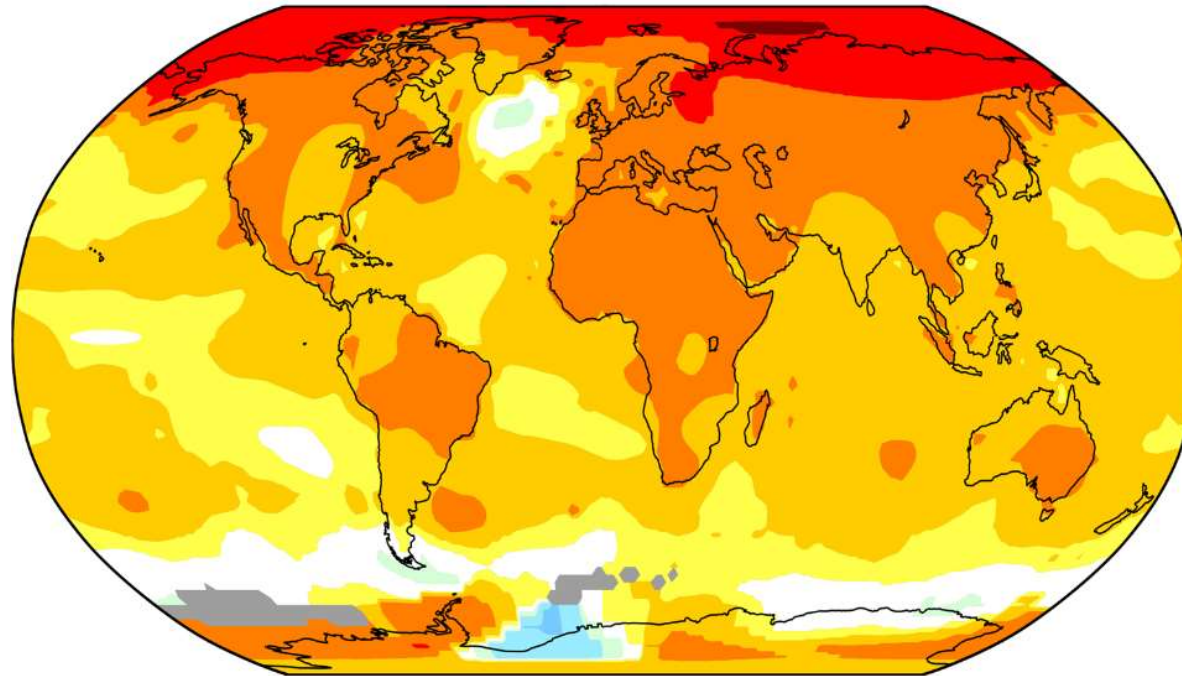


HEAT STRESS
in heifers
during the milky phase

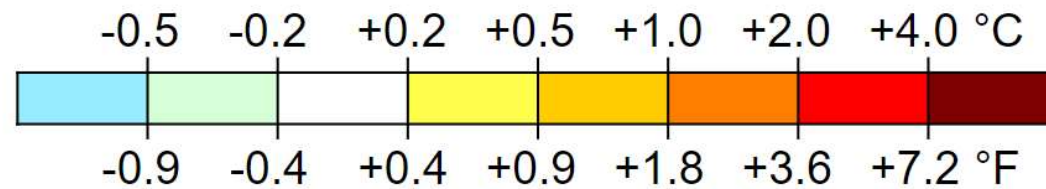
Context



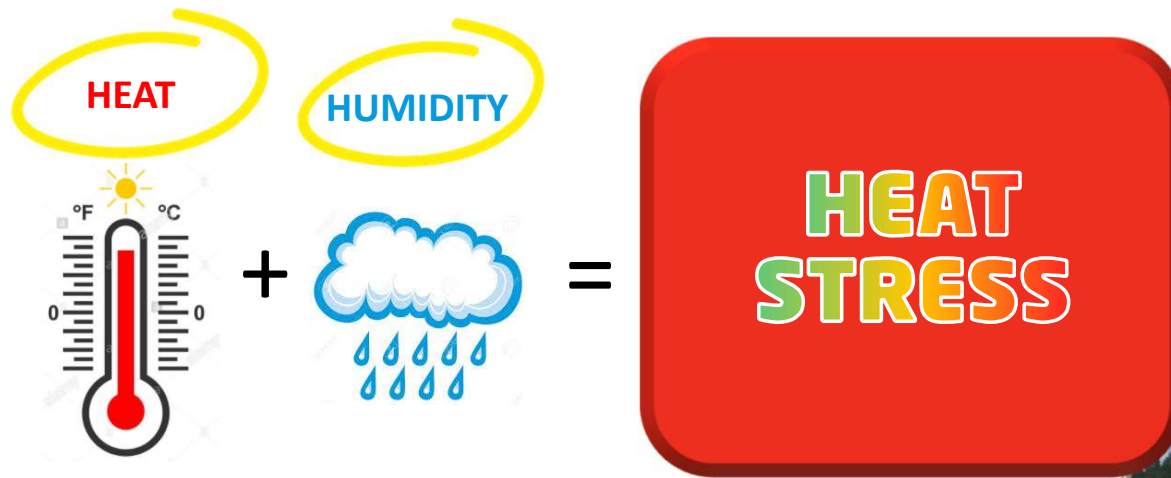
Temperature evolution over the last 50 years



Average 2011-2020 vs reference 1951-1980



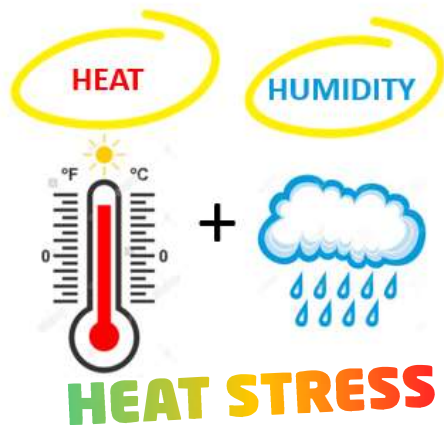
Heat stress in animals



When **T.H.I.**
(Temperature Humidity Index)
exceed the zone of
thermoneutrality of the
animal
(comfort zone).



How to measure Heat Stress?



T.H.I.

« Temperature Humidity Index »

**= temperature index felt
by animals**

Measured by the formula

$(1,8 \times T^{\circ} + 32) - (0,55 - 0,0055 \times \% \text{ of humidity}) \times (1,8 \times T^{\circ} - 26)$

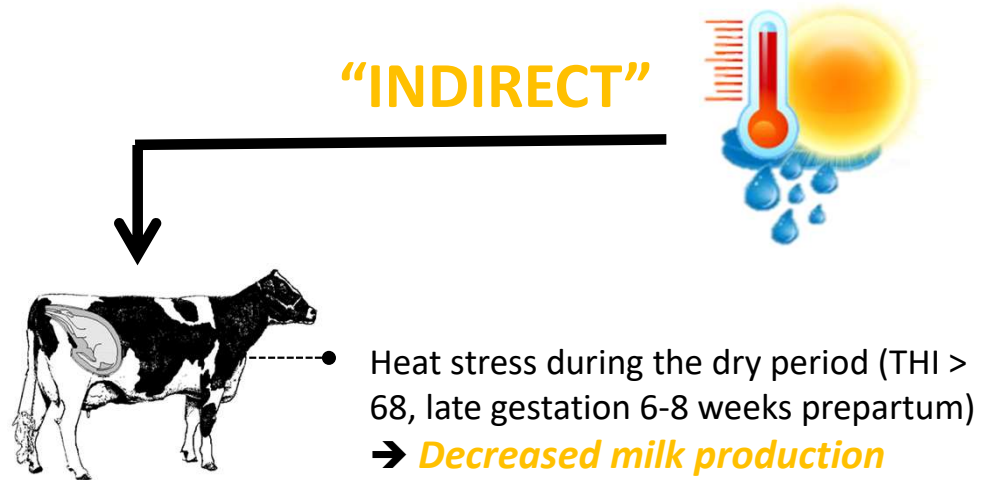
Source NRC

Temperature

Humidity

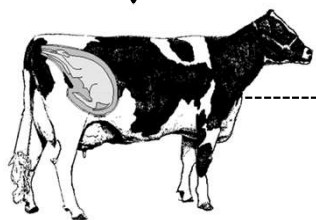
	0	5	10	15	20	25	30	40	45	50	55	60	65	70	75	80	85	90
21	60	64	64	64	65	65	65	66	66	67	67	67	68	68	68	69	69	69
22	64	65	65	65	66	66	66	67	67	68	68	69	69	69	70	70	70	71
23	65	65	66	66	67	67	67	68	69	69	70	70	70	71	71	72	72	73
24	66	66	67	67	68	68	69	70	70	70	71	71	72	72	73	73	74	74
25	67	67	68	68	69	69	70	71	71	72	72	73	73	74	74	75	75	76
26	67	68	69	69	70	70	71	72	73	73	74	74	75	75	76	77	77	78
27	68	69	69	70	71	71	72	73	74	74	75	76	76	77	77	78	79	79
28	69	70	70	71	72	72	73	74	75	76	76	77	78	78	79	80	80	81
29	70	71	71	72	73	73	74	75	76	77	78	78	79	80	81	81	82	83
30	71	71	72	73	74	74	75	77	77	78	79	80	81	81	82	83	84	84
31	71	72	73	74	75	76	76	78	79	80	81	82	83	84	85	85	86	86
32	72	73	74	75	76	77	77	79	80	81	83	84	84	85	86	87	87	88
33	73	74	75	76	77	78	79	80	81	82	83	85	86	87	88	89	89	90
34	74	75	76	77	78	79	80	82	83	84	85	87	88	89	90	91	91	92
35	75	76	77	78	79	80	81	83	84	85	86	87	88	90	91	92	92	93
36	75	77	78	79	80	81	82	84	85	86	87	88	89	90	91	93	94	95
37	76	77	79	80	81	82	83	85	86	87	89	90	91	92	93	94	95	96
38	77	78	79	81	82	83	84	86	88	89	90	91	92	93	95	97	97	98
39	78	79	80	82	83	84	85	88	89	90	91	92	94	95	96	97	100	100
40	79	80	81	82	84	85	86	89	90	91	93	94	95	96	98	99	100	101
41	80	81	82	83	85	86	87	90	91	93	94	95	97	98	99	101	102	103

