# The use of conjugated linoleic acids for better dairy cow performance

*by Wayoon Poonperm and Arnulf Troescher, BASF.*

For decades, dairy cows have been selected with an intense focus on higher milk yield, however, it resulted in a continued decrease in expected useful life and fertility. The following frequently cited example, from Butler, illustrates the problem. In the American state of New York between 1951 and 2001 milk output rose from around 4,200kg to 10,000kg. Over the same period the fertility rate dropped from around 66% to36 % (Fig. 1) and the same development of declining fertility in cow has been observed in many countries worldwide.

This because of the increasing negative energy balance (NEB) in the period before they give birth and at the beginning of lactation which leads to an altered metabolic state that has a major effect on cow health and fertility. One influencing factor causing NEB is the inadequate availability of glucose for their high milk yield during the start of lactation. It leaves the cow with an increased release of free fatty acids that can not be metabolised. This results in additional strain on the liver. It goes along with a rise of beta-hydroxybutyric acid levels in the blood. The animal's metabolism enters a ketotic state, which is related to a reduced feed intake and fatty degeneration of the liver. Especially during early lactation, this is often the starting point for additional complications that ultimately have a negative effect on health and fertility of the dairy cow.

| | Increased dry matter intake (kg) | |
|---|---|---|
| | Before calving | After calving |
| Bernal-Santos 2003 | 1.0 | 0.4 |
| Castaneda 2005 | 1.3 | 0 |
| de Veth 2005 | No data available | 0.7 |
| Odens 2007 | No data available | 1.4 |
| Castaneda 2007 | No data available | 0.2 |
| Metzger-Petersen 2008 | No data available | 1.0 |

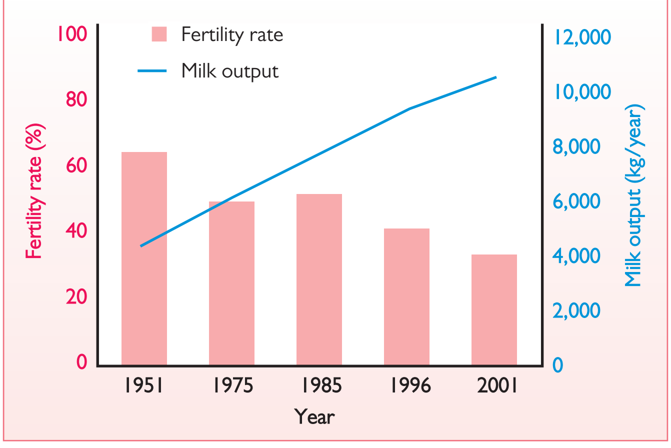
***Table 1. Higher intake of dry matter as a result of CLA feeding.***

| | Control group n = 8 | CLA group n = 9 | Difference |
|---|---|---|---|
| Natural milk (kg) | 37.50 | 41.60* | +9.86 |
| Fat (%) | 4.03 | 3.41* | -18.18 |
| Fat (kg) | 1.51 | 1.40 | -7.86 |
| Protein (%) | 3.28 | 3.17 | -3.47 |
| Protein (kg) | 1.22 | 1.30* | +6.16 |
| Lactose (%) | 4.77 | 4.71* | -1.27 |
| Lactose (kg) | 1.72 | 1.90* | +9.48 |
| ECM (kg) | 37.30 | 37.90 | +1.60 |
| Live weight (kg) | 650.00 | 661.00 | +1.67 |

*Significant difference ($p < 0.05$)

***Table 2. Biological performance in the first 100 days of lactation.***

***Fig. 1. Milk output and fertility data for herds from the American State of New York (Butler, 2003).***




The NEB can hardly be compensated by a customised feeding program as the cow often takes the average of 85-100 days postpartum to reach its maximum feed intake capacity. The best way to improve the cow's intake of nutrients is to increase the energy density of the feed by concentrated feed containing high fats, starch-or sugar- rich components.

This approach however is not without danger since the change from dry cow feed to lactation feed needs time for adjustments in rumen fermentation. In many cases we see that the increase in fermentation rate or an interference with fermentation by too much fat reduces the pH value in the rumen and leads to ruminal acidosis.

A new approach to overcome metabolic stress associated with NEB is to reduce energy requirement per litre of milk by lowering the milk fat contents with CLA in early lactation.

