YoungStock Solutions Guidebook

A guide to successfully rearing young animals
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Standing on their own four feet: Strong calves bring success

Efficient heifer rearing is one of the main factors for the success of a farm. Our guidebook provides useful tips on housing, feeding and hygiene so that your calves can grow up viable and healthy. Careful management, based on this knowledge and a clear view of the costs required for work and equipment, makes your business highly efficient: Draw the benefits of calf rearing and gain a good profit with each new generation!

Discovering weaknesses, managing expediently
Lively calves are an investment for the future and competitiveness of any dairy farm. However, as statistics have consistently shown, loss rates of young calves, a high age at first calving and low-performing heifers are areas for complaint. Every breeder is therefore faced with the task of discovering counter-productive factors and effectively eliminating them through specific management actions.

Capable of improvement – in many ways
Often bacterial and viral infections trigger off intestinal and respiratory diseases and cause calf losses. On the other hand, suitable actions can significantly reduce the risk of infection: A barn concept suited to young animals diminishes the typical problems in housing, such as high humidity, pollutant gases, draughts or overcrowding. Feeding strategies adjusted to the various phases of growth also strengthen the natural resistance, promote immunisation and optimise the overall health management of the young animals.

A reference for practical work
- The YoungStock Solutions Guidebook provides a comprehensive overview of the management and practical work involved in the successful rearing of calves.
- A calf develops into a heifer over the course of several time phases

Studies show high loss rates, for example, in Great Britain:
- approx. 8 % of all calves are still-born,
- approx. 85 % of the female calves survive the time to their own first calving,
- 12 – 17 % of these heifers do not reach their first lactation
- only 55 % of all heifers have a 3rd lactation.
  (cf. Wathes et al., 2009; Brickell et al., 2011).
Vitality – a quality feature, not a magic word

When caring for calves, specifically targeted rearing management helps to cover the relatively long period of time up to the first calving. As an indicator for productivity, a daily gain in weight is a sign for a young animal in a good state of health. This results in an early age for the first calving which saves on costs, and dairy cows which achieve the best results in the long term:

- Very good fertility
- High milk yields
- High lifetime performance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>% of calves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calves born alive</td>
<td>&gt; 95</td>
</tr>
<tr>
<td>Rate of difficult births</td>
<td>&lt; 10</td>
</tr>
<tr>
<td>Umbilical illnesses</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>Calf losses</td>
<td>&lt; 5–10</td>
</tr>
<tr>
<td>Respiratory illnesses</td>
<td>&lt; 5–10</td>
</tr>
<tr>
<td>Infection with parasites</td>
<td>&lt; 10</td>
</tr>
<tr>
<td>Calf losses in the first year</td>
<td>&lt; 5</td>
</tr>
</tbody>
</table>

Benchmarks table

Worthwhile goals: successful rearing of young animals that pays off

Focus on the costs

Of course, every calf which is reared costs money, but specifically targeted management increases the efficiency of housing, hygiene and feeding.

- On average, the rearing of a heifer in Europe costs 1.500 to 1.800 € (1940 to 2330 $) (cf. N. Mohd Nor et.al. 2012).

- Every illness holds back the growth of an animal and generates treatment costs of around 100 € (129 $).

- The extra cost of labour and feed for a heifer, which does not calve until after 30 months instead of 24, amounts to approximately 400 € (518 $).

Milk yield chart

Reducing milk net revenues with increasing age of first calving – ideal age for calving: 22 – 24 months

Hultgren et al. (2011)
For good upbringing – with system

Demands alter, depending on the age of the calves. The growth phases therefore form the structure of our guidebook.

