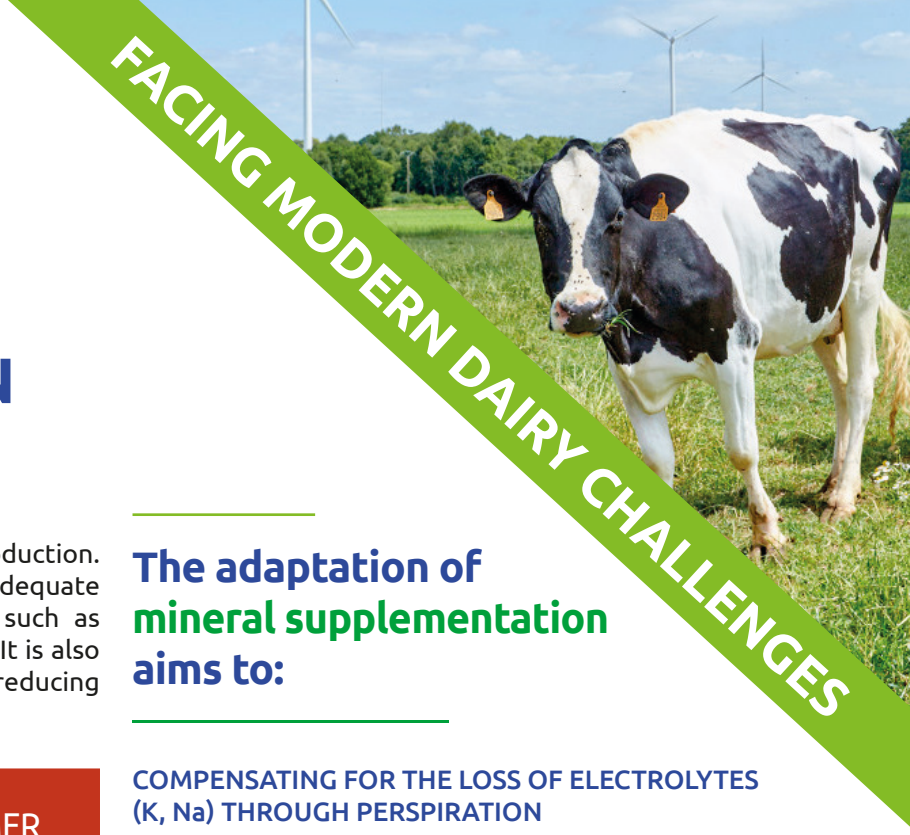
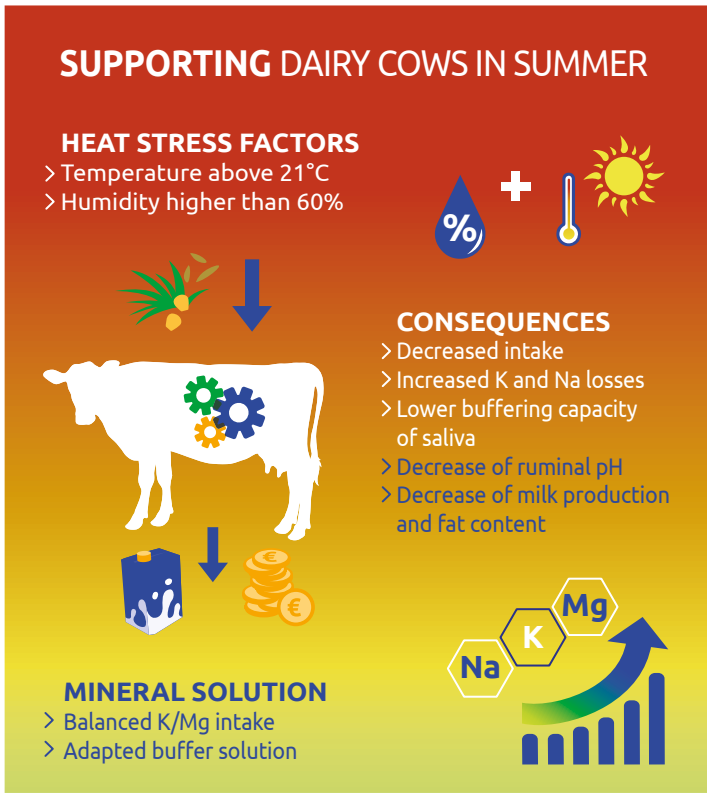
HEAT STRESS
FOCUS ON MINERAL SUPPLEMENTATION



Heat stress management is a key issue in dairy production. During heat stress it is necessary to provide adequate supplementation with mineral macro-elements such as potassium (K), sodium (Na) and magnesium (Mg). It is also essential to protect the rumen environment by reducing pH fluctuations.



