

Feeding the mammary cells and improving milk yield and quality

The structure of the mammary gland changes during the lactation cycle, and explains the variations in milk production.

In connection with these phenomena, the CCPA Group has developed Axion Start, a nutritional solution based on a patented extract of *Scutellaria Baicalensis*, which increases milk production and persistence, while contributing to milk quality.



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The appearance of a lactation curve is well known: a phase of rise after calving, a more or less high and durable peak, then a phase of regular decrease leading to drying up.

What is less well known is that, during this cycle, the udder structure constantly evolves and makes it possible to explain these different phases. Several phenomena occur during a cycle:

- Mammary epithelial cells, milk secretors, multiply. The secretion capacity of these cells is also stimulated. This leads to an increase in milk production
- From the mid-time of lactation, a mammary remodelling occurs. The udder tissues reorganise, disrupting the secretory epithelium and penalising lactation.

But this is not all. Another phenomenon – the exfoliation of mammary epithelial cells – is also at work, this time during milking.

Lucile Hervé, Doctor of Biology and Animal Physiology at INRA de Saint Gilles, France, conducted a

thesis on the relationship between mammary epithelial cells and milk production. "A better knowledge of the structure of mammary tissue helps to understand the reasons for a temporary decrease in milk production," she says. During milking, a process of exfoliation of the mammary epithelial cells (MEC) takes place and the analysis of the composition of the milk allows a better understanding.

"This process of exfoliation of MEC occurs mainly during milking, but also between milking," explains Lucile, who adds that "this loss of cells induces a loss of permeability of the epithelium that allows a migration of leukocytes into milk."

Because of this loss of permeability, other molecules can cross the epithelium. That is the case with lactose, its measurement in blood plasma is the best indicator of epithelial integrity. At each milking, "the mammary epithelium loses its integrity, then finds it again at the end of milking," added Lucile.

Therefore, if we can play on this

mammary tissue dynamics, we will be able to influence production, with an approach that is totally different from anything that has been practiced until now.

Flavonoids – key vitamins for cell protection

Discovered in 1935 by Hungarian Professor Albert Szent-Györgyi, flavones (one of the flavonoids families), were the subject of a first article in the journal *Nature* in 1936, highlighting their vitamin-like nature (A. Szent-Györgyi named them "Vitamin P") and biological activity that improved cell protection.

Indeed, these vitamins contribute to three phenomena:

- A stimulation of the NRF2 gene expression, which activates the inner defence mechanisms of cells.
- A reduction of inter-cellular permeability.
- An indirect antioxidant activity, in synergy with vitamin C and other antioxidant vitamins. This original

mode of action explains why flavonoids at low doses can play a significant role in animal metabolism and cell integrity, even though their direct antioxidant activity can be limited.

However, these essential organic compounds for growth and nutrition can not be synthesised by the animals. Their presence in fodder is variable, with a higher amount of flavonoids in natural grasslands and the lowest rates in corn silage for example.

The solution that reconciles milk quality and production

Considering the mammary tissue dynamics and the prospects offered by flavonoids, the CCPA Group has developed Axion Start, a natural nutritional solution for dairy cows, based on a combination of several flavonoids: a patented extract of *Scutellaria Baicalensis*, green tea, grape as well as rumino-protected vitamin C, all acting in synergy. *Scutellaria* contains a great quantity of vitamin P, a flavone called baicaline that activates mammary epithelial cells protection (Nrf2).

Axion Start increases the number of secretory mammary epithelial cells, their lifetime, and as a consequence, milk yield and milk persistence. Moreover, Axion Start strengthens the cell barrier integrity, reducing the exchanges between milk and blood and leading to a better quality milk.

Many tests have been conducted since the solution's commercial launch in 2014. Under experimental conditions, tests carried out on European dairy farms resulted in a 6% improvement in milk production, for the batch supplemented with Axion Start.

Further field observations on 22 farms in Northern and Eastern France, representing a total of more than a thousand cows, resulted in an average response of 1.5-2.0 litres of extra milk per day for the cows supplemented with Axion Start. ■

Table 1. The udder structure is constantly evolving.

	Mammary cells	Remodelling	Impact on milk production
Beginning of lactation	Proliferation > death → Increase in the number of secretory cells	No	High increase
Lactation	Proliferation = death → Stabilisation of secretory cells	Moderate	Stabilisation
End of lactation	Proliferation < death → Decrease in the number of secretory cells	High	Fall of production, drying up

References are available from the author on request