Actisaf® Heat Stress Presenter

phileo-lesaffre.com

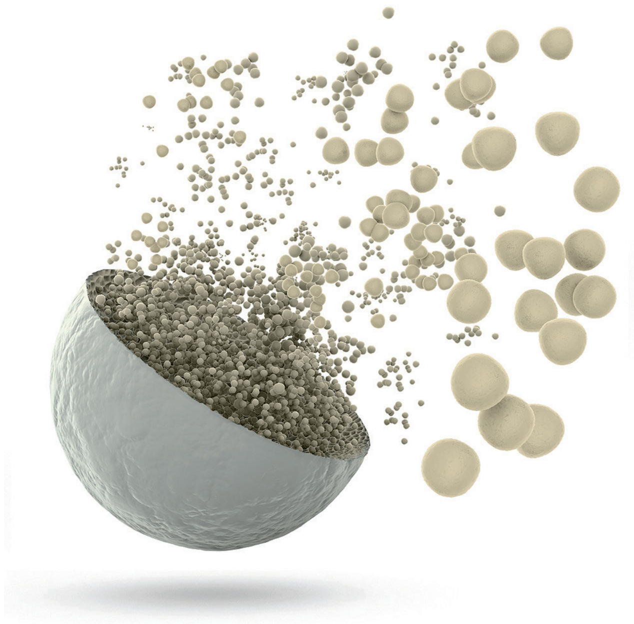
Phileo
LESAFFRE ANIMAL CARE

What is Actisaf®?

- Actisaf® is a **specific strain of live yeast** of the species Saccharomyces cerevisiae
- Yeast ferments carbohydrates, **respiring oxygen** and producing carbon dioxide
- The unique drying process used in the manufacture of Actisaf® results in a layer of dead cells around the edge of the prill (like the chocolate on a Malteser!) that protects the live cells within

Key factors for a live yeast to be effective:

- **Strain** - Actisaf® is a specific strain selected for performance as a feed additive
- **Stability** - Actisaf® has a unique drying process that gives excellent stability
- **Dose** - Yeast must be adminstered at the correct dose to get the optimum response



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About Phileo Lesaffre

- **Actisaf®** is produced by Phileo Lesaffre Animal Care, part of Lesaffre, the **world's largest manufacturer of yeast**

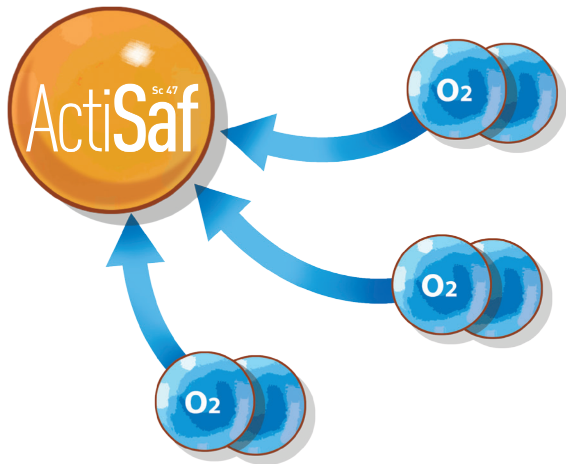
- Around **40% of the world's yeast** is made by Lesaffre!

- **Actisaf®** is manufactured by a **unique and patented process** in the production plant in Lille

How does Actisaf® work in the rumen?

- The rumen is continually challenged by **oxygen, which is toxic to rumen bacteria**

- **Actisaf® uses up oxygen**, resulting in the **growth of fibre-digesting bacteria and lactate-utilising bacteria**, increasing feed digestion and **stabilising rumen pH, which prevents acidosis** from developing

