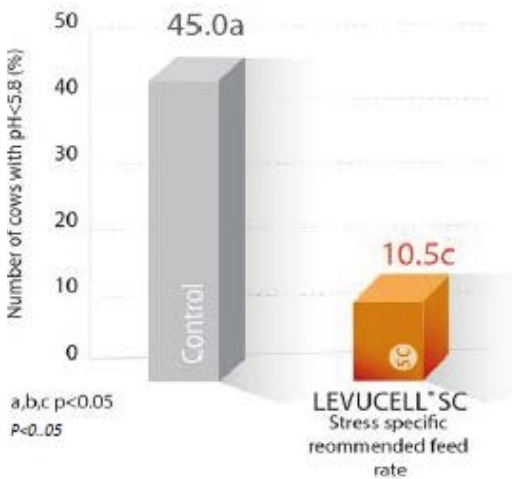
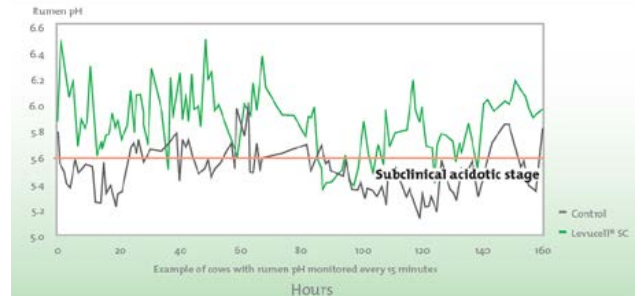
## Heat Stress Increases Risk of Rumen Acidosis

Cows under heat stress will typically avoid fibrous feeds to reduce internal heat generation in the rumen.

This puts them at risk of rumen acidosis under heat stress conditions, even if only a small amount of carbohydrates are fed (e.g. turnips, grain, tapioca, fodder beet, maize silage).

Levucell® SC significantly reduces time with rumen <math>pH < 5.6</math> in both heat stress and non heat stress conditions.

A study conducted at the University of Florida showed a significant reduction in the number of cows at risk of rumen acidosis when feeding Levucell®SC under heat stress conditions. This was published in the Journal of Animal Science (Vol 88) and Journal of Dairy Science (Vol 93).



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## Feed Conversion Efficiency

Improved feed conversion efficiency with Levucell® SC also occurs under heat stress conditions

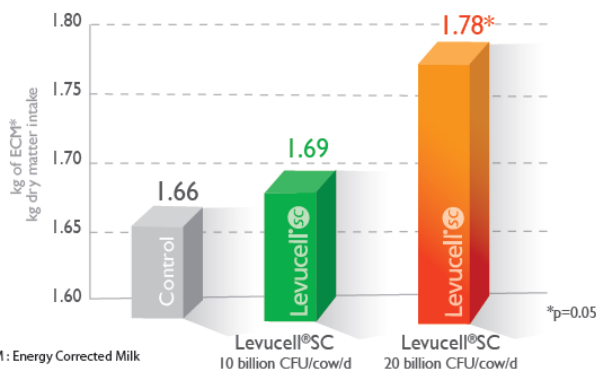
- If Levucell®SC is fed at 2g under heat stress conditions the return on investment (ROI) is **7.1:1**
- Standard Levucell®SC ROI is **6.5:1** under non heat stress conditions
- Responses on grazing trials have been as high as 110g milk/kgDMI **14.4:1**

ROI assumptions: 8.5% solids and \$6/kgMS payout

10 billion CFU in NZ is a standard 1g dose rate

20 billion CFU is a double dose rate in NZ recommended under heat stress conditions.

**+7%\* of feed efficiency + 120g/kg DMI**  $p < 0.05$



University of Florida, Journal of Animal Science (Vol 88) and Journal of Dairy Science (Vol 93)

## Summary of Levucell®SC heat stress trials

Trial reference	Animals	Environment	Effect of <i>S. c. I-1077</i> on feed efficiency	Effect of <i>S. c. I-1077</i> on rumen pH	Other indicator
<b>University of Florida</b> (Marsola et al., 2010)	60 dairy cows	Severe heat stress	+ 7%	Lower % of cows with rumen pH <5.8	
<b>New York State</b> (2004)	300 dairy cows		+9%		
<b>Bologna University</b> (Fustini et al., 2013)	40 dairy cows	Mild to-moderate heat stress	+6.5%	Improved	Improved fiber degradation and rumination
<b>University of Teheran</b> (2013)	36 dairy cows	Sever heat stress	+8.5%	Increased	Improved manure consistency

Table 1: Summary of University trials with live yeast *Saccharomyces cerevisiae* CNCM I-1077 under heat stress conditions



