Optimising potential in early lactation

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Genetic progress combined with improved nutritional management can increase performance. For example, in Wisconsin, average milk production per cow increased by 21% between 1991 and 1999, from under 14,000lb per year to 17,246lb, and is still increasing to a slower but steady pace of around 2% per year.

Increased productivity puts extra pressure on the animals' metabolism and health, especially during stressful periods of their life cycle.

For example, the peri-partum phase, with the establishment of lactation is a very critical point for cow metabolism and health.

Immunity and appetite are lower, and metabolic troubles frequent, such as ketosis, which shows a higher prevalence among high producers.

Calving and early lactation are at the cornerstone of the whole milk production campaign and the cow's next cycle.

Therefore, today's nutritionists and dairy herd managers must be even more careful to adapt the diet to the needs of early lactating cows and optimise the energy balance, but also optimise herd management and environment in order to limit additional stress factors, maximise feed intake and the cow's digestive physiology.

Phoderush is a natural blend of feed additives that has been designed by nutrition and olfaction experts within the French company Phodé, to optimise the physiological potential of highly productive farm animals.

This article looks at a recent trial to assess the benefits of Phoderush on the metabolism and milk production of early lactating Holstein cows.

This trial shows that the cows are in a better metabolic status when they receive the additive after calving, and the subsequent milk production is improved.

An innovative formulation

Phoderush is a blend of natural plant extracts that has been specially developed to optimise the physiological potential of highly productive farm animals during critical and stressful points of their life cycle, such as parturition and early lactation, but also feed transition, transportation and pen changes, heat stress, weaning and gestation.

It comprises three types of specially selected elements:

- Selected spices.

These are shown to strengthen the body's antioxidative defences and increase feed efficiency by improving the physiology of digestion (stimulation of saliva production, pancreatic enzymes activity, biliary secretions, gastric and intestinal motility, and increased mucosa permeability for nutrient absorption).

- A specific aromatic core destined to stimulate the animal's appetite and increase voluntary feed intake.
- A natural energy supply with high metabolic yield, to compensate for the loss of appetite associated with stress at times of high energy requirement.

Its role is to preserve the animal's body resources and also the liver function.

Adapted to early lactation

Stresses have a negative impact on appetite and feed intake. Phoderush aromatic core stimulates oropharyngeal receptors directly linked to the appetite centre.

Moreover, attractive ingredients stimulate voluntary feed intake. The

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Fig. 1. Effect of Phoderush aromatic core on the daily feed intake of dairy cows (mean of four trials, 410 cows, Génuol).

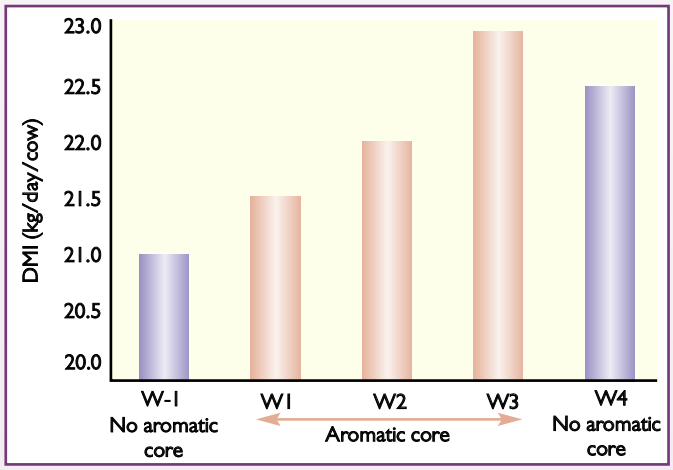
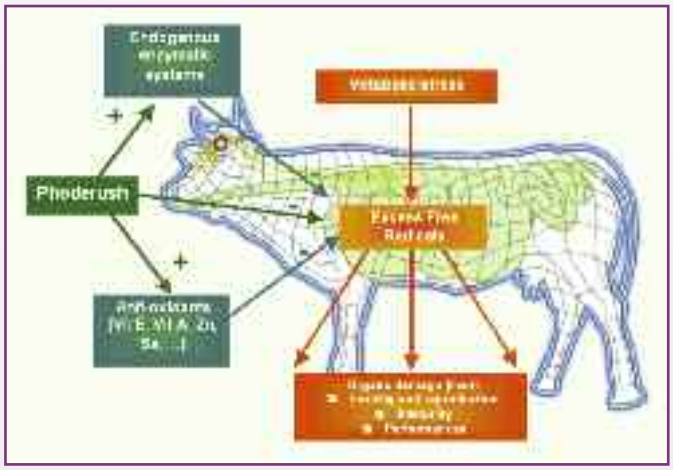


Fig. 2. The proven anti-oxidative effect of Phoderush acts on both arms of the body's natural anti-oxidative mechanisms – the anti-oxidant compounds and the anti-oxidant enzymatic system.