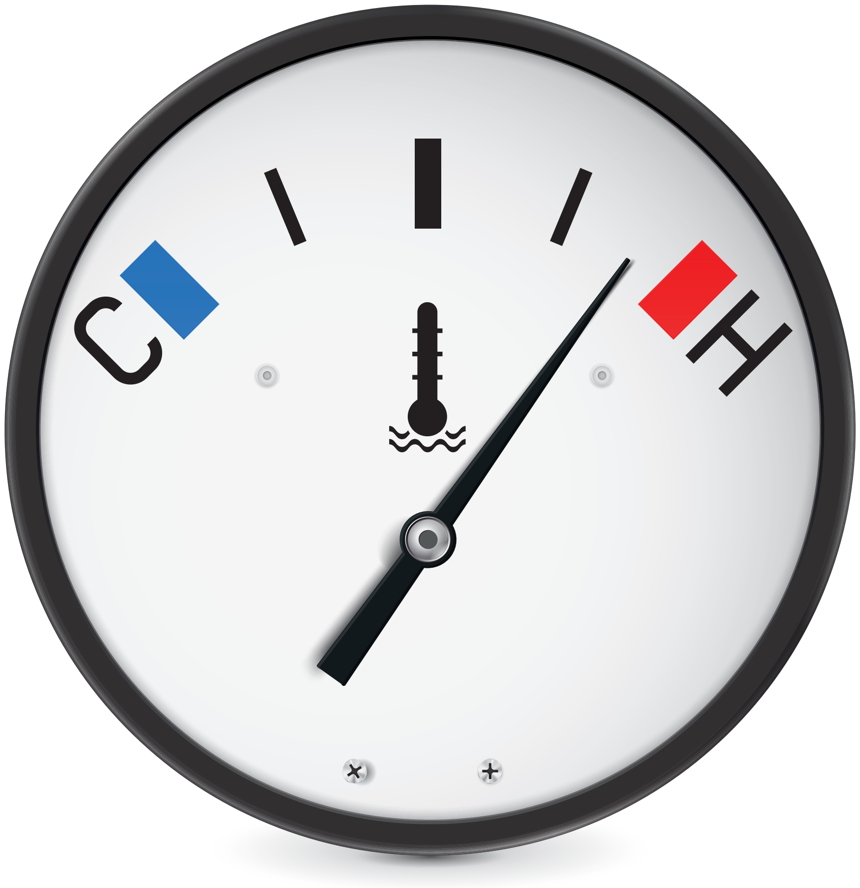


- **Actisaf®** allows the microbes to **convert lactate to propionate**, a volatile fatty acid (VFA) that optimises growth rates, feed efficiency and milk production

- **Five grams of Actisaf®** has been scientifically proven to have **a more positive effect on rumen function than 150 grams of sodium bicarbonate,** in terms of reduced lactate acid build up and increased production of volatile fatty acids

What is heat stress?

- An **increase of core body temperature** above its normal range, due to **increased total heat load exceeding the capacity for heat dissipation**
- Temperature alone is not a sufficient indicator for heat stress - **the combination of ambient temperature and humidity determine the level of heat stress**
- **Temperature Humidity Index (THI) measures the combined effects of ambient temperature and relative humidity** to determine heat load intensity
- THI can be calculated from the ambient temperature and the relative humidity with different existing formulas



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Temperature Humidity Index (THI) for lactating dairy cows

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	79	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

Stress Threshold: Respiratory rate exceeds 60/min. Milk yield losses begin. Reproduction loses detectable. Rectal temperature exceeds 38.5°C

Mild-Moderate Stress: respiratory rate exceeds 75/min. Rectal temperature exceeds 39°C

Moderate-Severe Stress: respiratory rate exceeds 85/min. Rectal temperature exceeds 40°C

Severe Stress: respiratory rate is 120-140 /min. Rectal temperature exceeds 41°C

THI = (Tdb-(0.55-(0.55*RH/100))*(Tdb-58) where Tdb is dry bulb temperature (°F) and RH is relative humidity • °C = (°F – 32)/1.8

(Zimbelman and Collier, 2011)

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Contributory factors to heat stress

- **Radiant heat** – sunshine on animals increases heat stress, whiter cows are less affected
- **Wind speed** - Moderate wind speeds reduce the effects of heat stress
- **Stocking rates** – tightly packed animals cannot dissipate heat
- **Milk yields** – Higher yielders have increased metabolic rates leading to greater generation of heat
- **Building design** – Buildings with poor ventilation increase the risk of heat stress in housed cows
- **Breeding & location** – Animals born and reared in hot climates have higher THI thresholds than those in temperate climates

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Heat stress - UK observations

- Studies during the summers of 2013 and 2014 from 12 cattle sheds indicate that a THI of 68 was rarely surpassed
- However, when milk yields were correlated with THIs for particular weeks, milk losses were identified with periods of increased THI.
- Similar results in Scotland seen by Hill & Wall (2015)
- Global warming is resulting in a warmer UK climate – we already have a humid climate!
- UK herd sizes are increasing and a trend towards more confinement
- UK cattle sheds are generally wetter, damper and, consequently, more humid than North American or Middle Eastern units – more humid climate, wet floors and passage ways
- A THI threshold of 62 has been suggested as being more applicable for temperate climates such as those in Northern Europe
- Shed siting, layout and regional geography are important factors

