Energy Supply
Basics and recommendations for the energy supply of dairy cows.
“The dairy cow’s life effectiveness is based largely on the optimal supply of energy.”
Over the last decades, developments in the breeding industry have brought the genetic potential of daily milk-yield into a much wider spectrum of herds. This increase in milk production leads simultaneously to an increase of requirements on ration, especially in regard to the supply of energy.

Energy deficiency leads to problems with health and fertility and are particularly noticeable during the lactation period. Currently the average lactation on dairy farms is less than three. This is often due to increased culling of young cows caused by metabolic disorders or subsequent illnesses.

In order to improve sustainability of it’s economic situation, the dairy industry must take high milk-yield into account, while at the same time bearing in mind the dairy cow’s life expectancy and performance. Recent economic studies list these values on life effectiveness together as kilos of milk per day.

Dr. Michael Hovenjürgen emphasizes, “The dairy cow’s life effectiveness is based largely on the optimal supply of energy as well as being the prerequisite for economic success of a business.”
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1.1 Developments in milk production

Milk yield has been increased enormously through performance development in breeding. This is especially clear when examining the developments of milk yield over the last years as recorded in the German Herd-Book.

Recent considerations in the breeding industry suggest that the genetic potential of cows lies above 16,000 kg. This development represents a major challenge in the animal nutrition industry, as an increase in milk yield leads simultaneously to an increase in ration and energy requirements.
The nutritional requirements of milking cows are covered primarily by the consumption of feed. Additional energy generation through the mobilization of body fat is a limited source. On the basis of current recommendations, rations of high-performance cows should contain a minimum of 7 MJ NEL/kg.

### Ration recommendations for lactating cows according to herd performance  
(according to Engelhard, 2013)

<table>
<thead>
<tr>
<th>performance levels</th>
<th>group 1</th>
<th>group 2</th>
<th>group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>8.000 kg</strong></td>
<td>≥ 30 kg early lactation</td>
<td>≥ 22 kg lightweight animals</td>
<td>≥ 22 kg heavyweight animals</td>
</tr>
<tr>
<td>milk yield animals</td>
<td><strong>≥ 7.0</strong></td>
<td>6.5 – 6.8</td>
<td>6.1 – 6.4</td>
</tr>
<tr>
<td>MJ NEL/kg TM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>10.000 kg</strong></td>
<td>early lactation, poor health animals</td>
<td>≥ 30 kg lightweight animals</td>
<td>≥ 30 kg heavyweight animals</td>
</tr>
<tr>
<td>milk yield animals</td>
<td><strong>≥ 7.0</strong></td>
<td><strong>≥ 7.1</strong></td>
<td>6.6 – 6.8</td>
</tr>
<tr>
<td>MJ NEL/kg TM</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
1.2 Rumen health

The energy density of ration must be at a high level in order to supply the necessary energy required by high performance cows. This can be achieved through the use of high quality silage and other concentrated feedstuffs that contain these required levels. However, the proportion of concentrated ration should not exceed a certain level as it can otherwise lead to hyperacidity of the rumen.

The following problems may occur:
- Reduction of milk fat content
- Sub-acute ruminal acidosis
- Clinical acidosis
1.3 Principles of energy supply

First class quality ration is essential for today’s high-yield cow. The crucial factor is the supply of energy. Disruption in this supply can lead to a reduction of body reserves. A high mobilization of body fat for instance has a negative effect on the animal’s health and therefore also on milk yield.

The energy requirements of high performance cows can only be covered through the use of high-density ration. Fats have the highest energy density of all feedstuff making them an essential component for the upgrading of ration.

During critical stages, for instance through the reduction of ration intake (i.e. during early lactation), it is essential that the supply of energy remain constant in order to avoid affecting the function of the rumen.
1.4 Energy metabolism and health

The first third of lactation is a critical time for high-yield cows. During this period, milk yield, as well as the demand on energy, are at a peak. In contrast however the actual ration intake has not yet reached maximum after calving. This is why cows are often not able to cover their energy demand, thus leading to an imbalance of energy.

If the necessary energy requirements for milk production and metabolism are not met, the cow then starts to use up body reserves. This leads to the generation of metabolic by-products, which are harmful to the liver and can cause problems in the reproductive cycle.

