



BUILDING AND SUPPORTING CLIMATE RESILIENCE IN UPPER RHINE LIVESTOCK FARMING

| Animal health and welfare



HEAT STRESS IN DAIRY COWS



Cofinanziato per l'Unione europea
Fonds européen de développement régional (FEDER)
Von der Europäischen Union kofinanziert
Europäischer Fonds für regionale Entwicklung (EFRE)



Dairy cows are sensitive to high temperatures. The comfort zone for cattle is relatively low, between -5 and 15°C . Dairy cows react to heat stress with reduced feed intake and performance, and even health problems such as uterine and udder inflammation and reduced reproductive performance. As soon as the temperature rises above 15°C , the animals start to set up physiological regulation mechanisms (see figure 1), which requires additional energy expenditure.

Effects of THI on animals

The THI (Temperature Humidity Index) is used to assess the thermal discomfort of herbivores. It takes into account not only the temperature but also the level of relative humidity in the air, which accentuates the effect of heat.

THI	Level of stress	Symptoms	TH-Index																																	
			Luftfeuchtigkeit (rel %)	Temperatur (°C)																																
< 68	no heat stress		20	16	25	17	30	18	35	19	40	20	45	20	50	21	55	22	60	23	65	24	70	25	75	26	80	27	85	28	90	29	95	30	100	31
			20	61	25	61	30	61	35	61	40	61	45	61	50	62	55	62	60	63	65	63	70	64	75	64	80	65	85	65	90	66	95	66	100	66
			20	62	25	62	30	62	35	62	40	63	45	63	50	63	55	64	60	64	65	65	70	65	75	66	80	66	85	66	90	67	95	67	100	68
			20	63	25	63	30	63	35	63	40	64	45	64	50	64	55	65	60	65	65	66	70	66	75	67	80	67	85	67	90	68	95	68	100	69
			20	64	25	64	30	64	35	64	40	65	45	65	50	65	55	66	60	66	65	67	70	67	75	68	80	68	85	68	90	69	95	69	100	70
			20	65	25	65	30	65	35	65	40	66	45	66	50	66	55	67	60	67	65	68	70	68	75	69	80	69	85	69	90	70	95	70	100	71
			20	66	25	66	30	66	35	66	40	67	45	67	50	67	55	68	60	68	65	69	70	69	75	70	80	70	85	70	90	71	95	71	100	72
			20	67	25	67	30	67	35	67	40	68	45	68	50	68	55	69	60	69	65	70	70	70	75	71	80	71	85	71	90	72	95	72	100	73
			20	68	25	68	30	68	35	68	40	69	45	69	50	69	55	70	60	70	65	71	70	71	75	72	80	72	85	72	90	73	95	73	100	74
			20	69	25	69	30	69	35	69	40	70	45	70	50	70	55	71	60	71	65	71	70	72	75	72	80	73	85	73	90	73	95	74	100	75
69-71	low heat stress	<ul style="list-style-type: none"> - search for shady places - faster respiratory rate - dilation of blood vessels - first effects on milk production 	20	70	25	70	30	70	35	70	40	71	45	71	50	72	55	72	60	73	65	73	70	74	75	74	80	75	85	75	90	76	95	76	100	77
			20	71	25	71	30	71	35	71	40	72	45	72	50	73	55	73	60	74	65	74	70	75	75	75	80	76	85	76	90	77	95	77	100	78
			20	72	25	72	30	72	35	72	40	73	45	73	50	74	55	74	60	75	65	75	70	76	75	76	80	77	85	77	90	78	95	78	100	79
			20	73	25	73	30	73	35	73	40	74	45	74	50	75	55	75	60	76	65	76	70	77	75	77	80	78	85	78	90	79	95	79	100	80
			20	74	25	74	30	74	35	74	40	75	45	75	50	76	55	76	60	77	65	77	70	78	75	78	80	79	85	79	90	80	95	80	100	81
			20	75	25	75	30	75	35	75	40	76	45	76	50	77	55	77	60	78	65	78	70	79	75	79	80	80	85	80	90	81	95	81	100	82
			20	76	25	76	30	76	35	76	40	77	45	77	50	78	55	78	60	79	65	79	70	80	75	80	80	81	85	81	90	81	95	82	100	82
			20	77	25	77	30	77	35	77	40	78	45	78	50	79	55	79	60	80	65	80	70	81	75	81	80	81	85	82	90	82	95	82	100	83
			20	78	25	78	30	78	35	78	40	79	45	79	50	80	55	80	60	81	65	81	70	82	75	82	80	82	85	82	90	83	95	83	100	84
			20	79	25	79	30	79	35	79	40	80	45	80	50	81	55	81	60	82	65	82	70	83	75	83	80	83	85	83	90	84	95	84	100	85
72-79	moderate heat stress	<ul style="list-style-type: none"> - increased saliva production - increased respiratory rate - increased heart rate - reduced food intake - increased water consumption - decrease in milk production 	20	80	25	80	30	80	35	80	40	81	45	81	50	82	55	82	60	83	65	83	70	84	75	84	80	85	85	85	90	86	95	86	100	87
			20	81	25	81	30	81	35	81	40	82	45	82	50	83	55	83	60	84	65	84	70	85	75	85	80	86	85	86	90	86	95	87	100	88
			20	82	25	82	30	82	35	82	40	83	45	83	50	84	55	84	60	85	65	85	70	86	75	86	80	87	85	87	90	87	95	88	100	89
			20	83	25	83	30	83	35	83	40	84	45	84	50	85	55	85	60	86	65	86	70	87	75	87	80	88	85	88	90	88	95	89	100	90
			20	84	25	84	30	84	35	84	40	85	45	85	50	86	55	86	60	87	65	87	70	88	75	88	80	89	85	89	90	89	95	90	100	91
			20	85	25	85	30	85	35	85	40	86	45	86	50	87	55	87	60	88	65	88	70	89	75	89	80	90	85	90	90	90	95	91	100	92
			20	86	25	86	30	86	35	86	40	87	45	87	50	88	55	88	60	89	65	89	70	90	75	90	80	91	85	91	90	91	95	92	100	93
			20	87	25	87	30	87	35	87	40	88	45	88	50	89	55	89	60	90	65	90	70	91	75	91	80	92	85	92	90	92	95	93	100	94
			20	88	25	88	30	88	35	88	40	89	45	89	50	90	55	90	60	91	65	91	70	92	75	92	80	93	85	93	90	93	95	94	100	95
			20	89	25	89	30	89	35	89	40	90	45	90	50	91	55	91	60	92	65	92	70	93	75	93	80	94	85	94	90	94	95	95	100	96
80-89	high heat stress	- discomfort due to increased symptoms	20	90	25	90	30	90	35	90	40	91	45	91	50	92	55	92	60	93	65	93	70	94	75	94	80	95	85	95	90	96	95	96	100	97
			20	91	25	91	30	91	35	91	40	92	45	92	50	93	55	93	60	94	65	94	70	95	75	95	80	96	85	96	90	96	95	97	100	98
> 90	danger	- cases of death may occur	20	92	25	92	30	92	35	92	40	93	45	93	50	94	55	94	60	95	65	95	70	96	75	96	80	97	85	97	90	98	95	98	100	99
			20	93	25	93	30	93	35	93	40	94	45	94	50	95	55	95	60	96	65	96	70	97	75	97	80	98	85	98	90	99	95	99	100	100

