# Heat stress: nutritional management of pigs in a tropical climate

Brazilian pig production is one of the biggest in the world and Brazil is the fourth biggest pork exporter, but many challenges are being faced by the industry.

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First, reducing production costs is a major challenge as we have to deal with high commodity prices, especiallyfor corn and soybeans, which are the main raw materials in Brazil. Feed makes up around 70-80% of the total production cost.

Secondly, we have to improve efficiency. For this, we are looking towards a shift in terms of investment, especially in technology.

Finally, animal welfare is being more and more scrutinised, driven in particular by international demand. Last, but not least, heat stress is an important challenge, especially in tropical and sub-tropical areas.

## Heat stress impacts all animals

Heat stress has an impact on all animal categories: it has a negative impact on milk production in sows, as well as on grower-finisher performance, translating into huge economic consequences.

Field and university studies have shown that milk production is reduced by 20-25% and, subsequently, so is piglet performance. Under conditions of heat stress, sows reduce their appetite in order to reduce endogenous heat production. This reduction in feed intake results in losses in the productive and reproductive performance of sows.

Modern sows are even more sensitive to heat stress, due to high growth rates, deposition of muscle tissue and hyperprolificity.

In finishing pigs, heat stress impacts protein deposition, which is reflected in carcase quality. Thus, heat stress really impacts the whole cycle, from piglet to finisher.

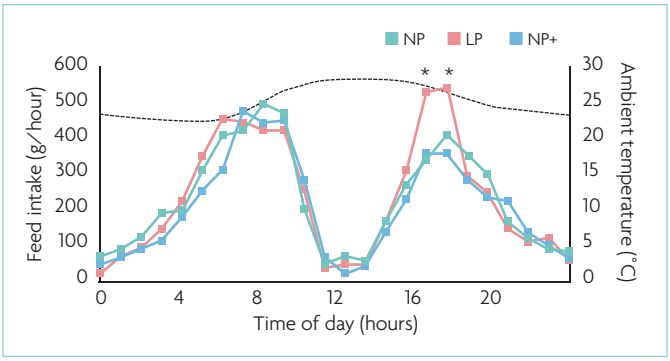


**Fig. 1. Effect of diet composition and time of day on daily feed intake in lactating sows. Each point is the least squares mean of 16, 16, and 15 sows fed normal protein (NP), low protein (LP), and normal protein plus an AA complement (NP+) diets. Asterisks indicate a diet effect (P< 0.05) on hourly feed consumption. The top solid line represents the average daily pattern of the ambient temperature (Silva et al., 2009).**

## Management strategies

Heat stress management is a multi-factorial approach around three axis:

- Genetic adaptation.
- Environmental solutions (cooling systems).
- Nutritional approaches.

Environmental changes are the first strategies to adopt. There is no nutritional strategy or genetic selection that can actually compete with the benefits of changing the environment.

Pigs have a very limited thermo-regulation system and the goal of any environmental approach is to enable the sow to have a more efficient thermoregulation in order to keep up with its genetic potential.

It is effective to work with cooling systems that improve heat dissipation via sensitive processes, such as floor cooling, drip cooling, drinking water or snout cooling, or changing the whole climate in the building. However, these environmental changes are costly and not accessible to all farmers, particularly to many tropical small-scale producers.

In the longer term, genetic adaptation is definitely a tool to help the industry cope with heat stress challenges. Selecting pigs and sows with a more efficient thermoregulatory response is essential. For example, in Brazil, there are already genetic lines on the market that are more robust against heat stress.

These selected sows show better performance under heat stress, especially regarding feed intake. Feed efficiency and milk production are also improved. The way these sows use nutrients is more efficient and the sows are more tolerant to heat. Finally, nutritional strategies represent an alternative, short-term and economically relevant approach that can be recommended to attenuate the negative effects of heat stress. These include dietary manipulation and/or the use of feed additives.

## Focus on nutrition

Nutritionists recommend several strategies to mitigate the effect of heat stress on sow feed intake and performance:

- Reducing crude protein (reducing soybean meal and supplementing industrial amino acids), with an aim at reducing the thermal effect of the feed (Fig. 1).