Hill & Wall, (2015) Animal:9(1),138-149 : Chalcombe, (2015)

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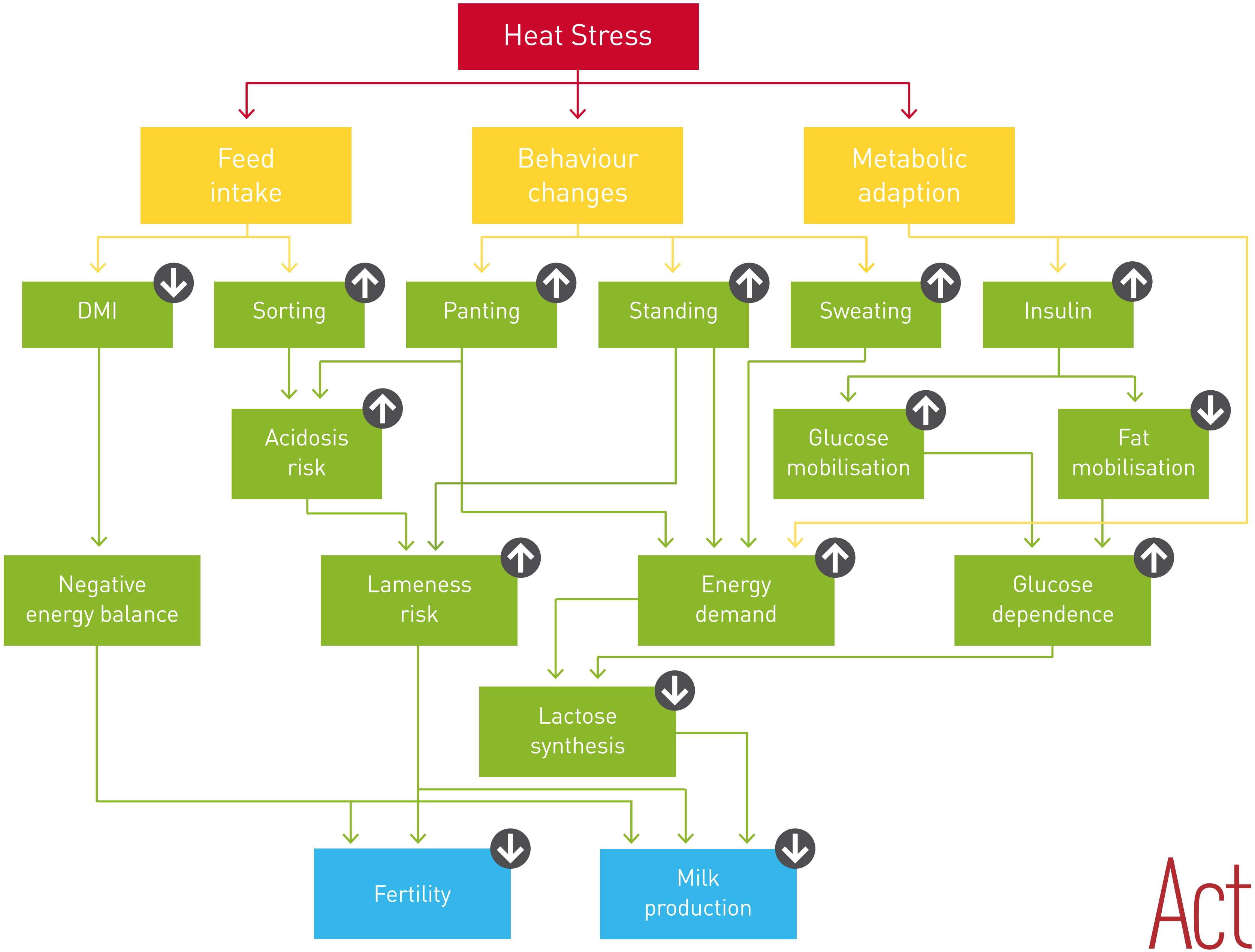
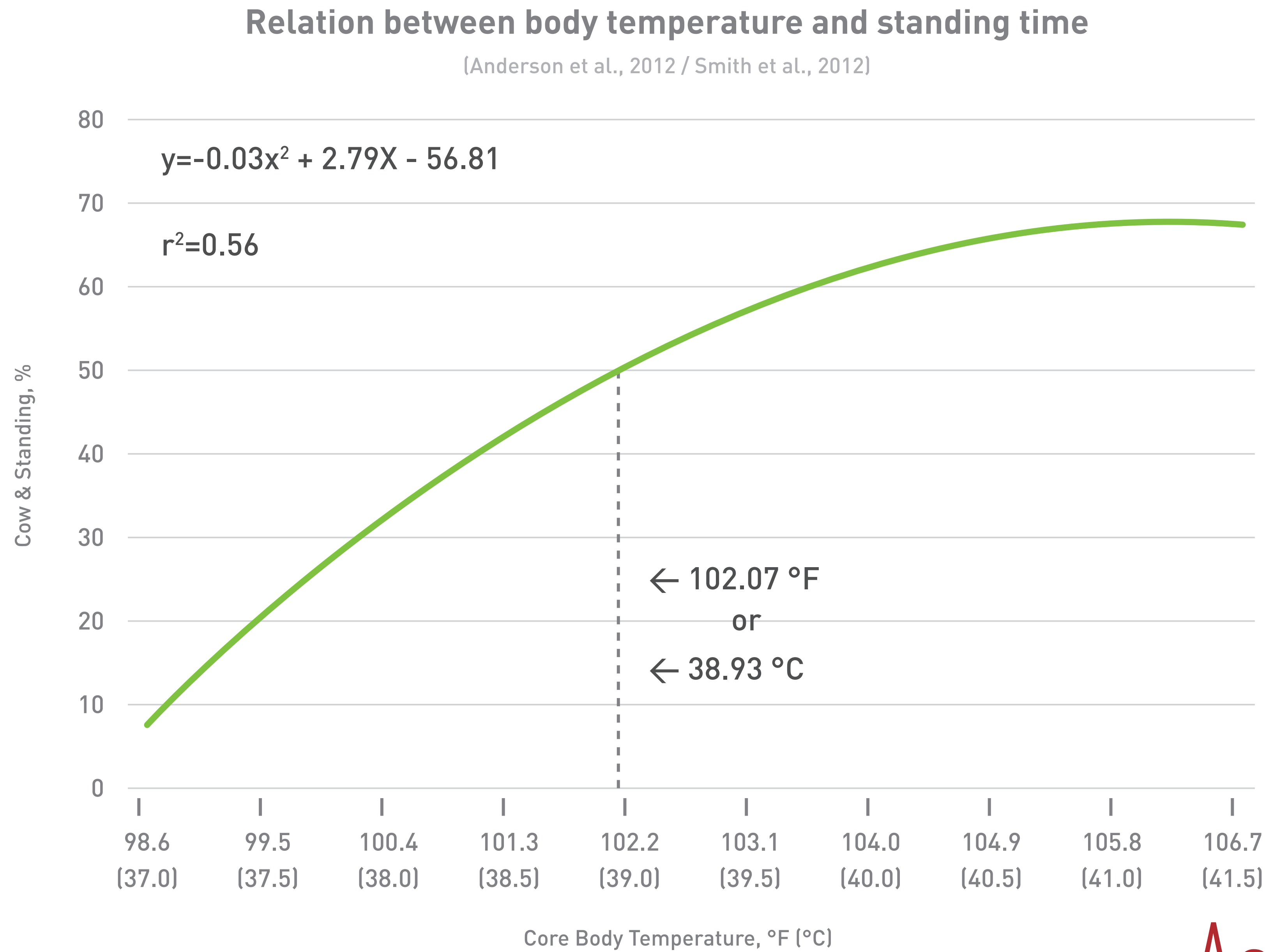
What impact does heat stress have?