Potential effects of heat stress in calves



Potential effects of heat stress in calves

“INDIRECT”

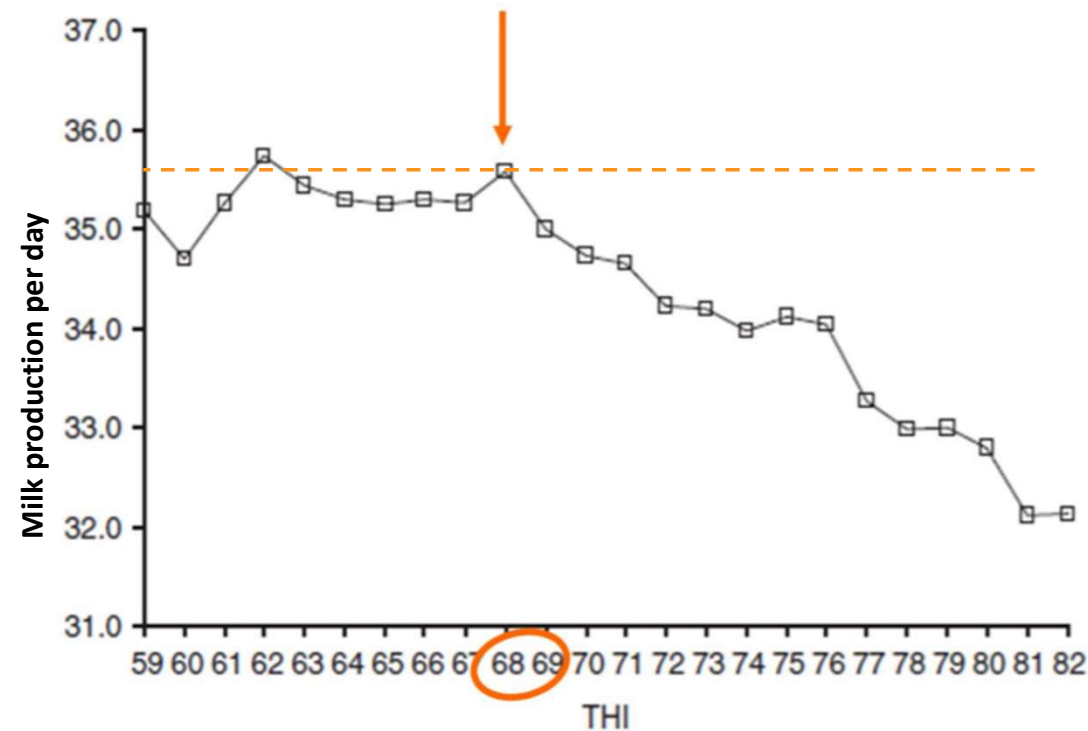


Heat stress during the dry period (THI > 68, late gestation 6-8 weeks prepartum)

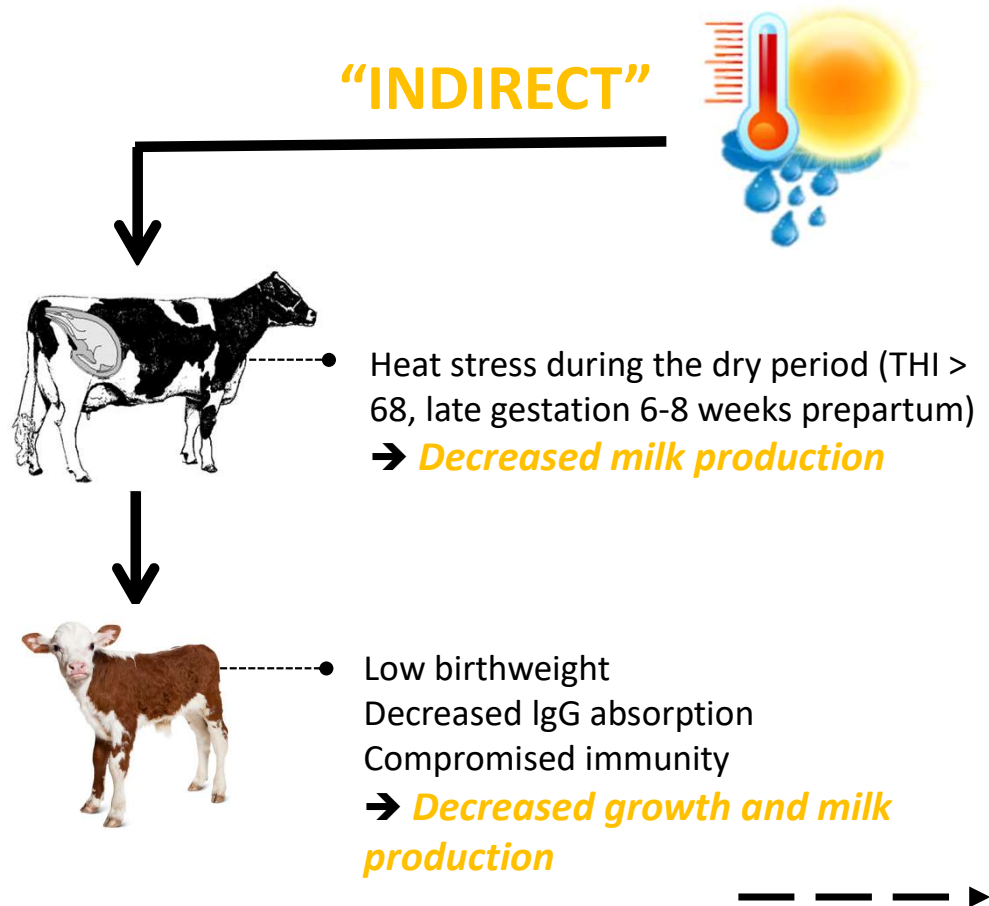
→ **Decreased milk production**

Milk production according to THI on a population of 1 million dairy cows in Italy.

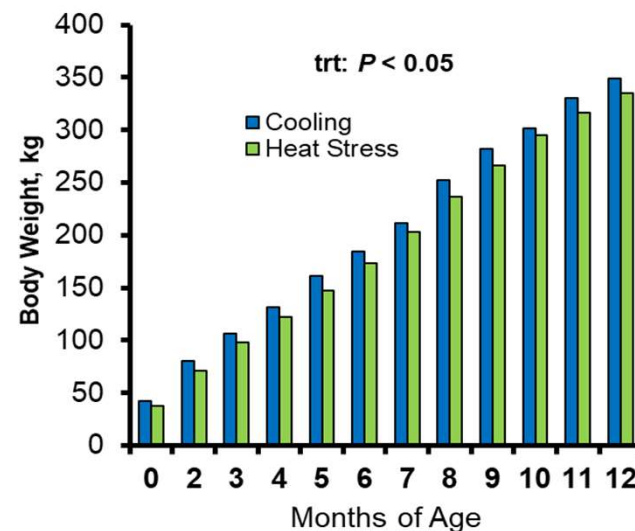
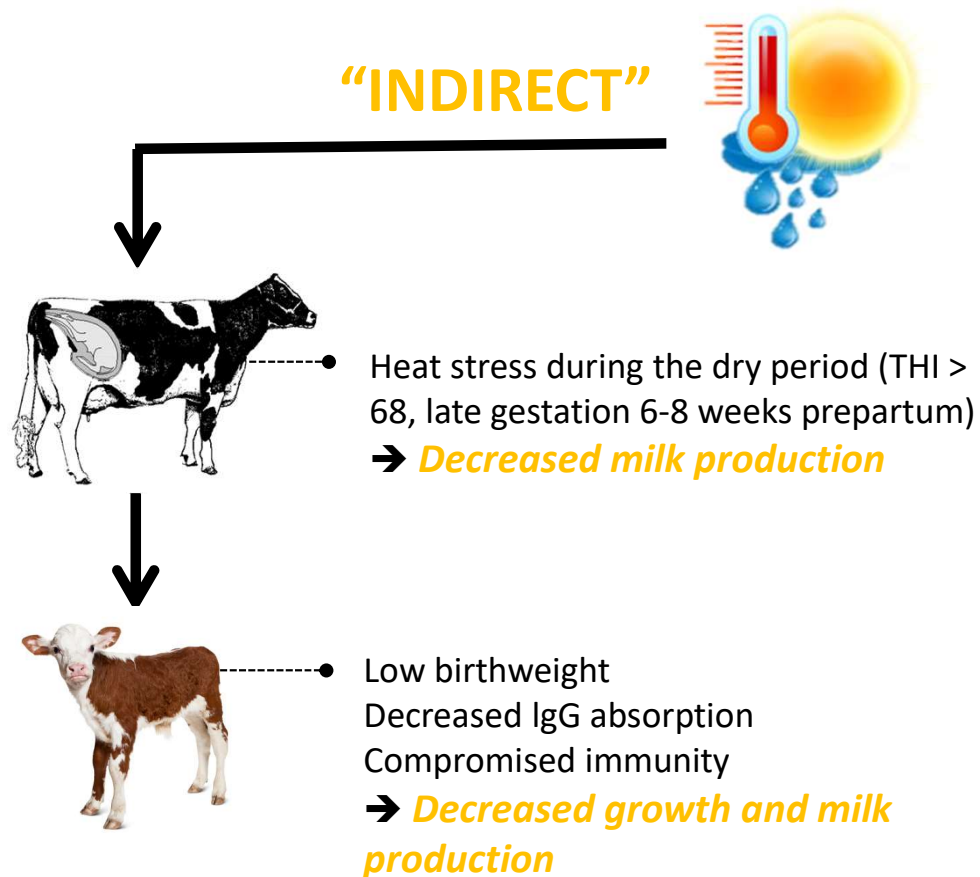
The THI threshold beyond which an impact on milk production is observed is 68-69.