- Modifying the electrolytic balance, inducing a metabolic acidosis. One of the effects of heat stress is a respiratory alkalosis: excess of $CO_2$ is lost through panting, leading to an increased blood pH. The body releases acids to compensate, which induces a complexation of protein molecules with calcium, which is no longer available for milk production. Reducing crude protein also helps reduce the electrolytic balance.
- Sensory imprinting. Depending on the region, there can be strong daily

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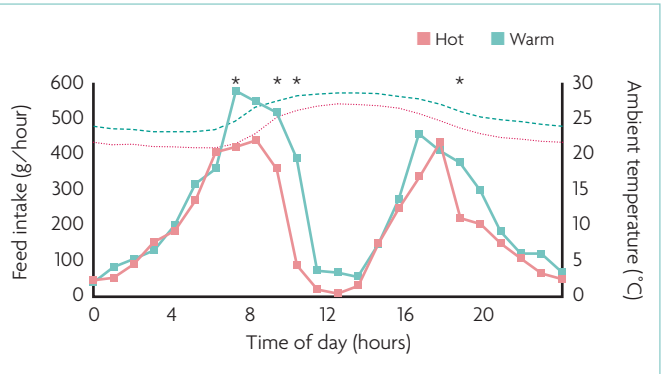
**Fig. 2. Effect of season and time of day on the daily fluctuations of ambient temperature (dotted lines) and daily feed intake in lactating sows (solid lines). Each point is the least squares mean of 18 sows in the warm season and 29 sows in the hot season. Asterisks indicate an effect of season (P < 0.05) on hourly feed consumption (Silva et al., 2009).**



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fluctuations between day and night. Thus, there are moments when the sows have the opportunity to eat more (Fig. 2).

Therefore, feed intake can be better stimulated by what we call 'sensory imprinting' with flavouring, especially when the temperatures are cooler in the evening and night.

Some studies have shown that the constant use of flavours could enhance feed intake and attenuate negative effects of a chronic heat stress.

● Improving feed digestibility by enhancing digestive microflora. Feed additives such as live yeast can also be a viable alternative.

Regarding the latter, the team at Lallemand Animal Nutrition conducted a trial in the northeastern region of Brazil, which shows the effects of live yeast Saccharomyces cerevisiae boulardii I-1079 supplementation of high-prolific sows both during the end of gestation and lactation under heat stress conditions.

During the last days of gestation, the supplementation leads to an improved farrowing process.

The number of live-born piglets was increased, while the mortality rate at birth decreased (5.00% vs. 4.02%).

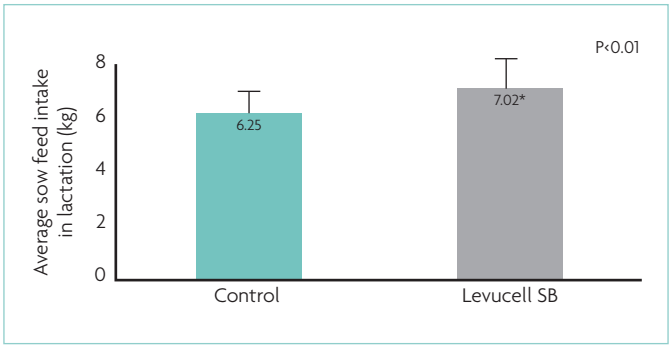


**Fig. 3. Effect of S. cerevisiae boulardii I-1079 supplementation under heat stress on sow feed intake in lactation (University Federal de Minas Gerais, Brazil, 2016).**

During lactation, sow feed intake was significantly higher with the supplementation (Fig. 3), leading to better preservation of the sow's body reserves during this critical phase.

Consequently, the sows are better prepared for the next reproductive cycle and piglet growth performance is preserved.

In this trial, piglet average daily gain in lactation was significantly improved by +8.2% vs. control (Table 1). This leads to heavier piglets at weaning.

When looking at milk composition, the team reported a higher fatty acid profile, indicating that the piglets benefitted from the sow's improved gut health and function, which leads to better nutrient absorption and, consequently, improved milk composition. Apart from better feed intake, one of the main drivers in the live yeast benefits could be an improved feed digestibility, an effect of Saccharomyces cerevisiae boulardii I-1079 increasingly well demonstrated.

In conclusion, heat stress is becoming an important issue, which concerns all major swine production facilities, with significant health and financial impact.

Prevention is always better than cure and different management approaches exist to alleviate the impact of heat stress.

Among them, nutritional approaches that could help improve feed intake, gut health and lactation efficiency of heat stressed sows and therefore allow piglets to benefit at weaning by improving vitality, survival rates and performance, represent interesting tools for nutritionists. ■

References are available from the author on request

**Table 1. Effect of sow feed supplementation with S. cerevisiae boulardii I-1079 under heat stress on piglet growth performance in lactation (University Federal de Minas Gerais, Brazil, 2016).**

| | Control | Levucell SB | P value |
|---|---|---|---|
| Piglets average daily gain (g/day) | 218 | 236 | 0.021 |
| Piglets average weight at weaning (kg) | 5.88 | 6.30 | 0.001 |