Increased body temperature increases standing time



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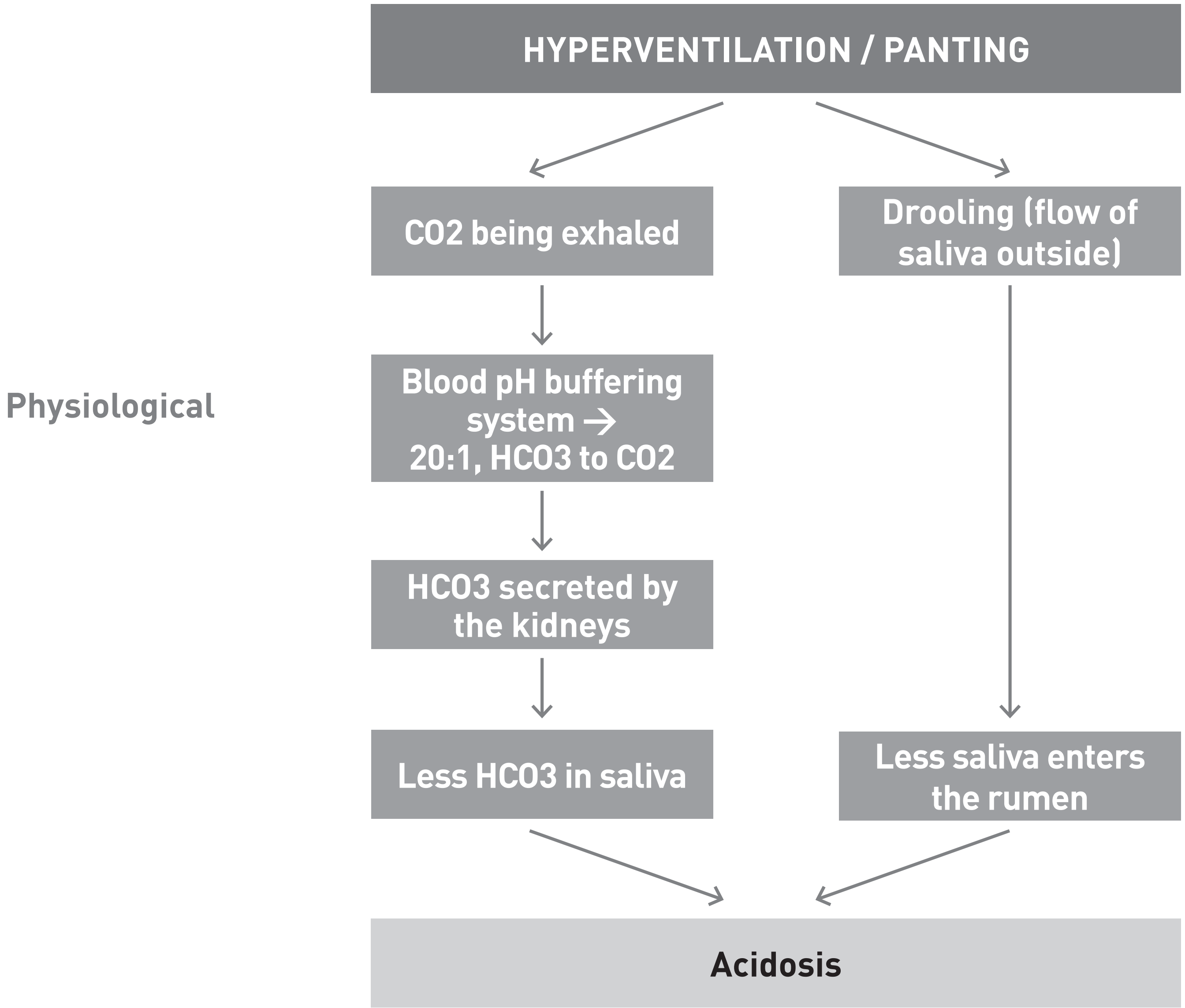
Heat stress affects rumen function