The liver is the cow’s “fertility organ”. 
1.5 Problem area high performance – health and fertility

- high milk-yield
- limited ration intake
  - energy deficiency
    - undersupply of the reproductive anatomy
    - Disorder of the estrous cycle, problems of the ovaries and oviducts, cysts
  - ketosis, fatty liver
    - reduced immunity – (Infection of udder, uterus and hooves)
- poor quality roughage
  - fibre deficiency
  - ruminal disorders – acidosis
  - Infections (uterus, udder, hooves)
According to recent analysis, the three main reasons for deaths in cows are:

1. Infertility / sterility
2. Udder disease
3. Hoof and joint disorders

Reasons for culling 2012 in % (according to ADR, 2013)

- In over 80 % of cases, metabolic disorder is the main reason for disease in cows and often results in culling.
Various vegetable oils are used in the production of ration for dairy cows. The raw oils, which are extracted from seeds and fruits, are cleaned in the refining process. Unwanted substances stored during growth (e.g. toxins, dioxins, pesticide residues), are removed.

In addition to the refined oils (triglyceride), by-products such as free fatty acids are also formed.

Refining process

- Oleiferous Fruit
  - Raw Oil
  - Expeller, Oil Meal

Refining Process:
- Refined Oils
- Fatty Acids
Vegetable oils differ in their individual fatty acid composition (i.e. the proportion of unsaturated fatty acids), and therefore also differ in their respective melting points.

<table>
<thead>
<tr>
<th>Fatty acid patterns</th>
<th>Coconut oil</th>
<th>Palm oil</th>
<th>Rapeseed oil</th>
<th>Linseed oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>C 12:0 and shorter</td>
<td>61 %</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>C 14:0 (Myristic acid)</td>
<td>18 %</td>
<td>1 %</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>C 16:0 (Palmitic acid)</td>
<td>9 %</td>
<td>44 %</td>
<td>4 %</td>
<td>6.5 %</td>
</tr>
<tr>
<td>C 18:0 (Stearic acid)</td>
<td>2.5 %</td>
<td>5 %</td>
<td>1.5 %</td>
<td>3.5 %</td>
</tr>
<tr>
<td>C 18:1 (Oleic acid)</td>
<td>7 %</td>
<td>39 %</td>
<td>63 %</td>
<td>18 %</td>
</tr>
<tr>
<td>C 18:2 (Linoleic acid)</td>
<td>2.5 %</td>
<td>10 %</td>
<td>20 %</td>
<td>14 %</td>
</tr>
<tr>
<td>C 18:3 (Alpha-linoleic acid)</td>
<td>-</td>
<td>-</td>
<td>9 %</td>
<td>58 %</td>
</tr>
<tr>
<td>Melting point</td>
<td>18 to 20 °C</td>
<td>30 to 37 °C</td>
<td>0 °C</td>
<td>- 18 to -25 °C</td>
</tr>
</tbody>
</table>

The concentration of unsaturated fatty acids in oils has various advantages as well as disadvantages:

+ Support important functions of the cow’s metabolism
- They are sensitive to long term storage, sunlight and oxygen production
2.2 Stability of fats in the rumen

At body temperature, refined oils in the rumen are in liquid form. Due to their structure they are digestible by ruminal microbes. However, in high quantities they can disrupt the metabolism. Therefore a maximum of 600-1000 g of rumen non-stable oils per day should not be exceeded in ration for high-performance cows.

On the contrary, rumen stable fats do not impair the microbes as they are not digested in the rumen and reach the abomasum unchanged. The digestion then occurs in the small intestine.

- Stability of the rumen is reached through processing the vegetable oils resulting in the formation of rumen stable fats.

When should rumen stable fats be used?
- High milk-yield
- Ketosis prevention – for heavyweight cows or by low quality food
- To improve fertility
- At high outdoor temperatures because fat digestion produces less heat than carbohydrate digestion
Processes for the production of rumen-stable fats

Rumen-stable fats can be produced through the use of various processing methods.
2.3 Saponification

The oldest method of producing rumen-stable fats is saponification. Fatty acids produced during the refining process are mixed with calcium or sodium. During the saponification, protection from microscopic attacks is generated through the esterification with calcium or sodium. This process depends on the pH-value.