A number of scientific studies confirmed that, lowering the fat content per kilogram of milk by administering rumen-protected conjugated linoleic acids (RP-CLA) via the feed, results in increased milk output and helps to decrease the intermediate glucose requirement for the milk synthesis and therefore optimises the dairy cow's energy balance. Rumen-protected CLA measurably relieves the metabolism and the dairy cow copes much better with this critical, unavoidable phase of negative energy balance at the start of lactation.

## Energy management

CLA was proven to improve performance of dairy cows by improving metabolic problems during the critical phase of NEB at the start of lactation and the correlated fertility issues. Administering Lutrell Combi (rumen-protected CLA) systematically in the close-up and early lactation phase showed to help in:

- **Relieving the metabolism**

The increasing NEB is a principal cause for the problem complexes associated with fertility and well being, along with the correlated overload from fat mobilisation. It is also thought that a shortage of glucose, a particularly critical factor for ruminants, plays a crucial part in this connection. The body fat reserve was used to generate energy, synthesis of milk lactose and synthesis of milk fat call for glucose.

Rumen-protected CLA represents a unique approach, based on relieving the lipid metabolism by reducing the milk fat content and so freeing up glucose that is saved from the milk fat synthesis (for example less glycerol and de-novo fatty acids) to produce more milk and to support the glucose requirements of other tissues. This means that more glucose is available to the reproductive organs (ovaries, uterus etc) and to the immune system. Numerous trials, backed up by practical experience, have shown that cows that were given CLA as early as the transit phase have a higher feed intake (Table 1).

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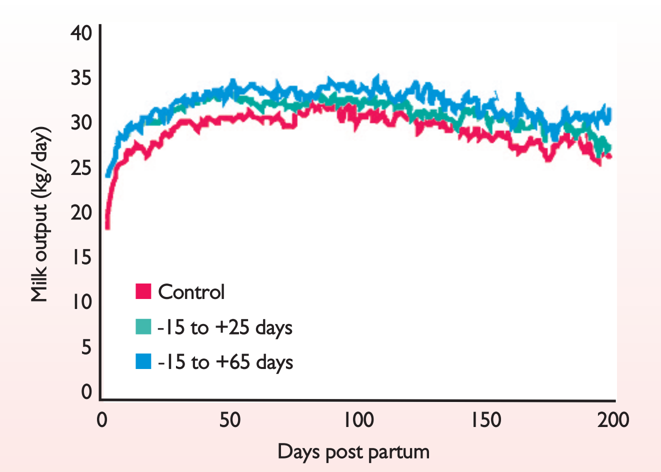


*Fig. 2. Increase milk output with CLA.*

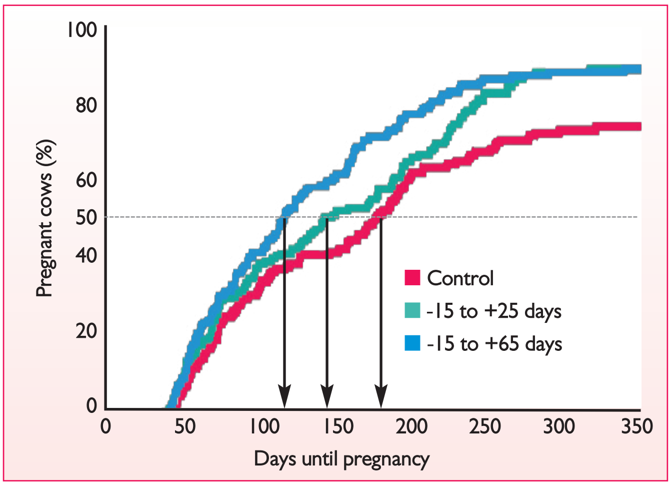


*Fig. 3. Reduced number of days open with CLA (large scale trial) (Jasso et al, 2009).*

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● Improving fertility

The ovarian cycle of the cow is heavily dependent on the animal's energy levels – where energy is lacking, fertility will be bad.

Using rumen-protected CLA helps to improve the fertility by rising of glucose level in the blood in the first week of lactation. As many scientific papers show, this is highly correlated with better fertility results. Glucose triggers hormones like insulin, IGF-1 and ultimately progesterone which are responsible for the successful pregnancy.