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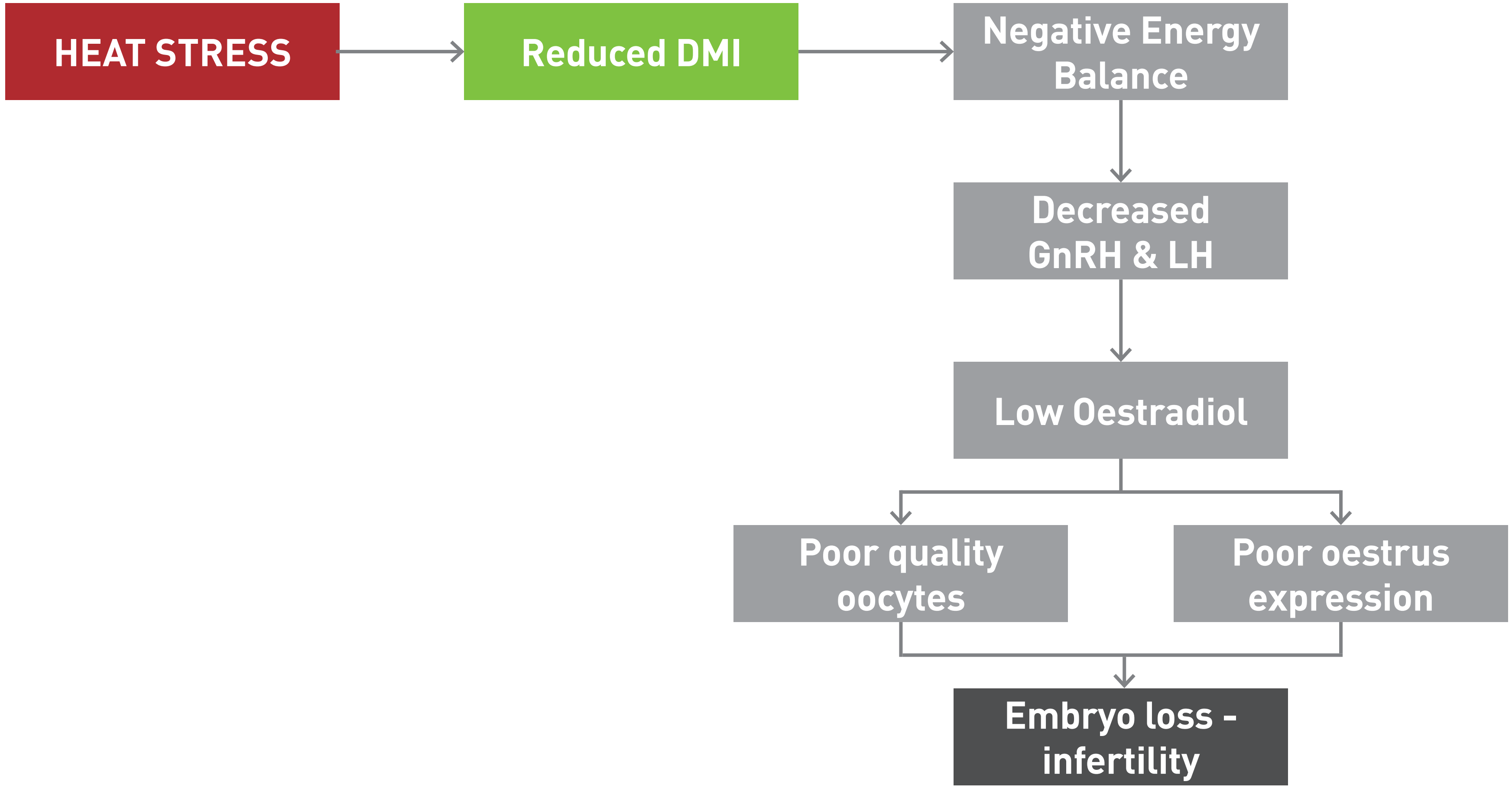
Heat stress reduces fertility



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What can be done to mitigate heat stress?

- Ensure adequate supply of cool, fresh water
- Increase the diet nutrient density to counter reduced DMI – manage rumen pH
- Feed rumen protected fat
- Feed more often and at night to avoid secondary fermentation at higher temperatures
- Keep feed pushed up to avoid sorting
- Feed sources of highly digestible structural fibre – counter acidosis but reduce heat production
- Bypass protein – reduced microbial protein production with lower intakes and FME
- Compensate for minerals lost through drooling sweating – sodium, potassium and magnesium
- Chemical buffers – rumen pH
- Consider feeding Niacin – thermal shock proteins
- Feed Actisaf® live yeast

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Heat stress study (1) - Actisaf®

- **Twenty-eight multiparous and 14 primiparous Holstein cows during heat stress** - THI 70/79 (morning/afternoon) supplemented with 1g of Actisaf® per 4 kg of dry matter consumed. The cows were 114 (±54) DIM and were group housed in shaded loose pens with adjacent outside yards, equipped with a real-time electronic individual feeding system. Cows yielding >40 litres/day.

- The treatments were as follows:

  1) Control: basal diet + 100 g of ground corn grain per d per cow;
  2) LY: basal diet + 1 g of Actisaf® per 4 kg of DM consumed, pre-mixed with 100g of ground corn grain

Journal of Dairy Science,92: 343-351

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Heat stress study (1) - Actisaf® (continued)

- Feed efficiency was defined as the production of 1 kg of 4% fat corrected milk per kg of DMI which was 3.7% greater in the Actisaf group than in the control (P< 0.03).
- The rumen pH values tended to be higher in the Actisaf cows than in the control; 6.67 and 6.54, respectively (pooled SEM = 0.03; P < 0.1).
- Rumen ammonia levels were significantly lower in the treated group, 151.9 mg/L vs 126.1 mg / L

Indicator	Control	Actisaf®	p<
DMI, kg/d	24.1	24.7	0.0001
Milk yield			
Milk, kg/d	36.3	37.8	0.007
FCM 4%, kg/d	32.8	34.8	0.0001
Milk solids g/d			
Fat g/d	1237	1368	0.03
Protein g/d	1172	1220	0.12
Lactose g/d	1810	1887	0.15
Feed efficiency			
FCM 4% per kg of DMI	1.36	1.41	0.03