A reliable rumen-stability is only possible at a pH-value of over 6.5. Under acidic conditions the soap structurally decomposes back into its smaller components, such as fatty acids and calcium or sodium. The free fatty acids are then non-stable and can influence ruminal microbes.

- Adequate rumen stability for high-yield cows cannot be reached through the saponification process.
PH-value of rumen during the course of a day

According to Steingass and Zebeli (2008), an average pH-value of 6.32 in the rumen, over a 24-hour period, is necessary in order to maintain optimal physiological conditions. However, as we can see from the graph, experiments of Mahlkow-Nerge on high-yield cows (2013), the pH-value fluctuates visibly during the course of a day.

PH-value of rumen during the course of a day
(n=24 high-yielding dairy cows)

(Mahlkow-Nerge, 2013)

- A reliable rumen-stability of soaps is not guaranteed at any time.
Improved processing in the production of rumen-stable fats is possible through the reduction of the proportion of unsaturated fatty acids and an increase of the proportion of saturated fatty acids (especially C 16:0 and C 18:0).

Vegetable oils based on C 16:0 and C 18:0 have a typical melting point of over 50 °C. This means that in solid form, under standard outside temperatures they are rumen-stable.

The reduction of the proportion of unsaturated fatty acids can be reached through two different processes.

1. **Fractionation = the separation of the saturated and unsaturated fatty acids:**
   - Heating of liquid oils
   - Controlled slow cooling leads to crystallization
   - Separation of the crystallized fatty acid fractions

2. **Hydrogenation = saturation of the double bonds**
   - Nickel acts as a catalyst when subjected to excess hydrogen
   - Nickel is restored completely
   - Saturation of the double bonds

A full reduction of the unsaturated fatty acids can only be achieved through hydrogenation.

**Advantages of pure triglycerides:**
- High quality production guaranteed – as there is no risk of undesirable by-products
- Hardened triglyceride cannot oxidize
- Highest possible stability in the rumen
- Pure triglycerides have the highest palatability
3.1 Production processes of rumen-stable fat powders

Rumen-stable fats, with high melting points, are only digestible for cows when in powder form.

Through our special spray-freeze procedure (see diagram), we produce a very fine, pourable powder which is highly digestible and also optimal for further use.

Spray-freeze procedure of fats

The production:

1. Supply of hot vegetable oil
2. Spraying via special nozzle
3. Passing through different temperature levels
4. Fine crystalline fat powder
Advantages of BEWITAL fat powders

The ease of digestion of these fat powders depends highly on the size and surface of their particles. A reduction in particle size leads to an increase of surface in relation to mass. A surface increase thus leads automatically to an increase of area that can be utilized by lipase bacteria in the digestive tract. This increases digestibility.

Conventional fat powder

- Small surface = small attack surface for enzymes = low digestibility

Fat powder of BEWITAL agri

- Large surface = large attack surface for enzymes = high digestibility
3.2 Our product line

**BEWI-SPRAY®**

The **BEWI-SPRAY®** product line covers all products, which have a fat content of **99 %** and over.

The **BEWI-SPRAY®** line provides concentrated nutrition for high-yield cows. This enables maximum energy generation at low amounts of ration and is of particular importance in phases of strain and high performance.

In order to cater for all necessary requirements and situations we use various sources of fat for our **BEWI-SPRAY®** products.

Possible areas of use of **BEWI-SPRAY®** products:
- In compound feed
  - Pelleted concentrates
  - Supplementary feed in powder form
- Straight in the total mixed feed ration (TMR)
3.3 Our product line

**BEWI-LACTO+®**

The BEWI-LACTO+® product line covers product combinations, which take over special metabolic functions of the cow. The BEWI-LACTO+® product range combines the fat powders of the BEWI-SPRAY® production line with other metabolism enhancing components.

These include:

- Amino acids
- Vitamins
- Urea
- Dextrose

Possible uses of BEWI-LACTO+ products:

- Straight on the farm
  - Mixed in TMR
  - As top dressing
3.4 Solutions for dairy cow’s different metabolic situations

Our high-energy product range provides the solutions necessary, when difficulties arise in the feeding of high-yield cows.
Nitrogen supply in the rumen

Liver health

Fertility

ENERGY
4.1 Energy deficiency in the first third of lactation

After calving the nutritional requirement of the dairy cow increases rapidly, whereas ration intake increases slowly. This leads to an immense energy deficiency during the first 100 days of lactation. Furthermore, the estrous cycle begins again which may lead to further pregnancy.