Potential effects of heat stress in calves



Potential effects of heat stress in calves



Effects of heat stress *in utero*

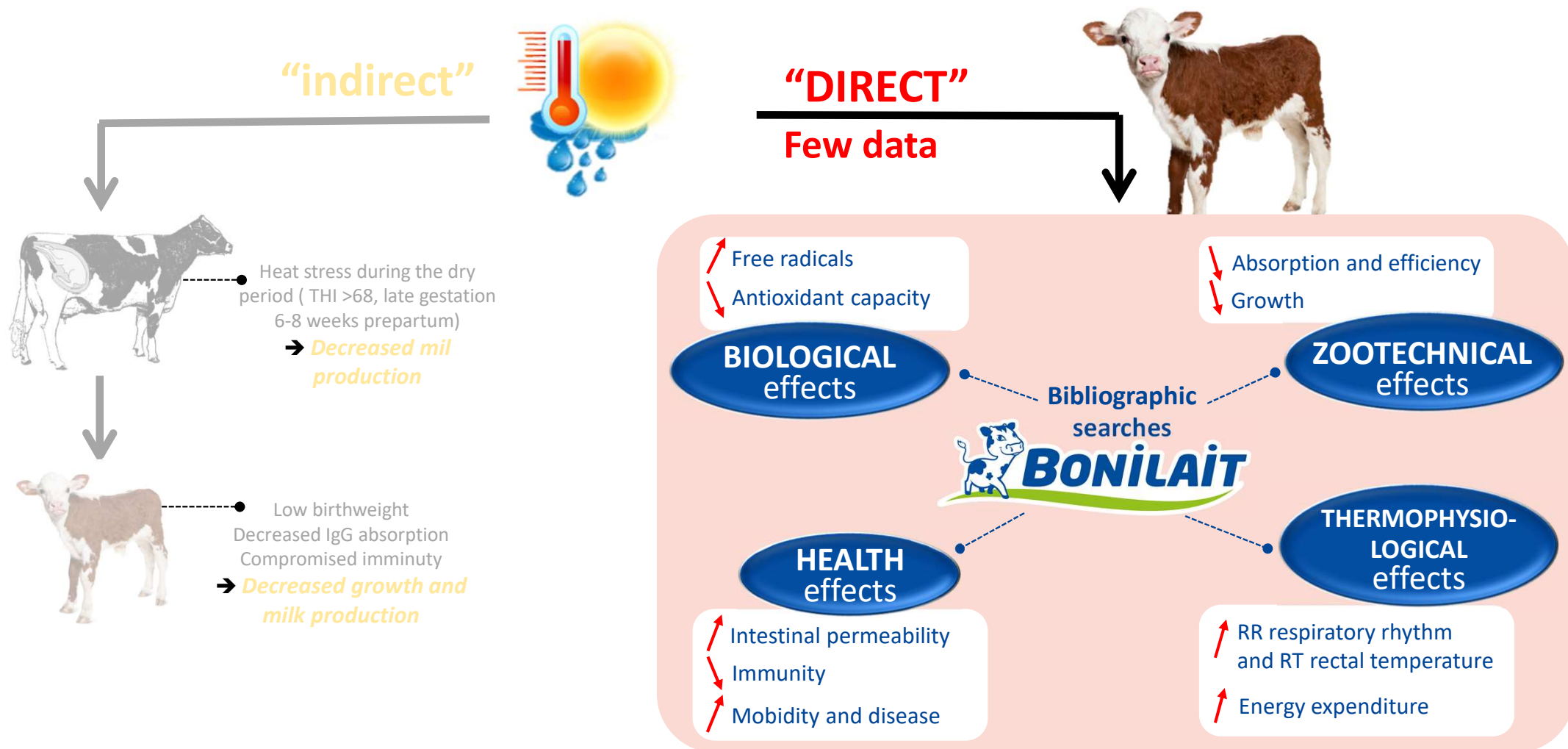
-> Decreased growth and immunity of young heifer

- Negative effect on birth weight (- 4,7 kg to -6 kg)
- Negative effect on growth until weaning (10,3 to 12,6 kg)
- Negative effect on 1st month immunity (absorption of IgG 19,2% vs 33,6% under normal conditions)

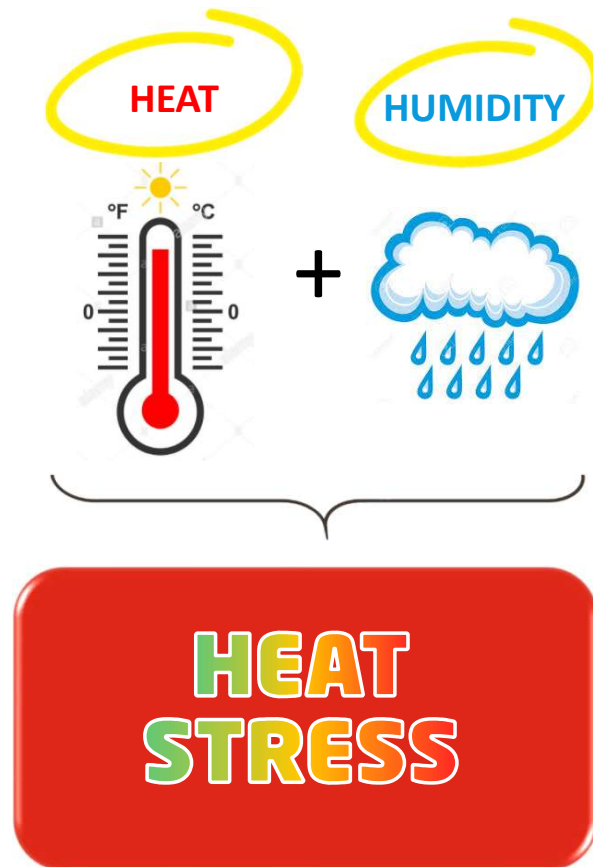
-> But also epigenetic effects leading to a decrease of milk production (-3,5 L/d)

- Less secretory cells in the breast
- Impact on liver development

Potential effects of heat stress in calves



Objectives



2 RESEARCH OBJECTIVES



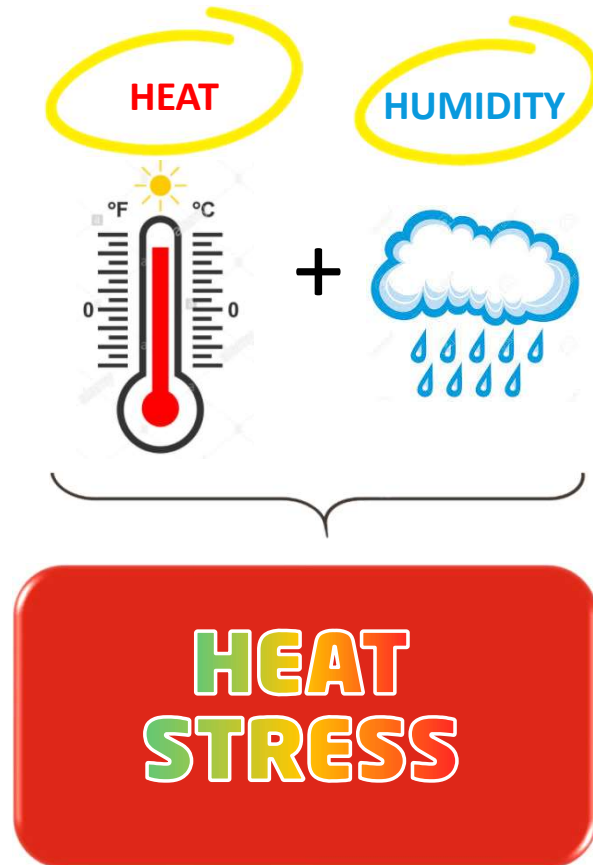
1 Determination of critical THI
in preweaned calves

(Temperature Humidity Index)

INÉDIT

2 Purpose a nutritional solution
to mitigate negative effects of heat
stress during milky phase.

Objectives



2 RESEARCH OBJECTIVES



1

**Determination of critical THI
in preweaned calves**

(Temperature Humidity Index)

INÉDIT

1

Determination of critical THI in preweaned calves



How ?