As a result, animals start their cycles earlier and the embryo meets much improved conditions and can therefore settle into the uterus more safely. Glucose status improvement also results in an earlier start to oestrus, more pronounced oestrus symptoms, a rise in the Non Return Rate coupled with a lower insemination index and a shorter number of days open.

In a large-scale trial, 450 freshly lactating cows were divided into three groups shortly before calving. A control group (red) was given a standard TMR diet (total mixed rations based on corn silage, grass silage, corn grain and soy bean meal, including protected fat); one of the test groups (green) was given 60g CLA per day from 15 days before calving to 25 days after calving, and the third group (blue) continued to receive CLA until the 65th day following calving.

From Fig. 2, the control animals reached a milk output of around 35kg per day, while the CLA animals took less time to reach a level of over 37kg per day. On average the 'blue' CLA group yielded 4kg more milk per day than the 'red' control group (statistically highly significant). The 'green' group too almost reached the same level as the 'blue' group. It is particularly interesting to note that the CLA effect persisted after the treatment was discontinued.

From Fig. 3, positive effects on fertility have also been reported. It took 171 days for 50% of the animals of the control group to become pregnant, while in the CLA group, 50% were pregnant after 140 and 115 days respectively.

Fig. 4 showed the statistical evaluation (meta-analysis) of five separate studies that confirmed that rumen-protected CLA has an obvious and positive effect on fertility. With CLA-supplemented diets, 50% of the cows became pregnant again after 105 days of lactation, while the control group only reached this level after 143 days. CLA thus reduced the number of days open for 38 days.

● Increasing milk yield

Rumen-protected CLA lowers the milk fat content per kilogram of milk and therefore optimises the dairy cow's glucose and energy balance. It depends on the state of energy status of the cow whether she uses this glucose for more milk production or for body weight management.

The House Riswick Agricultural Centre in Kleve, Germany has investigated the effects of CLA on the yield and composition of the milk of dairy cows.

Over a three-week preparatory period and in the first 80 days of lactation, the cows were given CLA instead of rumen protected fat daily in a compound feed. A control group was given the same feed but with rumen protected fat.

Table 2 shows the biological performance of the cows up to the 100th day of lactation. The saving in glucose which is not used for fat synthesis can produce more lactose and therefore more milk.

In the treatment group, an increase of milk yield of +10% was observed. At the same time, the receiving CLA had a 6% lower fat content than that of the control group. A higher protein yield was also found where CLA was administered.

Fig. 5 shows patterns of milk output during the first 180 days. The effect of CLA on the volume of milk was ongoing. Even 100 days after the end of CLA feeding, the daily quantity of milk produced by the CLA group was still higher than in the control group.

## Conclusion

The use of Lutrell Combi or a rumen-protected CLA reduces the energy requirement per litre of milk during the critical phase of the unavoidable NEB at the start of lactation.

Among other things, this leads to a higher glucose level in the blood and higher milk yields. Furthermore, fertility and health are improving due to the higher glucose availability, which measurably extends the expected useful life and life performance of the dairy cow. ■

*Fig. 4. Reduced number of days open with CLA (Meta analysis).*

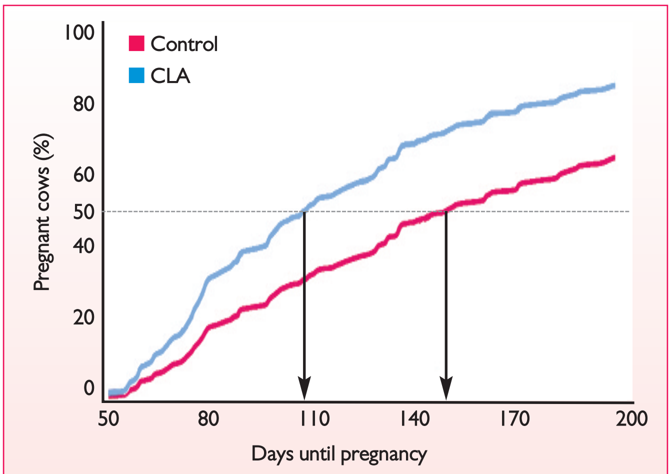


*Fig. 5. Natural milk yield production in the first 180 days of lactation (Metzger-Petersen, 2007)*