Energy balance and energy use of dairy cows during lactation

(according to Staufenbiel, 2007)

Consequences:
- Adipose mobilization in order to cover high energy demand
- Negative consequence for animal’s health and yield
Challenges:

- To ensure energy supply, despite reduced ration intake after calving
- To reach milk yield of between 40 to 60 liters per day without disturbing ruminal health

Our solution: **BEWI-SPRAY® 99 M** or **BEWI-SPRAY® RS 70**

- Rumen-stable fat powders (24.5 MJ NEL) ensure energy supply despite reduced feed intake
- Reduces the break-down of body reserves
- Prevents reduction of yield
- Do not disturb ruminal functions
4.2 Energy deficiency caused by heat-related stress

The process of digesting carbohydrates generates heat. When outdoor temperatures are above 22 °C the cow’s digestive process is reduced immensely in order to avoid collapse.

**Consequences of heat related stress:**

- Reduction of energy because of low feed intake
- Increased risk of acidosis
- Decreased milk yield
- Decreased fertility

• Cows can experience heat related stress at a temperature of 20 °C!
Challenges:
- Lowering the risk of acidosis
- Securing of milk yield
- Protection of animal health

Our solution: **BEWI-SPRAY® 99 M** or **BEWI-SPRAY® RS 70**
- Rumen-stable fat powders do not produce as much heat as carbohydrates during digestion therefore relieving strain on the metabolism
- Increase energy concentration intake without disturbing the rumen
- Help generate high milk yield even through heat related stress periods

Advantages of BEWITAL – energy products:
- Rumen-stable fat generates high energy supply without disturbing rumen functions
- Highly digestible in the small intestine due to fine spray process
- Tasteless for optimal intake
- Better rumen-stability and acceptability in comparison to Ca-soaps
- Improvement of animal’s health and yield
- Improvement of fertility
Rumen-stable fat powder based on palm oil

- Allows for high energy supply without disturbing ruminal functions
- Rumen-stable due to high melting point
- Allows rumen suitable crude fibre of 18 % in ration
- Easily digestible through the use of fine spray process
- Free from taste and smell
- Increased rumen-stability and better compatibility than Ca-soaps
- Promotes animal’s health and improves milk yield
- Improves fertility

Application:
Use BEWI-SPRAY® 99 M as supplementary feed with 200-500 g per cow and day.
**BEWI-SPRAY® RS 70**

Rumen-stable fat powder based on rapeseed oil
- Processed from European raw materials (rapeseed oil)
- Fulfills quality standards of different creameries (e.g. Landliebe)
- Allows for high energy supply without disturbing ruminal functions
- Rumen-stable due to high melting point
- Allows rumen suitable crude fibre of 18 % in ration
- Easily digestible through the use of fine spray process
- Free from taste and smell
- Increased rumen-stability and better compatibility than Ca-soaps
- Promotes animal’s health and improves milk yield
- Improves fertility

**Application:**
Use **BEWI-SPRAY® RS 70** as supplementary feed with 200-500 g per cow and day.
4.3 Feed intake / organization of ration

A common problem in the first lactation of the dairy cow is the limited ration intake in this period. The rumen plays a central role in the digestion process of the major ration components. In addition to the palatability of the feed, balanced supplies of fast, medium and slow degradable components are of utmost importance in order to allow the ruminal microbes to function optimally. It is therefore especially important to pay attention to the sugar content of grass silage rations.

Low content of residual sugar in grass silage occurs by:
- Late cutting (low sugar content of plants)
- Erosion during field retention time
- Silo opening during filling
- Poor fermentation of silage
- Re-growth and autumn cuts

Consequences:
- Unbalanced protein supply
- Reduced sugar in the ration
Challenges:

- Balance supply of slow, medium and fast degradable ration components
- Palatability of the ration guaranteed

Our solution: **BEWI-LACTO+® Sweet**

- Dextrose increase the palatability of the ration and therefore feed intake
- Dextrose serves as a fast available energy source for the ruminal bacteria
- Optimizes the energy supply of the dairy cow with a combination of energy which is available to, and protected from, the rumen
Sugar provides quick energy

The addition of sugar to the ration of post-parturition cows helps generate the energy required. The concern that high sugar content could cause rumen acidosis is unfounded. This has been proven by Canadian studies using targeted addition of readily available sugars.