<table>
<thead>
<tr>
<th>Age</th>
<th>Phase</th>
<th>Housing</th>
<th>Key words</th>
<th>Legend</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–0.5 Months*</td>
<td>Colostrum phase</td>
<td>Individual housing (box)</td>
<td>Individual housing</td>
<td>K1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Individual housing (calf hutch)</td>
<td>Colostrum management: Quality, quantity, Timing of feeding, Health monitoring</td>
<td></td>
</tr>
<tr>
<td>0.5–3 Months</td>
<td>Rearing phase</td>
<td>Group housing</td>
<td>Group housing, Individual automatic feeding, Weaning</td>
<td>K2</td>
</tr>
<tr>
<td>4–6 Months</td>
<td>Growth phase</td>
<td>Group housing</td>
<td>Group housing, Group feeding, Monitoring of weight increase</td>
<td>Y1</td>
</tr>
<tr>
<td>7–12 Months</td>
<td>Puberty phase</td>
<td>Cubicles with a comfort mattress</td>
<td>Group housing in a free shed with cubicles, Deep litter, Pasture rearing, Optimisation of feeding</td>
<td>Y2</td>
</tr>
<tr>
<td>13–18 Months</td>
<td>Heifer rearing I</td>
<td>Cubicles with a comfort mattress</td>
<td>Group housing, Fertility management</td>
<td>Y3</td>
</tr>
<tr>
<td>19–25 Months</td>
<td>Heifer rearing II</td>
<td>Cubicles with a comfort mattress</td>
<td>Group housing, Adjustment of feeding, Preparation for calving</td>
<td>Y4</td>
</tr>
</tbody>
</table>

* The length of the colostrum phase may vary.
Barn design:

as comfortable and effective as possible

Whether it is a new or existing building – a well thought-out barn concept creates the best basis for housing in various age groups. The design of the barn, as well as the size of the groups of animals, depends on some fundamental parameters:

**Herd size**
- Number of dairy cows
- Time between calving
- Number of heifers
- Loss rate

**Planning for the future**
- Growth scenario
- Culling and selection

**Pre-conditions**
- Type of building (new, existing, conversion)
- Number and quality of labour
- Legal requirements
Colostrum phase
Colostrum: Protective shield for a good start in life

Newborn calves are literally defenceless and are exposed to a high risk of infection directly after birth. The colostrum gives the necessary resilience regarding crucial diseases to the calf, because the mother’s first milk is rich in immunoglobulins and protects against pathogens through blood circulation.

The best conditions for the first days can be created with the use of calf hutches and individual boxes:

Accommodation

- Calves should be able to lie down under dry conditions
- Protection against weather conditions (rain, snow and strong sun)
- Free of draughts (no barns between two buildings)
- Separate vessels in the feeding area for solid and liquid feed
- Eye contact between calves promotes a common good feeling

Management and care

- Easy access
- Smooth surface for easy cleaning
- Bottles and buckets can be easily fixed
- Attachments for water and milk
- Preferably with a moveable frame to enable speedy changes in position
- In line with the local country regulations, calf boxes should have the following dimensions:
  - Minimum width: 80 / 100 cm (31" / 39")
  - Minimum length: 120 / 130 cm (47" / 51") or 2,95 m² (32 ft²) (according to country codes)
- Arrangement on sloped concrete (2 %)

Individual housing ensures the greatest safety

Clean, disinfected individual boxes have a number of advantages and prevent infections:

- Simple monitoring of health, feed intake and digestion
- Clean environment, lower risk of infection
- Physical separation so that illnesses cannot spread through mutual licking and suckling
- Eye contact for social interaction
Alternatives in individual housing

The calf boxes and calf hutches from GEA Farm Technologies are flexible and mobile, and provide ideal conditions for individual housing at any time of the year.

Calf boxes
- Various sizes available: Width: 80 to 120 cm (31” to 48”)  
- Length, interior: 130 to 215 cm (51” to 85”)  
- Side frame made of either wood or polypropylene  
- Rolling frame optional  
- Side window for social interaction  
- Optionally with sliding roof

Calf hutches
- In “Small” size fitted with (L x W x H)  
  box 150 x 120 x125 cm (59” x 47” x 49”) and  
  fence 150 x 120 x 95 cm (59” x 47” x 23”)

- In “Comfort” size fitted with (L x W x H)  
  box 200 x 120 x140 cm (79” x 47” x 55”) and  
  fence 150 x 120 x 95 cm (59” x 47” x 23”)

1 | Box position in summer
Facing north in the summer time: Calf boxes or hutches with a front open to the north offer protection against direct summer sun and strong heat.

2 | Box position in winter
South-east on dull winter days: In the European winter a front open to the south-east protects against rain and wind but takes advantage of the positive effect of sunlight.
Jump start for the immune system

Colostrum is the cow’s first milk, directly after the birth of a calf. This cocktail of high-quality, bioactive ingredients initialises and strengthens the calf’s immune system, and also promotes the development of the gastrointestinal tract. In comparison with normal milk, colostrum has a higher proportion of solids and a higher content of protein, fat and vitamin A.