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Heat stress study (2) - Actisaf®

- Twenty-eight Holsteins (207 ± 87 DIM) were housed in an open-walled, sand-bedded, tie-stall barn with fans and high-pressure sprinklers.
- The cows were fed a standard diet for 14 d as a co-variate period.
- After the adaptation period the cows were assigned to one of 2 groups for 10 weeks:
  1) Actisaf group : Actisaf top dressed on to the control diet.
  2) Control group: Control diet.
- Confined housing with active cooling system. Cows experienced heat stress with THI above 68 for more than 75% of the time

Parameters	Control	Actisaf®	p<
DMI, kg/d	19.0	19.5	0.53
Milk, kg/d	25.4	26.7	0.03
ECM, kg/d	23.0	24.4	0.05
4% FCM, kg/d	21.7	23.1	0.05
Fat, kg/d	0.777	0.824	0.09
Fat, %	3.06	3.17	0.22
Protein, kg/d	0.801	0.828	0.06
Protein, %	3.21	3.17	0.39
Solids, kg/d	2.921	3.062	0.05
Solids, %	11.67	11.72	0.64
Milk/DMI, kg/kg	1.34	1.37	0.77

Journal of Dairy Science,98:1-12

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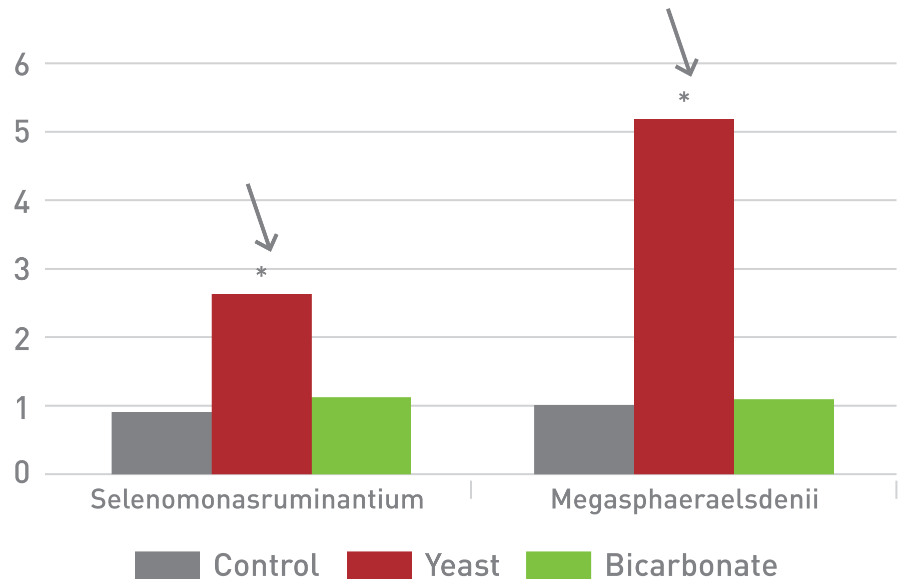
Actisaf® and rumen function

- Better anaerobic environment promotes the growth and activity of the anaerobic bacteria which utilise the lactic acid and convert it to VFA.

- Lower redox potential in the rumen creates a better environment for the growth and activity of anaerobic rumen microflora, which leads to improved feed digestion, lower lactic acid levels and increased VFA.