- The intake of dry ration increased with addition of sugar (+ 1.1 kg DM/day)
- The pH-value in the rumen tended to be higher with additional sugar (not less)
- With addition of sugar, milk fat production increased (+ 1.44 kg compared to 1.35 kg/day)

The addition of sugar increases the intake of ration and improves the rumen fermentation, while also helping to optimize the supply of energy.

The theory that sugar-rich rations provoke rumen acidosis was proven incorrect in this study. (Penner and Oba, Journal of Dairy Science 2009).
BEWI-LACTO+® Sweet

Rumen protected fat with dextrose

- Combination of rumen stable fat and readily available sugar (dextrose)
- Rumen stable fat has a direct effect on the cow's metabolism
- Dextrose improves the palatability and promotes increased feed intake
- Improves the supply of energy to the cow and the ruminal bacteria
- Also applicable in the calf breeding industry in order to exploit growth potential
- Energy content: 21.4 MJ NEL/kg or 31 MJ ME/kg

**Application:**
Feed 200-500 g per cow and day or 100-150 g per calf and day of BEWI-LACTO+® Sweet as feed supplement.
4.4 Nitrogen supply in rumen

The most important issues for high performance during the lactation period are, next to energy supply, an adequate supply of rumen protein and nitrogen. This guarantees the optimal formation of bacterial protein. An insufficient supply of ruminal microbes leads to a reduction of ruminal protein production. The milk protein synthesis deteriorates.

Rumen microbes need two components to synthesize microbial protein:

1. Nitrogen (from ration or urea)
2. Energy (from fibre, starch or sugar)

Consequences of inadequate bacterial protein formation:

- Reduction of milk protein content
- Reduced milk yield
Challenges:

- Synthesis of bacterial proteins
- Optimal supply of nitrogen to ruminal microbes

Our solution: BEWI-LACTO+® Urea 80 D

- Provides the ruminal microbes with nitrogen
- Dextrose serves as a readily available energy source for the ruminal microbes
- Equal release during the day through encapsulation (slow release urea)
- Normal feed urea has the disadvantage of quick release and is therefore less effective
Slow release urea

Slow release urea is made from the raw material urea, which is covered by a special fat coating. This coating contains multiple pores through which the urea can disperse slowly in the rumen.

Therefore, a constant supply of urea is ensured to the microbes that convert urea into microbial protein.
BEWI-LACTO+® Urea 80 D

Slow release urea with dextrose
- 80 % urea (ration quality), protected by a fat coating
- Slow release in the rumen to deliver nitrogen for ruminal microbes
- Ruminal fermentation becomes more efficient delivering amino acids to the ruminant
- Dextrose as a rapidly available source of energy for ruminal microbes

Application:
The daily amount of BEWI-LACTO+® Urea 80 D should not exceed 40 g per 100 kg live weight.
4.5 Liver health

80 % of dairy cow diseases are caused by metabolic disorders in which the liver plays a central role.

- A large proportion of digested food components are rebuilt in the liver and made usable for the production of milk in the udder.
- The liver produces up to 4 kg glucose daily.
- Detoxification of ammonia takes place in the liver.

During early lactation as well as in times of increased fat mobilization, the liver is pushed to its limits when trying to rebuild free fatty acids into suitable triglycerides.

Consequences of a capacity overload of the liver:
- Ketosis
- Fat mobilization syndrome
- Puerperal disorders
- Fertility problems
Challenges:
- Preservation of metabolic health in high-yield dairy cows.
- Additional liver supplements.
- Supplements have to reach the liver and should not be digested in the rumen.

Metabolism of dairy cows (schematically)
Solution:  
- **BEWI-LACTO+® MC Protect** rumen-protected choline and methionine help support the conversion of fats into lipoproteins.  
- Lipoproteins reach the udder via the blood system and can be used there for milk fat conversion.  
- Prevents excessive deposition of fat in the liver (fatty liver) and guards against negative consequence.  
- Promotes milk protein synthesis through methionine and supports energy metabolism through niacin.  