2 trials in partnership Bonilait & University of Milan



2 livestock farms in Lombardie
> 400 cows
followed by the
University of Milan



40 heifers
Trial batch
40 heifers
Control batch
Birth>weaning



Hot summer season
Summer 2019 (trial 1)
Summer 2020 (trial 2)
June to September
THI* > 80

**THI was calculated from data
recorded by the machine*



Average
health
conditions
(50,6 % of sick
animals)



Studied parameters:
751 measures on
respiratory rate
177 measures on
rectal temperature

1

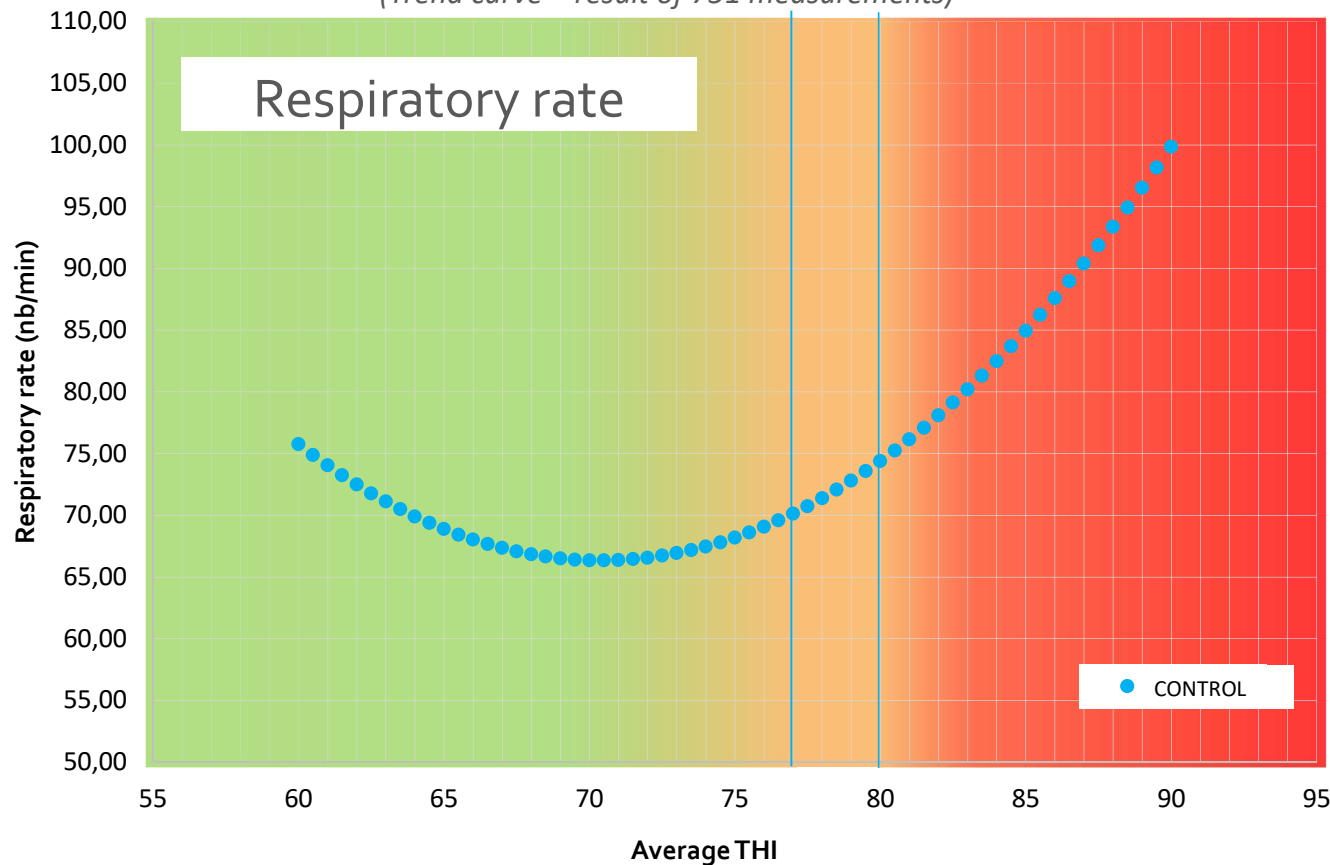
Determination of critical THI in preweaned calves

BONILAIT APPROACH based on RR

Trial
results

80 heifers - 0 to 9 weeks – June to Sept. 2019 and 2020

(Trend curve = result of 751 measurements)



Low heat stress (RR<70)	THI average* < 77
Moderate heat stress (RR 70-75)	THI average* 77-80
High heat stress (RR>75)	THI average* > 80

*THI average = average of the readings between 8h to 20h

The results obtained during the trials allowed us to determine the threshold of

critical THI at 80

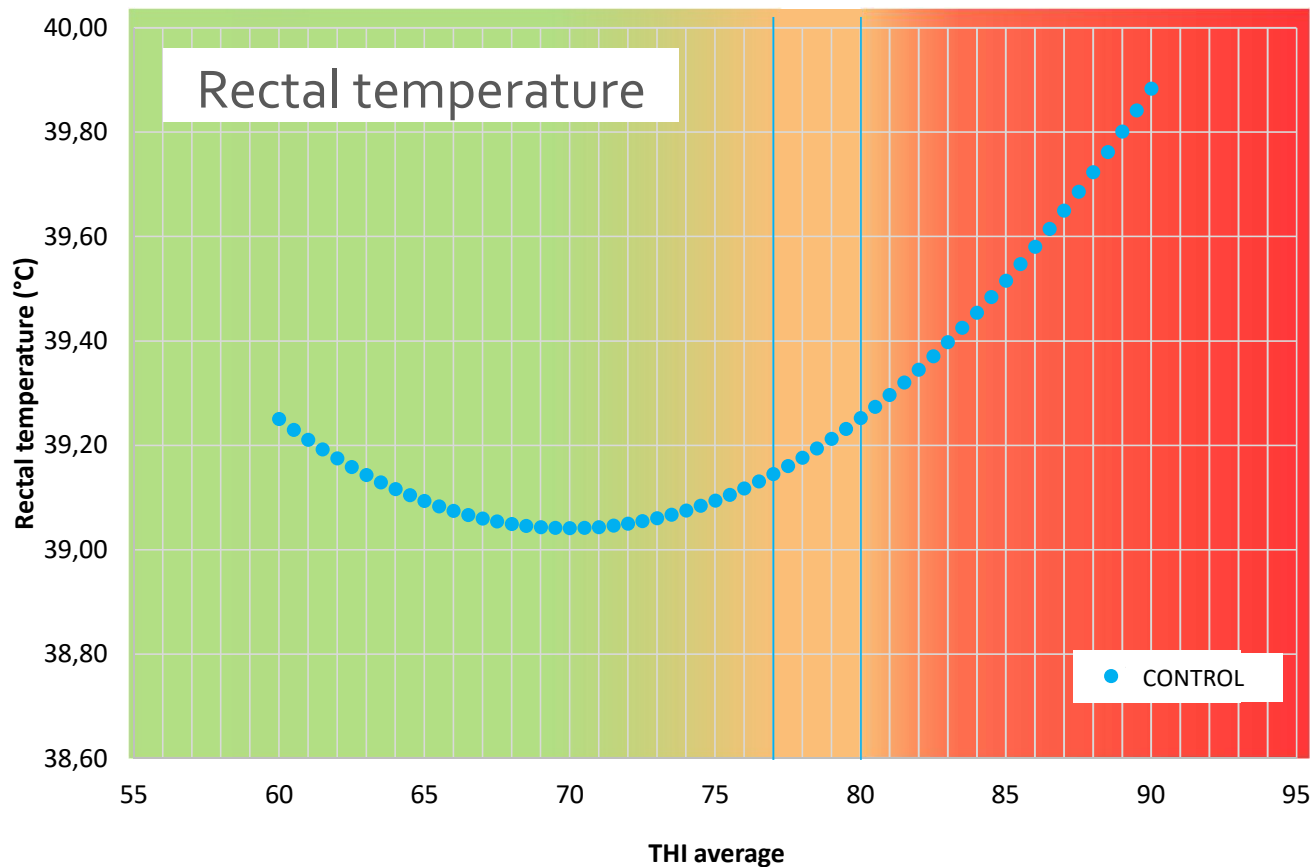
1

Determination of critical THI in preweaned calves

BONILAIT APPROACH
based on RRTrial
results

80 heifers - 0 to 9 weeks – June to Sept. 2019 and 2020

(Trend curve = result of 177 measurements)



Low heat stress (RR<70)	THI average < 77
Moderate heat stress (RR 70-75)	THI average 77-80
High heat stress (RR>75)	THI average > 80

**THI average = average of the readings between 8h to 20h*

The results obtained during the trials allowed us to determine the threshold of

critical THI at 80

1

Determination of critical THI in preweaned calves

Trial
results

Humidity

Temperature

	0	5	10	15	20	25	30	40	45	50	55	60	65	70	75	80	85	90
21	63	64	64	64	65	65	65	66	66	67	67	67	68	68	68	69	69	69
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41	80	81	82	83	85	86	87	90	91	93	94	95	97	98	99	101	102	103

comfort zone: no stress

Heat stress

INÉDIT

For the 1st time
in preweaned calves,
the original approach of
Bonilait allows
to determine the
threshold of critical THI.