Ingredient (% of DM)	TMR (%)
Corn silage	26.52
Alfalfa haylage	20.49
Ground corn	19.84
Soybeans (cooked)	8.66
Liquid molasses	4.31
Cookie meal	3.88
Cottonseed hulls	3.80
Canola meal	3.75
Minerals and vitamins premix	3.32
Alfalfa hay	3.01
Soybeans (heat treated)	2.42
Chemical composition	**Means ± SD**
Dry matter (%)	56.56 ± 3.11
Crude protein (% of DM)	16.00 ± 0.10
NEL (Mcal/kg)	1.62 ± 0.03
ADF (% of DM)	24.33 ± 0.98
NDF (% of DM)	35.77 ± 3.25

Table 1. Percentage of ingredients and chemical composition of the basal lactation TMR fed during the trial.

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dairy cow's appetite and feed intake can thus be optimised during these stress periods.

These effects have been demonstrated in field trials across Europe.

Phoderush aromatic core was tested on four farms, involving 410 cows in total, during mid lactation (around 150 days). In each trial, feed intake increased with time and, as a consequence, milk yield was increased by 1.7kg per day on average (Fig. 1).

Around calving, with the onset of lactation, the energy needs of dairy cows are greatly increased, while feed intake is still low. As a result, the cow energy balance is always negative, leading to body fat utilisation and liver neoglucogenesis.

To limit the disastrous metabolic consequences usually linked to parturition and early lactation, this product provides a concentrate of energy. Last, but not least, early lactation is typically a period of high oxidative stress for the cow.

At cell level, oxidative stress (the excess of free radicals in the organism) results in the damage of the phospholipids constituting the cell membrane, proteins or DNA, with consequences on major cell functions, their proliferation or death.

In dairy cows, oxidative stress can lead to alterations of cellular structures, resulting in organ damage, in particular the liver; decreased immunity, resulting in higher risks of placenta retention, mastitis, milk fever, respiratory and digestive diseases; impaired reproductive functions (decrease in fertility, viability and vitality of embryos and offspring); and loss of performance (decrease in growth rate and milk production, increase of the feed conversion rate).

The spice extracts contained in the product have the unique ability to help restore the oxidative balance by acting at various levels of the body's own anti-oxidative systems (Fig. 2):

- They stimulate the activity of the endogenous anti-oxidant enzymatic systems, while inhibiting the pro-oxidant endogenous enzymes.
- They protect the cells against free radicals by scavenging them.
- They protect the cells against lipid peroxidation, which is the main source of cell membrane damage in organs such as the liver.

As a result, the animal's body defences, metabolic status and liver integrity are preserved.

New field evidence

In order to confirm the benefits of Phoderush formulation for dairy cows, a field trial was conducted between September 2006 and January 2007 in a research station in the USA.

Some 39 gestating Holstein dairy cows were divided between two groups, equivalent in terms of parity, previous milk production and expected calving date.

After calving, the two groups received the same diet (Table 1), supplemented or not (control) with 250g/cow/day of the product, fed as a topdress, once daily, from the

Table 2. The effect of Phoderush on average feed efficacy in early lactation and the return on investment.

	1-3 weeks	1-6 weeks
Effect of Phoderush on feed efficacy vs control	+11.5%	+10.4%
Return on investment	1:3	1:5

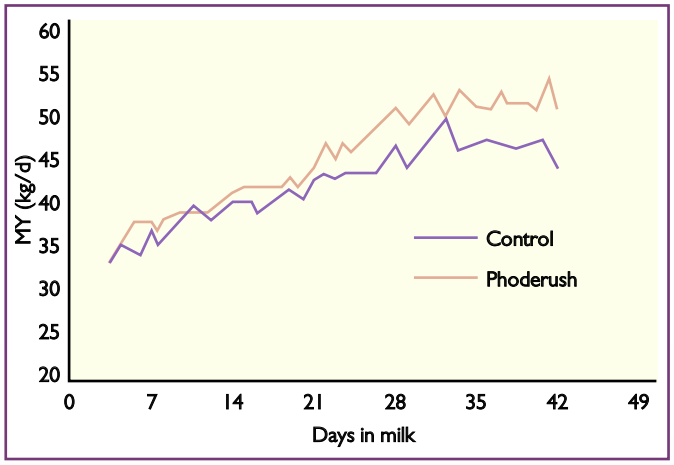

Fig. 3. Effect of Phoderush additive on dairy cow productivity in early lactation.

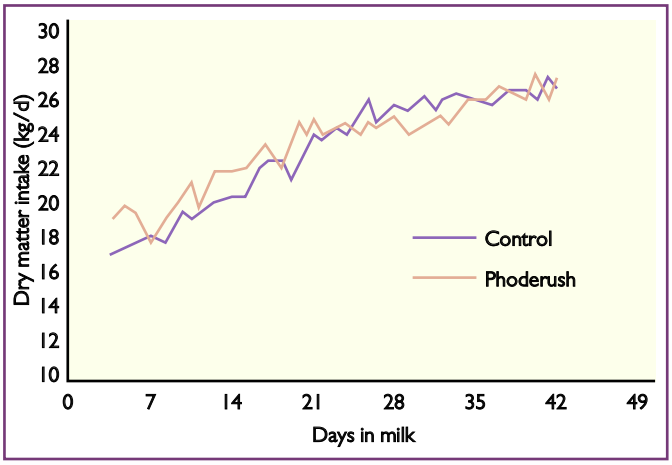

Fig. 4. Evolution of daily dry matter intake in early lactation, showing the 'smoothing' effect of Phoderush.

day of calving to week three post-calving. The cows were milked twice daily.