Heat stress: risk factors

Dairy cows are sensitive to high temperatures, especially when relative humidity is also high. Heat stress is evaluated with the Temperature Humidity Index (THI). This index takes into account the temperature but also the level of relative humidity in the air, which accentuates the effect of heat. According to the THI, heat stress appears as soon as the temperature exceeds 21°C or with a relative humidity of more than 60%.

The adaptation of mineral supplementation aims to:

COMPENSATING FOR THE LOSS OF ELECTROLYTES (K, Na) THROUGH PERSPIRATION

Under normal conditions (15°C), 25% of the body heat naturally produced by cows is dissipated by lung evaporation (breathing) and perspiration. However, under heat stress conditions, this value increase up to 75%, resulting in higher excretion of sodium and especially potassium.

MAINTAIN A STABLE RUMINAL PH

Cows increase their respiratory rate in hot weather, resulting in a decrease of blood CO_2 concentration, which is necessary for bicarbonate production. This induces the loss of natural buffering capacity of the saliva. At the same time, an increase of concentrates in the diet is recommended, in order to compensate for the lower feed intake by increasing the energy density. This will also increase the risk of Sub Acute Rumen Acidosis.

REBALANCING THE K/MG INTAKE

Magnesium absorption begins to decrease once the total amount of K exceeds 1% of the DMI (dry matter intake). Therefore, it is important to adapt the amount of Mg in the diet during periods of heat stress, keeping in mind the following ratio: at least 4g of Mg for every additional 10g of K[1].

Table 1: Metabolism and needs during heat stress period

Temperature Humidity Index (THI)	72	75	78
Respiration rate	75	80	85
DMI decrease (%)	0	-5%	-10%
DMI (kg/day)	24.1	22.9	21.7
K requirement (% DM)	1%	1.15%	1.30%
Na requirement (% DM)	0.18%	0.23%	0.28%
Mg requirement (% DM)*	0.25%	0.31%	0.37%

** magnesium content adapted in order to compensate for the absorption decrease linked to K supplementation*

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TIMAB magnesium

MAGNESIUM SUPPLEMENTATION RECOMMENDATIONS FOR DAIRY COWS DURING PERIODS OF HEAT STRESS

Adding sodium bicarbonate is not the only option

The addition of sodium bicarbonate to the diet of dairy cows is a well-known practice (Table 2). However, in order to have a high buffering capacity, the dose delivered must be high (≥250g/cow/day). Moreover, the effect on intake and milk production of the additional sodium intake can be generated by the introduction of salt (NaCl) in the diet, which is economically more advantageous[2].

Recommendations in periods of heat stress (Table 1) can thus be obtained by adding salt to the diet (Table 3):

- **85g of potassium carbonate**
- **85g pHix-up**
- **45g NaCl**

Table 2: Solution with sodium bicarbonate during heat stress period

HEAT STRESS SUPPLEMENTATION	DOSAGE IN DIET
$NaHCO_3$ g/cow/day	250g
K_2CO_3 g/cow/day	85g
MgO g/cow/day	40g

Table 3: Solution with pHix-up during heat stress period

HEAT STRESS SUPPLEMENTATION	DOSAGE IN DIET
pHix-up g/cow/day	85g
K_2CO_3 g/cow/day	85g
NaCl g/cow/day	45g

Indeed, **pHix-up at 85g/cow/day has a neutralizing capacity higher than 250g of sodium bicarbonate and a Mg supply higher than 40g of MgO at 51%**. In addition, a high level of Mg^{2+} (necessary to rebalance the K/Mg ratio) in the diet stimulates the production of the precursors required for fatty acid synthesis in the udder, thus maintaining the milk fat content. **The mineral intake linked to heat stress is in this manner reduced by 40% (215g vs 375g) and the cost per cow per day is reduced by 2 to 3 cents.**

The magnesium present in pHix-up at 48.5% is highly soluble, with a high acid neutralizing capacity (39 meq/g), which allows :

- **a stable ruminal pH**
- **a mineral supply at an optimal level**
- **a stabilised milk yield and fat content**

Its speed of action and persistence are perfectly adapted in case of heat stress and ensure complete protection of your dairy cows.

References

[1] Schoneville J.T., Everts H., Jittakhot S., Beynen A.C., 2008 Quantitative Prediction of Magnesium Absorption in Dairy Cows, J. Dairy Sci. 91:271–278.

[2] Schneider P.L., Beede D.K., Wilcox C.J., 1986. Responses of Lactating Cows to Dietary Sodium Source and Quantity and Potassium Quantity During Heat Stress, J Dairy Sci 69:99-110.

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