Low heat stress (RR<70)	THI average < 77
Moderate heat stress (RR 70-75)	THI average 77-80
High heat stress (RR>75)	THI average > 80

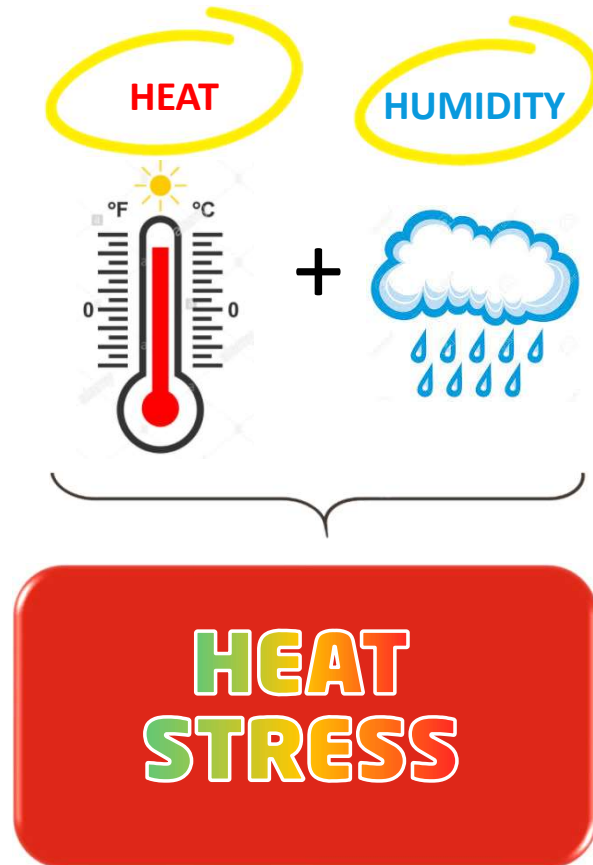


Beyond a THI of 80, young calves can no longer efficiently regulate their temperature:

➔ Increased respiratory rate, discomfort.



Objectives



2 RESEARCH OBJECTIVES



1 Determination of critical THI
in preweaned calves

(Temperature Humidity Index)

2 Purpose a nutritional solution
to mitigate negative effects of heat
stress during milky phase.

2

Purpose a nutritional solution to mitigate negative effects of heat stress during the milky phase.

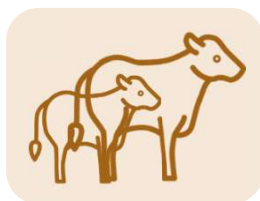


How ?

2 trials in partnership Bonilait & University of Milan



**2 livestock farms
in Lombardie**
> 400 cows
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40 heifers
Trial batch
40 heifers
Control batch
Birth>weaning



Hot summer season
Summer 2019 (Trial 1)
Summer 2020 (Trial 2)
June to September
THI* > 80

* THI was calculated from data
recorded by the machine



Average health
conditions
(50,6 % of sick
animals)



Studied parameters :

- ✓ **Growth**
- ✓ **Feed efficiency**
- ✓ **Health status**
- ✓ **RR (1489 measures) &
RT (352 measures)**
- ✓ **Antioxidant status**

2

Purpose a nutritional solution to mitigate negative effects of heat stress during the milky phase.

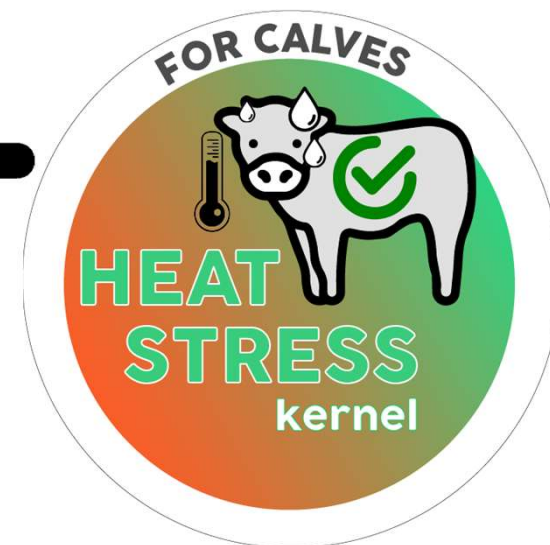


2 trials in partnership Bonilait & University of Milan



Milk feeding

From birth to weaning,
2 meals/day



KERNEL
Formulated by Bonilait

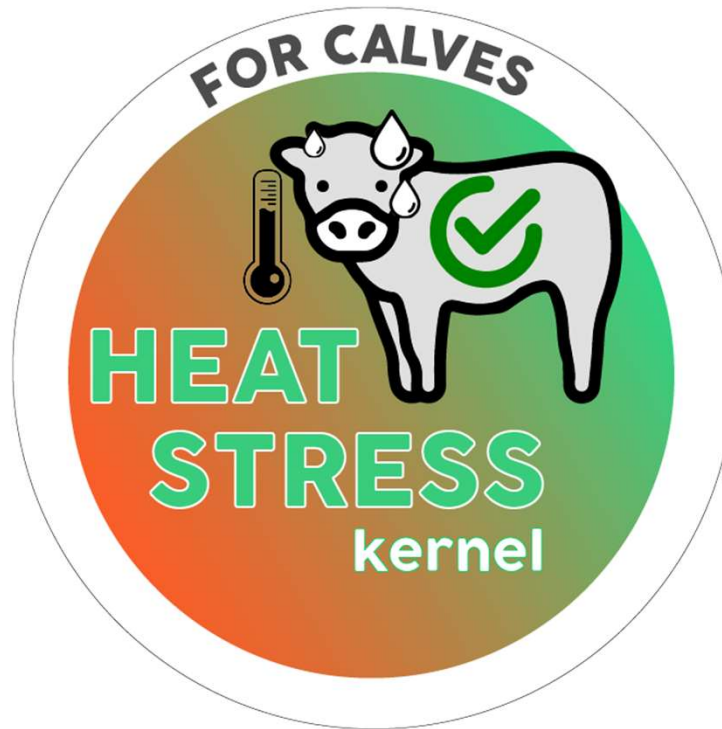
2

Purpose a nutritional solution to mitigate negative effects of heat stress during the milky phase.

Innovative formula



Kernel « Heat Stress Control »



**Incorporated
into milk
feeding**

2

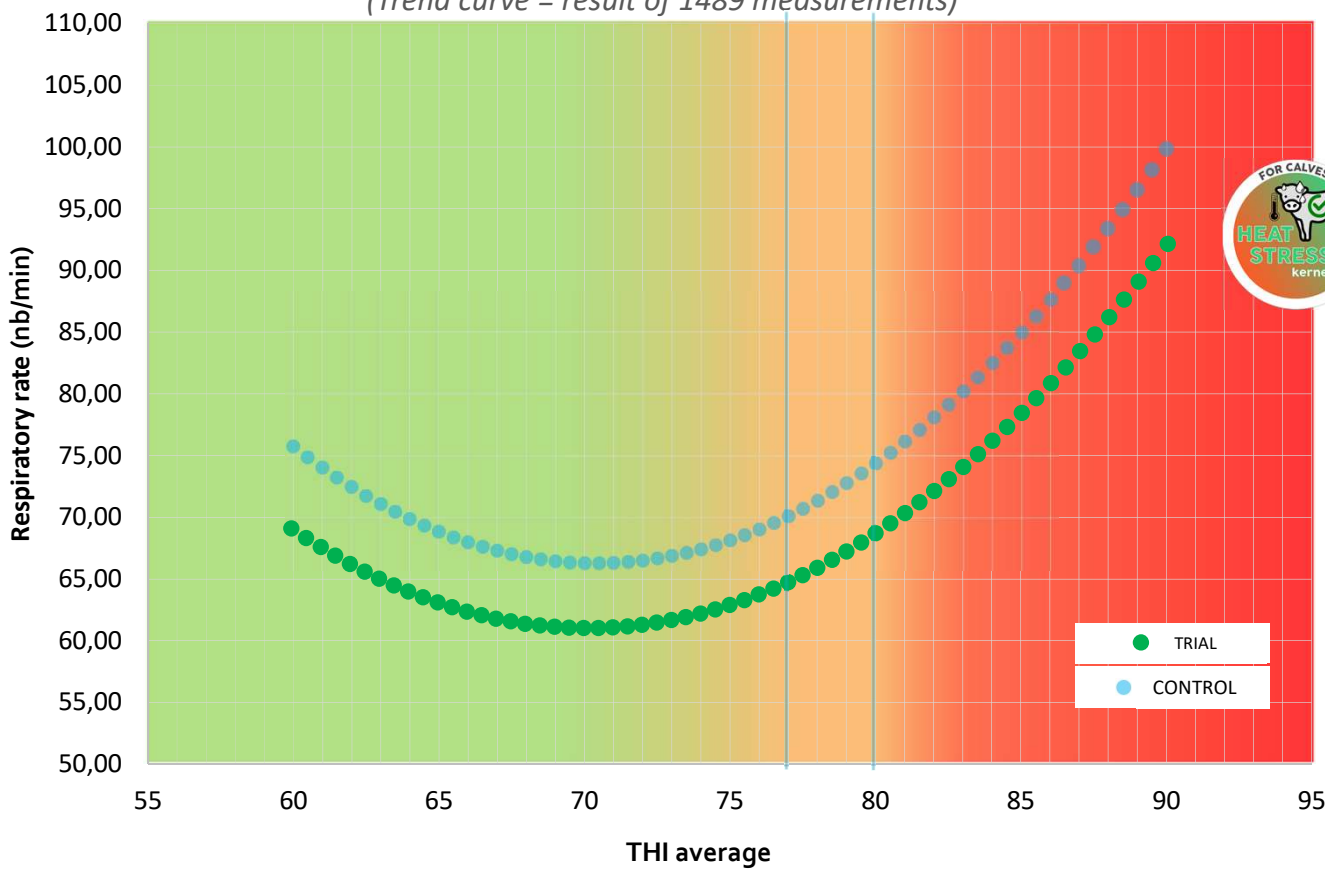
Purpose a nutritional solution to mitigate negative effects of heat stress during the milky phase.