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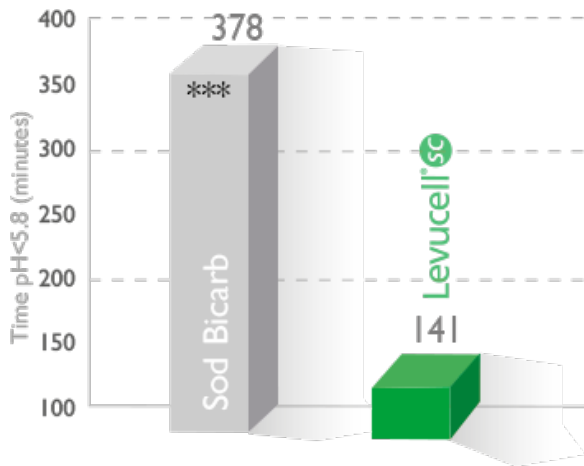
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## Levucell<sup>SC</sup>® or Sodium Bicarbonate for rumen acidosis?

Both improve rumen pH, however Levucell<sup>SC</sup> significantly reduces time below pH 5.8

Use both if required, however Levucell<sup>SC</sup> is a more economical and effective long term tool to help prevent SARA



### RESULTS

Rumen pH	Levucell <sup>SC</sup> 1077	Sodium Bicarbonate
Mean Daily pH	6.22	6.03 ***
Time pH < 5.8 (minutes)	141	378 ***

150g sodium bicarbonate = 20 cents per cow per day

1g Levucell<sup>SC</sup> = 7 cents per cow per day

## Fibre Digestibility – important for summer grazing

Levucell<sup>SC</sup> has a positive effect on NDF digestibility in more than 180 different forages.

\* average of 24-28h



\*\*Oba & Allen 1999, *J Dairy Sci* 82:589–596. Guedes et al., CECAV Portugal, 2008. *Anim Feed Sci Technol* 145:27–40, Guedes et al., CECAV Portugal, 2010. Proceeding from Wageningen Symposium, Netherlands pp 25-30, Gomez M.J. et al, CECAV Portugal, Congresso de Zootecnica 2015. Chaucheyras-Durand F. et al., INRA France, 2010, *J Dairy Sci. Anim. Sci.* 88 (S2)/*J. Dairy Sci.* 93 (S1) : 145, Walker and Cintora, BRI, Canada 2010, Ding G. et al, China Agricultural University, China, 2014 *J. Anim. Sci. and Biotech.* 5 :24, Souza D.O. Lallemand Internal report, University of São Paulo, Brazil, 2015, Souza D.O., University of São Paulo, Brazil, 2018, *Anim Feed Sci Technol* 236:149-158



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## Mycotoxins

Mycotoxins are toxins produced by fungi. There are thousands out there, and they are present all the time, however the risk for cattle sheep and goats increases when: (a) pasture goes to seed (b) base of sward becomes fibrous (c) warm, humid weather (d) silages are fed and (e) feeding out in advance.

Mycotoxin binders can help reduce the impact of food borne mycotoxins. It is important to look for one that contains both clay and yeast cell wall (e.g. Fusion® DYAD) to give the best possible protection from a range of mycotoxins.

Clay helps reduce the risk of Aflatoxins, Fumonisin, Lolitrem-B & Ergot alkaloid mycotoxins while yeast cell wall work well on Zearalenone, aids in the reduction of *Salmonella* and *E-coli* bacteria while also acting as an immune modulator.



## Oxidative Stress Under Heat Stress Conditions

- Total antioxidant status is lower in the summer (Turk *et al.*, 2015).
- Summer heat increases reactive oxygen metabolite substances and decreases total carotenes and vitamin E in mid-lactating cows (Calamari *et al.*, 1999).
- In addition, heat stress increases antioxidant enzymes activities (Slimen *et al.*, 2016).
- The new Nutritech Heat Stress pack features extra antioxidants to help cows during times of heat stress. The additional Vitamin E, organic selenium and primary antioxidant enzyme Melofeed® provides a powerful antioxidant top up to your regular mineral nutrition.

## Nutritech Heat Stress Pack

Use to top up your current mineral/additive programme during times of heat stress.

	Mild to moderate heat stress (typically 24-28 degrees)	Moderate to severe heat stress (typically 29 degrees +)
Fusion® DYAD®	10g	20g
Levucell®SC	1g	2g
Melofeed® primary antioxidant	50mg	100mg
Organic selenium	1.0mg	2.0mg
Natural vitamin E	35mg	70mg
Mature dairy cow dose rate	15g	30g
Doses per 25kg bag	1667	833



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