The positive effects of rumen-protected substances on metabolic health and milk production as underlined through trials with dairy cows.
**BEWI-LACTO+® MC Protect**

**Energy boost package for high-yield dairy cows**
- Rumen-stable fat significantly improves the energy supply to high-yield dairy cows
- Dextrose provides quick energy for the ruminal microbes and promotes food intake
- Rumen-protected Methionine ensures the provision of amino acid for milk protein synthesis
- Rumen-protected choline supports the liver in the conversion of fats and ensures the metabolism of energy
- Niacin, in optimal dosage, holds key functions in the provision of energy
- Biotin improves hoof health and supports the metabolism of energy
- Energy: 21.5 MJ NEL / kg

**Application:**
Feed 200-250 g of **BEWI-LACTO+® MC Protect** per cow and day during the first half of lactation.
Problems of low fertility and reduced lactation in dairy cows often occur simultaneously. These problems are not due to the high milk yield of the animals, but rather to their insufficient supply of energy.

The demand on energy for milk production is dependent mainly on the fat content of the milk. The higher the milk fat content, the more energy a dairy cow requires for production. Consequently, this energy is not available for other metabolic processes.

Consequences of energy deficiency on fertility:
- Reduced estrus
- Debilitated ovaries
- Slow regeneration of ovaries
- Premature embryonic exitus
- Increased calving index
- Cows culled earlier
Challenges:
• Improve the balance of energy during lactation
• Support of health and fertility function despite high milk-yield

Our solution: **BEWI-LACTO+® CLA 125**
• Conjugated linoleic acid (CLA) reduces the synthesis of milk fat in the udder.
• Lower energy requirement per kg milk due to lower fat content.
• Released excess energy can be used for other important processes (e.g. milk production, fertility and metabolic processes).
Positive effect of CLA on fertility

The evaluation of comprehensive studies from America, Britain and the Netherlands clearly show the positive effect of CLA on fertility.

Relationship between CLA and gestation probability

CLA supplementation has a positive effect on fertility. A gestation rate of 50% can be achieved much faster within the herd when CLA is added.

(de Veth et al., 2009)
Rumen-protected fat with conjugated linoleic acid and dextrose

- A combination of rumen-stable fat, conjugated linoleic acid (CLA) and dextrose optimizes the balance of energy in dairy cows
- Rumen-stable fat increases the energy yield of the feed without disrupting ruminal functions
- Conjugated linoleic acid decreases the demand on energy per kg milk
- Dextrose supplies ruminal microbes with rapidly fermentable energy and increases palatability of the ration
- Increases milk yield
- Improves fertility

Application:
Feed 125 g of BEWI-LAC-TO+® CLA 125 per cow and day. It can be used as a feed component during the entire lactation period enhancing milk yield or as a supplement.
The dairy cow is exposed to particularly high strain during calving, which can thus significantly affect the start-up phase of lactation as well as the cow’s further life.

Consequences of a birth
- Weakening of the cow through loss of energy
- Dramatic loss of liquid through the passing of the amniotic fluid
- Lack of electrolytes, trace elements and vitamins
- Increased risk of abomasum displacement through void in the belly
Challenges:
- Ensure optimal general health of the cow with regard to body condition, ruminal function, immunity, udder and hoof health
- Avoid reduced feed intake
- High intake of food and fluids directly after calving

Our solution:
BEWI-SAN® Dairylyt
- Keeps the cow fit as well as improving the metabolism of energy
- Compensates for the lack of liquids, electrolytes, trace elements and vitamins
- The newly developed combination of aroma and flavor ensures acceptance and stimulates intake
- Helps fill the void in the digestive tract
**BEWI-SAN® Dairylyt**

- Vitalizes cows directly after calving
- Reduces strain
- Compensates for the lack of fluids, electrolytes and minerals
- Glucose boosts energy and vitamins after birth
- Additional calcium prevents milk fever
- Improves feed intake after calving
- Decreases the risk of acetonemia and abomasum displacements
- Optimal acceptance due to newly developed combination of aroma and flavor substances