BONILAIT APPROACH
based on RR

Trial
results

80 heifers - 0 to 9 weeks – June to Sept. 2019 and 2020

(Trend curve = result of 1489 measurements)



With supplementation

Low heat stress (RR<70)	THI average < 77
Moderate heat stress (RR 70-75)	THI average 77-80
High heat stress (RR>75)	THI average > 80

2

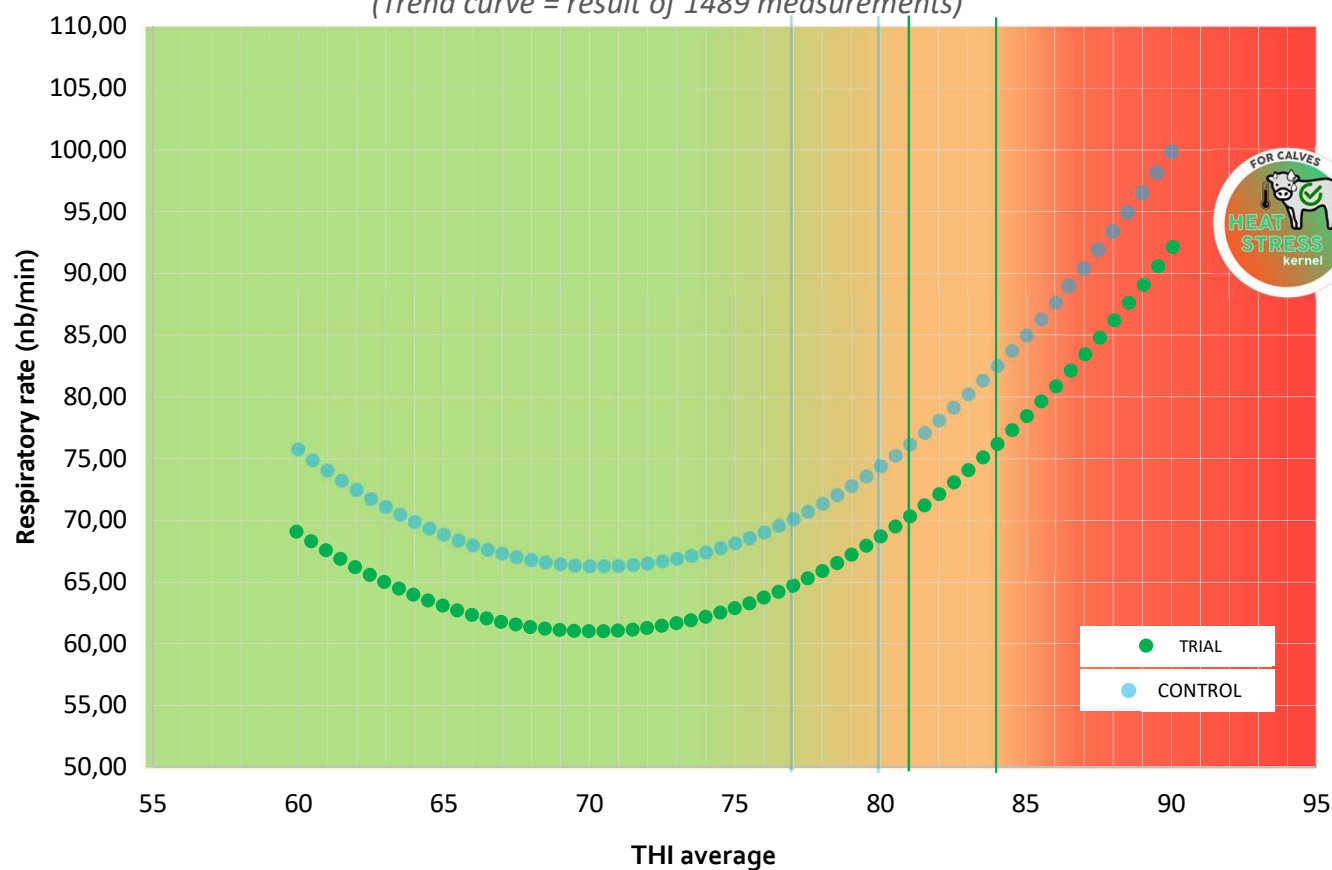
Purpose a nutritional solution to mitigate negative effects of heat stress during the milky phase.

BONILAIT APPROACH based on RR

Trial
results

80 heifers - 0 to 9 weeks – June to Sept. 2019 and 2020

(Trend curve = result of 1489 measurements)



The threshold of the critical THI

Pushed from 80 to 84

thanks to the kernel
Heat Stress Control.



	WITHOUT supplementation	WITH supplementation
Low heat stress (RR<70)	THI average < 77	THI average < 81
Moderate heat stress (RR 70-75)	THI average 77-80	THI average 81-84
High heat stress (RR>75)	THI average > 80	THI average > 84

2

Purpose a nutritional solution to mitigate negative effects of heat stress during the milky phase.

Trial
results

Humidity

Temperature

	0	5	10	15	20	25	30	40	45	50	55	60	65	70	75	80	85	90
21	63	64	64	64	65	65	65	66	66	67	67	67	68	68	68	69	69	69
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25	67	67	68	68	69	69	70	71	71	72	72	73	73	74	74	75	75	76
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27	68	69	69	70	71	71	72	73	74	74	75	76	76	77	77	78	79	79
28	69	70	70	71	72	72	73	74	75	76	76	77	78	78	79	80	80	81
29	70	71	71	72	73	73	74	76	76	77	78	78	79	80	81	81	82	83
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31	71	72	73	74	75	76	76	78	79	80	80	81	82	83	84	85	85	86
32	72	73	74	75	76	77	77	79	80	81	81	83	84	84	85	86	87	88
33	73	74	75	76	77	78	79	80	81	81	83	84	85	86	87	88	89	90
34	74	75	76	77	78	79	80	82	83	84	85	86	87	88	89	90	91	91
35	75	76	77	78	79	80	81	83	84	85	86	87	88	89	90	91	92	93
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41	80	81	82	83	85	86	87	90	91	93	94	95	97	98	99	101	102	103

→ The threshold of the critical THI

Pushed from 80 to 84

thanks to the kernel
Heat Stress Control.



	WITHOUT supplementation	WITH supplementation
Low heat stress (RR<70)	THI average < 77	THI average < 81
Moderate heat stress (RR 70-75)	THI average 77-80	THI average 81-84
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2

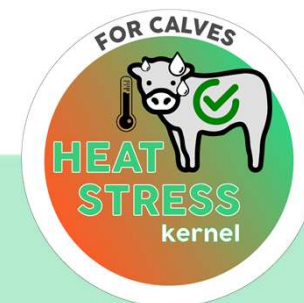
Purpose a nutritional solution to mitigate negative effects of heat stress during the milky phase.

Trial
results



Critical THI pushed from 80 to 84

- + Better technical and economic performance;
- + Better animal health and welfare;
- + Gain of 3° or 10 moisture points.



The kernel Heat stress allows the calf, **to better combat against thermal stress and to adapt to its environment.**



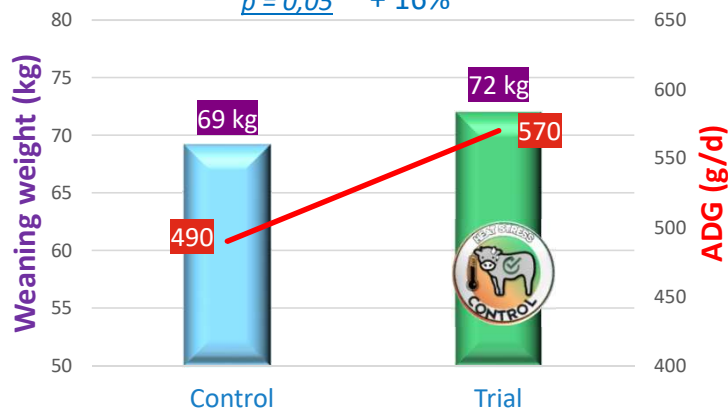
Growth performance and food efficiency

Trial results

Trial 1

Growth performance

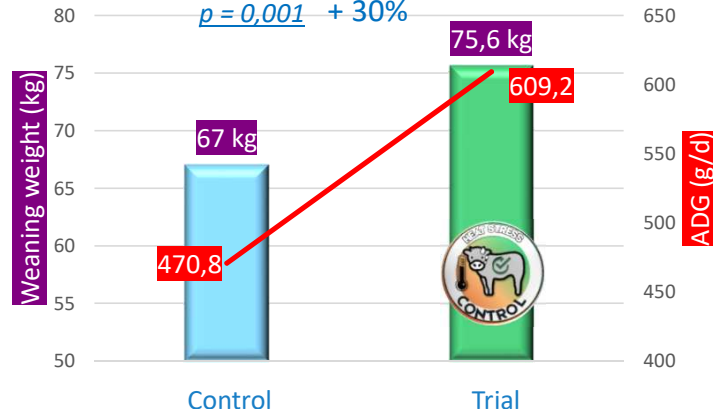
$p = 0,05$ + 16%



Trial 2

Growth performance

$p = 0,001$ + 30%



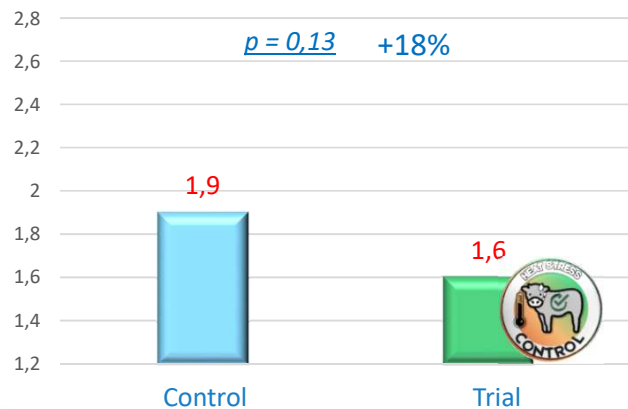
+ 16 to 30% ADG with the kernel (significant)