Figure 1: THI index in lactating dairy cows. According to Zimbelmann & Collier (2009)

➤ Reducing heat stress through feeding

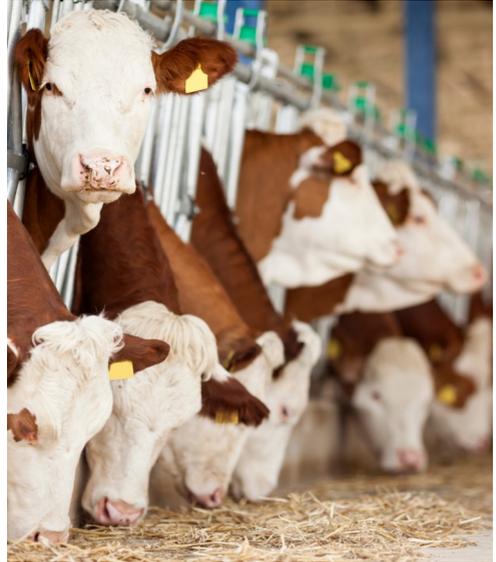
- As cows reduce their dry matter (DM) intake under heat stress, it may be beneficial to increase the proportion of concentrates in the ration. However, this increases the risk of acidosis.

- The ruminal medium can be buffered by adding sodium bicarbonate. Live yeast can also stabilise the rumen and increase pH.

- By adding water to the TMR¹ (35-40% DM), it is possible to reduce the sorting behaviour. The animals also absorb more water via the ration.

- As sweating leads to increased elimination of minerals, it is a good idea to increase the intake of mineral foods (Mg and K) and salt (80-100g).

- To increase feed intake, the ration can be distributed at cooler times.



- When ensiling, ensure optimum compaction and tight sealing of the silo. Choose a silo with sufficient advance (>20cm per day) to avoid overheating.

- The addition of acid stabilises the TMR and reduces heating of the feed area.

- No hard-to-digest fibres, as digestion causes heat production.

- Heat production decreases when dietary fats are used. In this case, the proportion of cereals can be reduced, which minimises the risk of acidosis.



¹Total Mixed Ration

Other important management measures

- When temperatures rise, the water requirements of cows increase significantly (up to 150 l per day). To be able to absorb these quantities, it is best to install open troughs in several places, with trough lengths of 10 cm per cow and high flow rates. Water and drinking troughs should be clean and always accessible. Cold water provides additional cooling.
- Avoid overcrowding: the higher the density of cows, the higher the heat production.
- Due to the negative impact of heat on the immune system, extra attention should be paid to cubicle and alley hygiene to minimise the risk of udder and hoof diseases.
- Additional handling such as transport, dehorning and hoof trimming should be avoided or postponed to cooler times of the day.
- Grazing hours can be shifted to night hours.



In the framework of the mentioned measures, all groups of animals should be considered in the same way. Studies have shown that heat stress has clear negative effects, especially during the transition and calving phases. This can affect the vitality and performance of future calves.

Additional measures

- Ensure that there is sufficient air circulation. Optimise ventilation possibilities. Installing fans can be a worthwhile investment. Critical areas, such as the milking parlour/waiting area, should also be considered.
- If there is sufficient air movement in the barn, the use of misters and showers is a good cooling option.
- Reduce unnecessary exposure to the sun. Ensure that there are shaded areas, especially when animals are put out to graze.