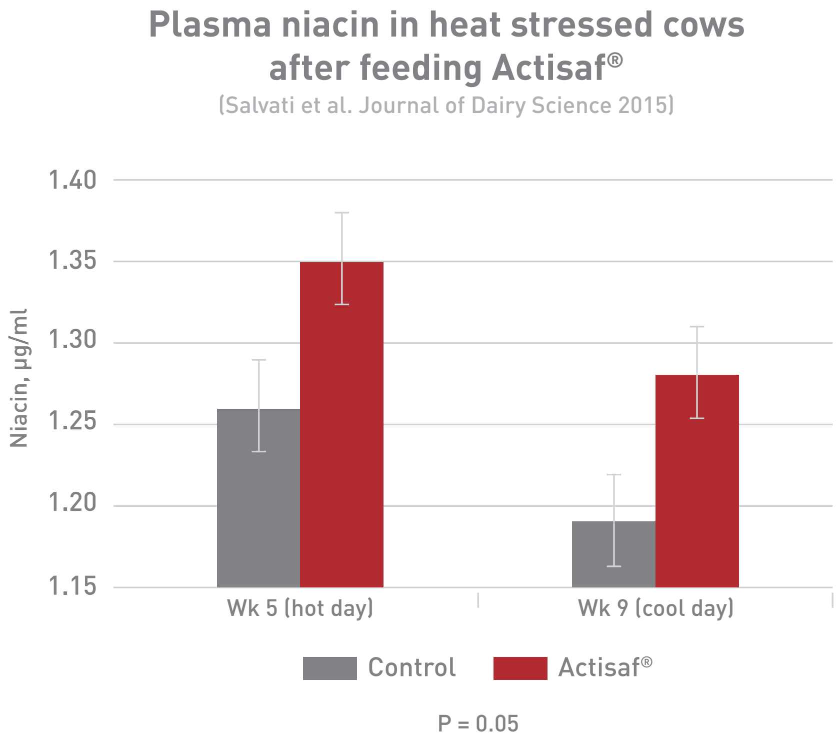
(mM)	Control	Yeast	Bicarbonate
Total VFA	85.3[a]	99.4[b]	95.3[b]
Acetate	53.2[a]	59.1[b]	60.8[b]
Propionate	18.0[a]	**25.8[a]**	20.0[a]
Butyrate	10.6	10.2	10.1
Lactate	16.5[b]	**5.4[a]**	12.2[b]



PLOS ONE,8:1-10

Actisaf® and heat regulation

- Several studies prove the beneficial effects of Niacin (vitamin B3) during heat stress situations.
- Niacin supplementation may improve heat tolerance through elevation of cellular heat shock proteins and peripheral vasodilation. (Animal Feed Science and Technology (2013). 180:26-33)
- **Niacin is normally produced by rumen microflora.** The increase in plasma niacin content of cows supplemented with live yeast approached similar magnitude to the increase of cows supplemented with rumen-protected niacin. (Journal of Dairy Science (2015). 98:1-12)



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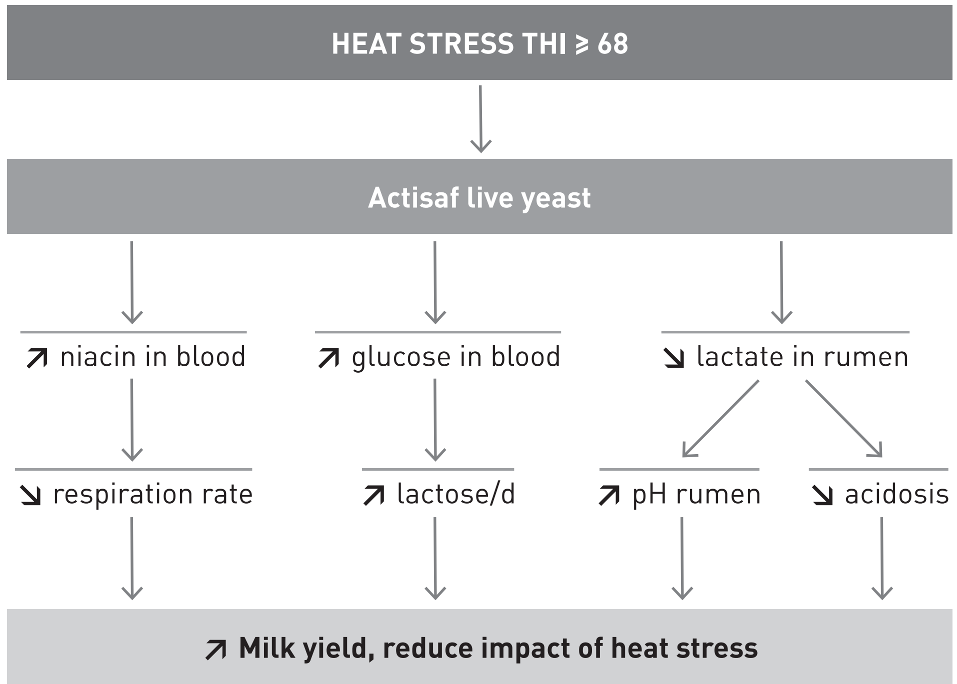
Summary

Feeding Actisaf® live yeast during periods of heat stress is proven to:

- Minimise the risk of acidosis
- Improve feed digestion and feed conversion efficiency
- Support higher dry matter intake
- Increase plasma niacin and blood glucose levels
- Support higher milk yield and milk constituents



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