Trial 1

Consumption index (consumed/weight gain)

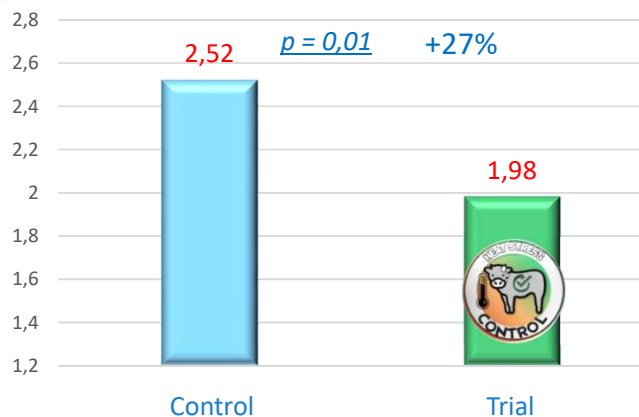
$p = 0,13$ + 18%



Trial 2

Consumption index (consumed/weight gain)

$p = 0,01$ + 27%



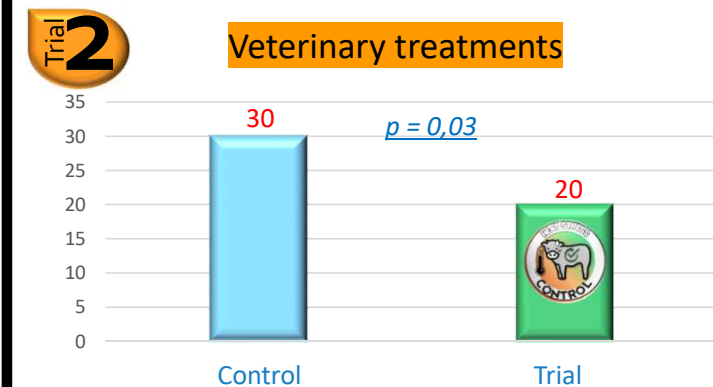
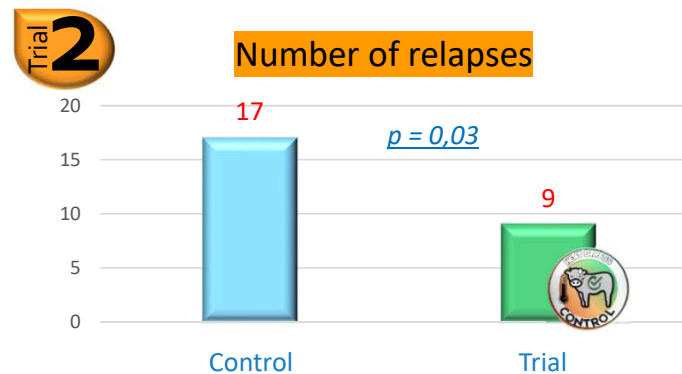
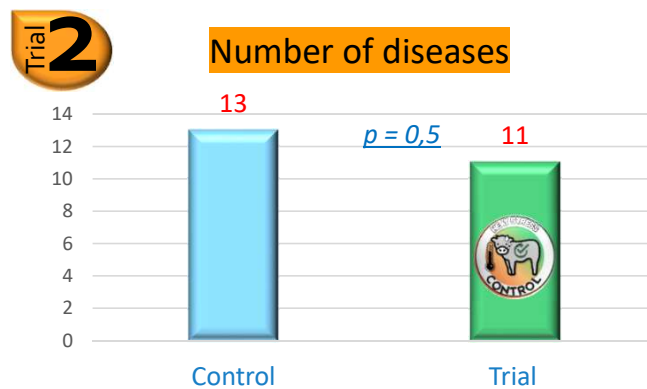
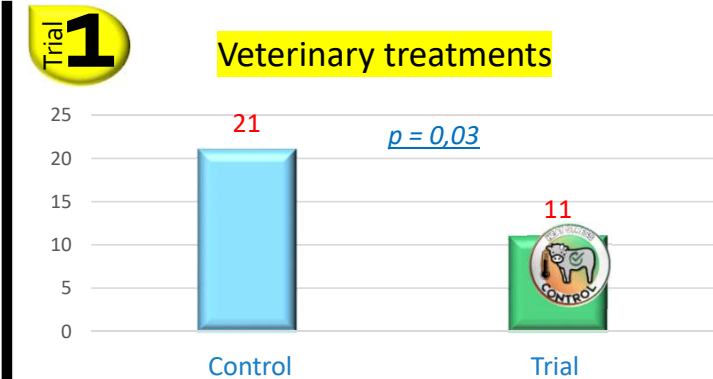
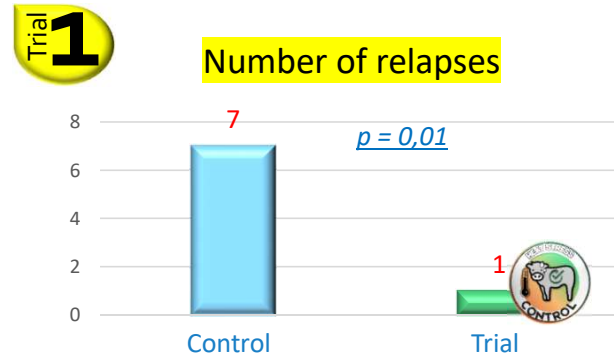
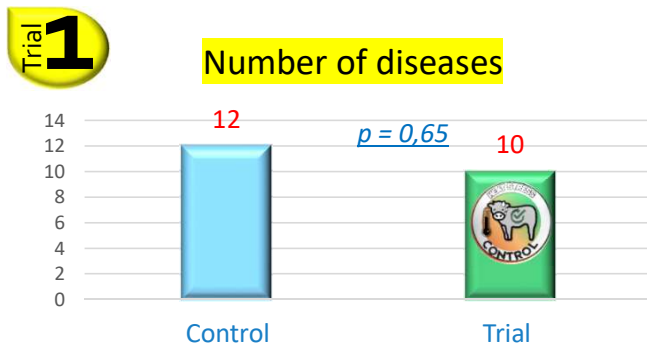
+ 18 to 27% food efficiency

With the kernel (significant)



Health status

Trial results



Significant decreased of relapses (diarrhea & respiratory problems)
and therefore **reduced number of veterinary treatments**

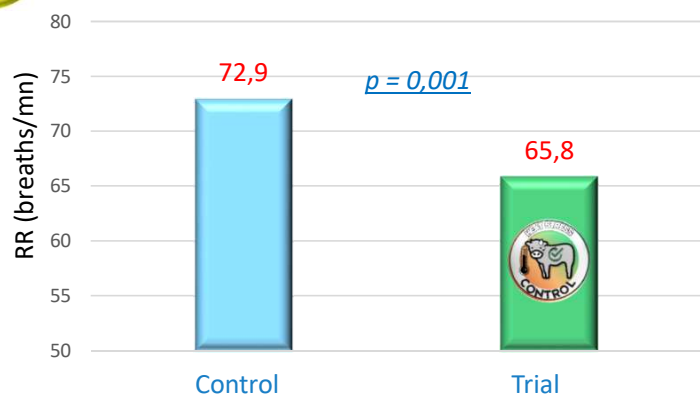
RR RESPIRATORY RHYTHM AND RT RECTAL TEMPERATURE

Trial
results

Respiratory rhythm and rectal temperature are two **very representative parameters of heat stress**. They are non-exhaustive and easily measurable in breeding conditions, and give direct indications of the degree of stress.