Increased feed efficacy

Phoderush treatment had no significant effect on milk yield during the three weeks of supplementation, but, interestingly, the group that received the treatment produced more milk between weeks three and six (+4kg/day, Fig. 3), once the lactation was set up. Protein and fat yields were similar between the two groups.

This could indicate that a product of this type is able to optimise the cows' metabolism and better prepare it for milk production.

Feed intake was also monitored in both groups, showing that Phoderush improved feed efficacy, increasing the value of feed for the farmer. The return on investment (ROI) could be estimated between 1:3 and 1:5 (Table 2).

Moreover, if we consider the day to day variations of feed intake, we notice that the treatment had a positive effect on feeding behaviour, which is a good indicator of cow status and an important factor of digestive health.

In the first days after calving, when the cows' feed intake capacity and/or appetite is down, while their nutritional requirements are greater, it is important that the cows have a regular and sustained feed intake, as observed with Phoderush (Fig. 4), and an optimal feed value.

Metabolic status

In the same trial, with a view to highlighting the effects of Phoderush on early lactating cows metabolism, blood metabolites (glucose, β–hydroxybutyrate (BHBA), non esterified fatty acids (NEFA), insulin and urea nitrogen), were analysed weekly, approximately two hours after morning feeding, and urine ketones were assessed. The effect of the additive on urine ketones was the most notable.

On average, Phoderush led to over a 2.5 fold reduction of urine ketones compared to control (P= 0.18), indicating a dramatic reduction in blood ketones (Fig. 5).

These results show that, even though the cows in the treated group had a tendency to eat less DM, they mobilised less body fat in early lactation than the control cows.

This is certainly due to an improved feed utilisation and the readily available energy supply brought by the additive.

Thus, Phoderush helped improve the cows' metabolic status.

This important effect on urine ketones also points to the potential benefits of this product in the prevention of ketosis in early lactation.

Since ketosis incidence was already low in the experimental groups, it could be interesting to pursue investigations in higher risks animals, in order to assess the efficacy of Phoderush as a natural alternative for the prevention of ketosis in early lactation.

Overall blood level of β-hydroxybutyrate, a product of incomplete oxidation of non esterified fatty acids in the liver, was slightly lower (non significant) with Phoderush.

But its variations in time are more informative. In fact, they reflect those of the urine ketones: for the two parameters, both indicators of body fat utilisation, there is a significant reduction at day 14 (Table 3), compared to control, while, at day 21, the control group had caught up with the treated group.

These trends suggest that in the presence of Phoderush the animal metabolism is restored earlier.

It seems that the critical period for the cows' metabolism (utilisation of body fat, deficient energy balance) is shortened by about one week with Phoderush, with positive effect on the rest of the milk production campaign. These observations are correlated with the blood glucose levels.

While overall blood glucose level was not significantly different between the two groups, there was also a noticeable difference at day 14 into lactation (Table 3).

Then, both values were equivalent at day 21 (±58.7mg/mL). Again, it seems that the cows' metabolism was restored more quickly with this approach. These data are correlated further with the increased milk yield observed after three weeks with the additive.

From these data we can conclude that cows receiving Phoderush responded by better expressing their physiological potential and increasing milk yield.

There was no effect of the additive on NEFA, also issued from lipids mobilisation, but lipids mobilisation was higher in the treated group at time zero, which may be due to a difference between both average live weight, non significant but numerically high.

The treated group cows were on average 31kg lighter than control before the study. This difference in the two groups at start can also explain that body weight and energy balance were numerically lower in the treated group, while the feed utilisation was improved.

The properties of Phoderush, a blend of an aromatic core, antioxidative natural extracts and a natural energy source, are well reflected in the various trials. Feed intake is either improved or more regular, and feed efficiency is enhanced, certainly resulting from better digestive functions, nutrients absorption and energy supply.

The cows metabolism is improved too, with less pressure on the cows body reserves and hepatic function. As a consequence, milk yield is improved after the transition period.

In conclusion, a product of this type helps high producing dairy cows cope with the metabolic pressure of early lactation, and enables them to express their full physiological potential in a natural way. ■

	Control	Phoderush	P=
Urine ketones (mg/dL)	21.4	1.7	0.08
Blood BHBA (ÌM)	1047	688	0.10
Blood glucose (mg/dL)	57.2	54.2	0.15

Table 3. The effect of Phoderush on the metabolic status of dairy cows at 14 days.

Fig. 5. Effect of Phoderush on average urine ketone contents.