**Application area:**
Feed 50 g of **BEWI-SAN® Dairylyt** per liter of luke-warm water directly after calving.
Dairy cow’s requirements of ration during first third of lactation

**Total mixed ration (TMR)**
- **MJ NEL**: > 7.0
- **Starch + sugar**: 240-280 g/kg TM
- **Derived from sugar**: 60 g/kg TM
- **Rumen-stable starch**: 50-65 g/kg ZM
- **Crude fibre**: > 160 g/kg TM
- **Structure value**: 1.2

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Guidelines for application of BEWITAL fat powders

**Milk production as a basis**

- **Milk production < 8,000 kg**
  - **BEWI-SPRAY® 99 M**

- **Milk production 8,000 - 10,000 kg**
  - **BEWI-SPRAY® 99 M**
  - **BEWI-LACTO® CLA 125**
    - first 100 days of lactation

- **Milk production > 10,000 kg**
  - **BEWI-SPRAY® 99 M**
  - **BEWI-LACTO® CLA 125**
    - first 100 days of lactation
  - **BEWI-LACTO® MC Protect**
    - first half of lactation
## Application areas of BEWITAL problem-solvers

<table>
<thead>
<tr>
<th>Issue</th>
<th>BEWI-SPRAY® 99 M / RS 70</th>
<th>BEWI-LACTO+® Sweet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low milk production</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Insufficient energy supply during lactation</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Heat stress</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>Poor feed intake</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Rations with low content of sugar</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>Basic feed with low content of protein</td>
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<td></td>
</tr>
<tr>
<td>Low content of milk protein</td>
<td></td>
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</tr>
<tr>
<td>Fatty liver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced estrus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low success of insemination / increased calving index</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth stress</td>
<td></td>
<td></td>
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<tr>
<td>Problems after calving</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BEWI-LACTO+® Urea</td>
<td>BEWI-LACTO+® MC Protect</td>
<td>BEWI-LACTO+® CLA 125</td>
</tr>
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</tbody>
</table>
## Comparison of Ca-soaps, fractionated fats and hydrogenated fats

<table>
<thead>
<tr>
<th></th>
<th>Ca-Soaps</th>
<th>Fractionated fatty acids</th>
<th>Fractionated triglyceride</th>
<th>Hydrogenated fatty acids</th>
<th>Hydrogenated triglyceride BEWI-SPRAY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fat content</strong></td>
<td>84.0 %</td>
<td>99.0 %</td>
<td>99.0 %</td>
<td>99.0 %</td>
<td>99.0 %</td>
</tr>
<tr>
<td><strong>Crude ash</strong></td>
<td>12.5 %</td>
<td>0.5%</td>
<td>0.5%</td>
<td>0.5 %</td>
<td>0.5 %</td>
</tr>
<tr>
<td><strong>Calcium</strong></td>
<td>9.0 %</td>
<td>0.0 %</td>
<td>0.0 %</td>
<td>0.0 %</td>
<td>0.0 %</td>
</tr>
<tr>
<td><strong>FFA</strong></td>
<td></td>
<td>min. 70 %</td>
<td>max. 10 %</td>
<td>min. 85 %</td>
<td>&lt; 2 %</td>
</tr>
<tr>
<td><strong>MJ NEL/kg</strong></td>
<td>ca. 20.5</td>
<td>ca. 25</td>
<td>ca. 25</td>
<td>ca. 25</td>
<td>ca. 25</td>
</tr>
</tbody>
</table>

|                |          | Ø                         | Ø                         | -                        | +                                     |
| **Smell**      |          |                          |                           |                          |                                       |
| **Palatability**|         | Ø                         | Ø                         | -                        | +                                     |
| **Acceptance** |          | Ø                         | Ø                         | -                        | +                                     |

<table>
<thead>
<tr>
<th><strong>Structure</strong></th>
<th>very coarse</th>
<th>coarse</th>
<th>coarse</th>
<th>different (coarse - fine)</th>
<th>very fine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rumen stability</strong></td>
<td>- -</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><strong>Digestibility</strong></td>
<td>Ø</td>
<td>Ø</td>
<td>Ø</td>
<td>+</td>
<td>++</td>
</tr>
</tbody>
</table>
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