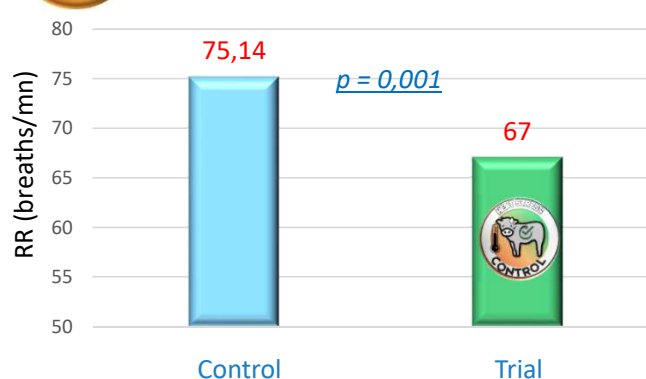
Trial
1

Respiratory rhythm



Trial
2

Respiratory rhythm

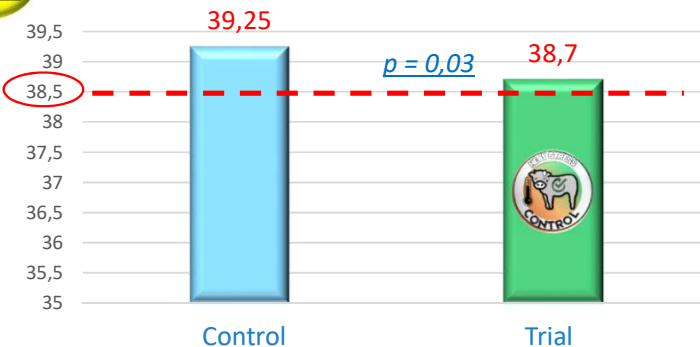


-7 to -8 breaths/min RR
with the kernel (significant)



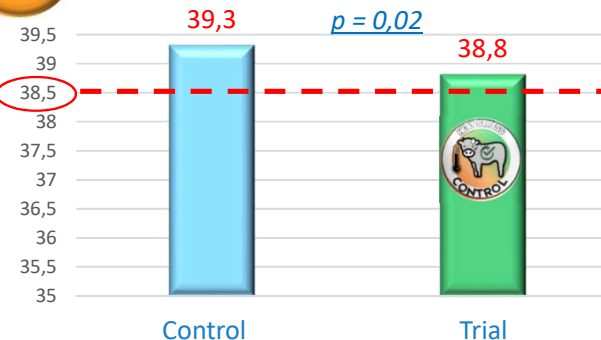
Trial
1

Rectal temperature (°C)



Trial
2

Rectal temperature (°C)

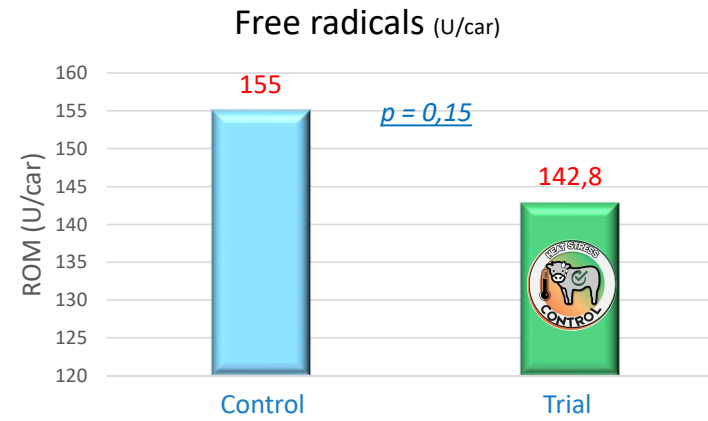
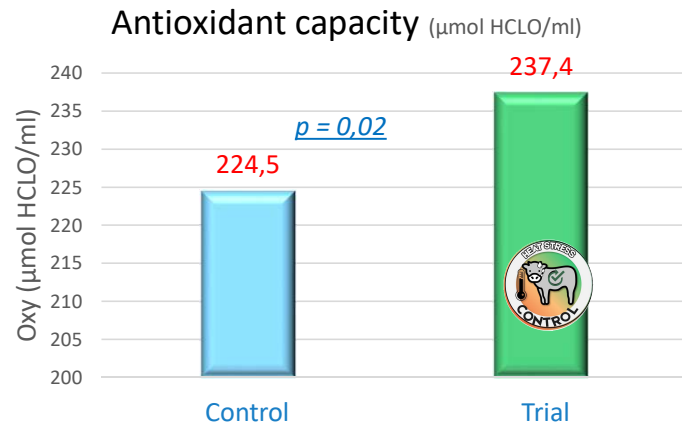


-0,5 to -0,55°C of RT
with the kernel (significant)



Antioxidants status

Trial
results



Significant improvement of the antioxidant capacity thanks to the use of the nucleus

➔ The use of the kernel decrease the production of free radicals

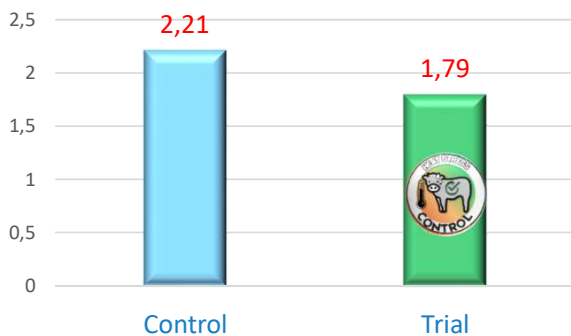
Better resistance of the animals to oxidative stress caused by extended and serious heat stress



Economic gain

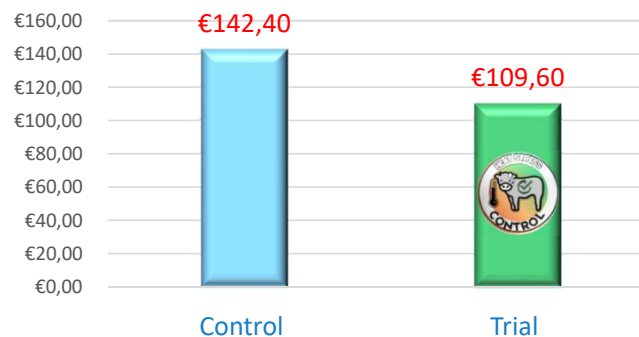
Trial
results

IC average (2 trials)



For 40 kg
Of gain

Cost/calf

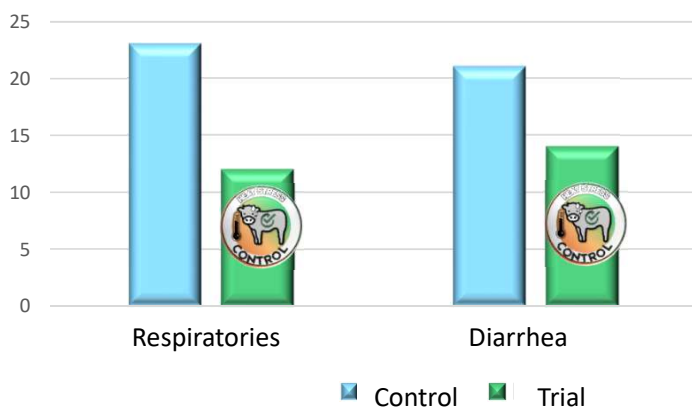


Economic gain 32 €/calf
with the kernel

Price MP
1800€/T

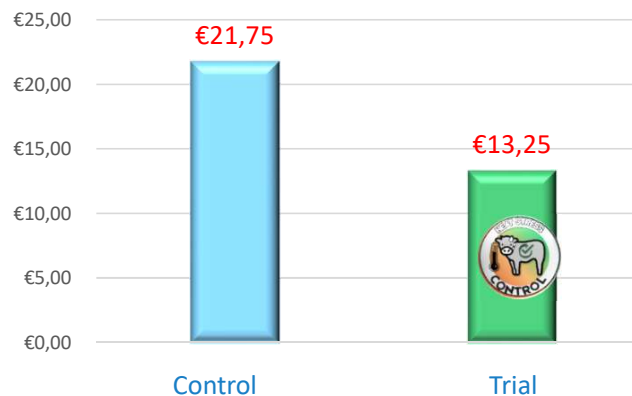


Respiratory diseases and diarrhea (2 trials)



Per calf

Total veterinary treatments costs/calf



Economic gain 8 €/calf
for veterinary treatments
against diarrhea and
respiratory diseases



Respiratory treatment cost= 15€;
Diarrhea treatment cost: 25€
(average costs given by our Italian partners)

The use of the “Heat Stress Control” kernel during the 2 trials allowed :

Significant improvement of growth performances

ADG + 16 % trial 1 / ADG + 30 % trial 2

Improvement of feed efficiency

+18% trial 1 / +27% trial 2

Economical gain of 32€ per calf

Economical gain of 8€ per calf on veterinary treatments

Against diarrhea & respiratory diseases

Significant reduction of economic losses

caused by relapses due to diarrhea and respiratory diseases, and therefore the number of veterinary treatments

Important improvement in respiratory rhythm

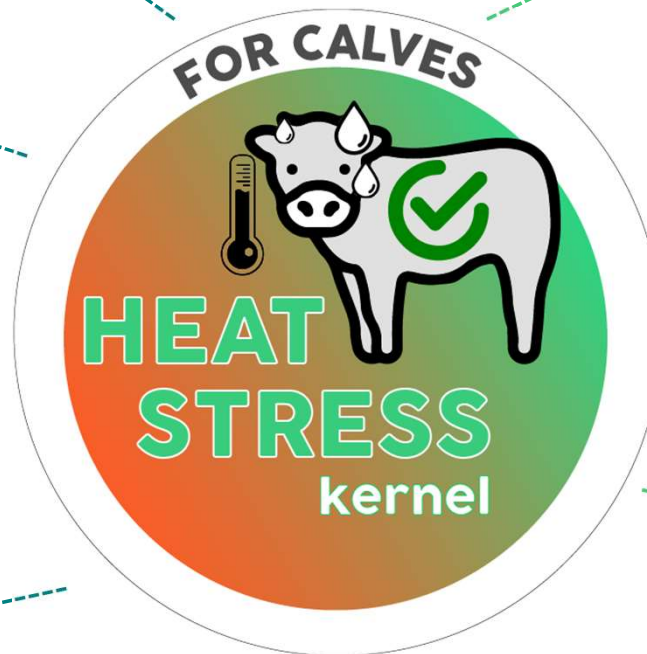
= Welfare

Significant reduction in rectal temperature

= Welfare

Better antioxidant capacity

= Better resistance/ welfare





HEAT STRESS CONTROL kernel
will be soon
incorporated in some formulas of
our milk replacers



**NO
STRESS !**



**THANKS FOR YOUR
ATTENTION**