This is best protection for calves and for their rearing, since calves enter the world without a fully-developed immune system. In contrast with other mammals, no passive immunisation takes place in the womb of the ruminant via the placenta. A calf more or less sucks up its powers of defence up for the first time with the colostrum. The vital immunoglobulins pass through the intestinal wall and protect against pathogens as antibodies in the bloodstream.

The order of the day: quickly feed high-quality colostrum! Directly after birth the permeability of the intestinal wall for the passage of immunoglobulins into the blood circulation is at its highest. However, after this time the ability to absorb the high-quality protein molecules reduces from hour to hour. It is therefore of vital importance to feed colostrum not just immediately after the birth and to provide it in sufficient quantity but also to actively ensure an excellent quality of this valuable elixir of life.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Milking after calving</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter (%)</td>
<td>23.9</td>
<td>17.9</td>
<td>14.1</td>
<td>12.9</td>
<td></td>
</tr>
<tr>
<td>Proteins (%)</td>
<td>14.0</td>
<td>8.4</td>
<td>5.1</td>
<td>3.1</td>
<td></td>
</tr>
<tr>
<td>IgG (mg/ml)</td>
<td>48</td>
<td>25</td>
<td>15</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>Fat (%)</td>
<td>6.7</td>
<td>5.4</td>
<td>3.9</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>Lactose (%)</td>
<td>2.7</td>
<td>3.9</td>
<td>4.4</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>Minerals (%)</td>
<td>1.1</td>
<td>1.0</td>
<td>0.8</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>Vitamin A (mg/dl)</td>
<td>295</td>
<td>190</td>
<td>113</td>
<td>34</td>
<td></td>
</tr>
</tbody>
</table>

Successful start: Schedule for colostrum feeding

Take advantage of the natural protective mechanism of colostrum for the start of calf rearing!

**Schedule (When?)**
- Feed freshly-milked colostrum within one hour, store cool for up to 24 hours or freeze in storage.
- Slowly thaw out frozen colostrum and feed directly (preferably in a water bath, 40 °C (104 °F), a microwave may in some circumstances destroy the substances).

**Quantity (How much?)**
- The quantity to be fed depends on the quality of the colostrum. As a rule of thumb, you calculate 10 % of the body weight of the calf.
- Use suitable aids, such as drinking bottles, and pay attention here to hygiene and cleanliness: Only drench if the calf does not drink of its own free will.
- Use different drenchers for the colostrum and for the feeding of additives, electrolytes etc. to sick calves.

**Quality (How good?)**
Various factors play a part in the content of immunoglobulins (IG) in the colostrum. The highest content can be found
- The older the calving cow is (3rd/4th calving),
- The more antibodies the mother possesses as a result of cured illnesses,
- In the first milking directly after the birth,
- Depending on the quantity produced (< 8 l = < 2 G) – A higher content of IgG. Further influences are the breed, the feeding and condition and the length of drying off of the mother before the birth.

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**Optimise the quality of the colostrum with UVPure**

Colostrum frequently has a high bacterial contamination of more than 1.000.000 CFU/ml. With the help of the milk purifier unit, UVPure, you can decisively reduce the contamination of colostrum and milk without destroying the valuable ingredients. This takes place using the anti-bacterial properties of ultraviolet light. Give the youngest members of the herd a good future!

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**Use appropriate aids in the feeding of the colostrum:**
Drencher (l), drinking bottle (r)
Monitoring is the be-all and end-all

It goes without saying that only colostrum from healthy cows should be used. It makes just as much sense to continuously monitor its quantity and quality. The immunoglobulin content of the milk can be easily determined through its thickness with a colostrometer or refractometer. Experts test the passive immunisation of the calves by checking the blood serum, six hours after receiving the colostrum. A consumption of 3 l (0.8 G) gives, for instance, a content of 11.9 g/l of antibodies in the blood serum – a top value for strong growth.

Health maintenance in the colostrum phase

Clean conditions are the key for long-term rearing success. The passing on of pathogenic bacteria may also be eliminated by quickly separating calf and mother. There is most certainly divided opinion concerning early separation, but it offers the advantage of significantly reduced stress, as the bond has not yet been strongly established. The danger of injury to the calf is also reduced.

Vaccination of the mother cannot replace hygiene

First and foremost: It is best to plan a vaccination programme together with your vet! Vaccinations work specifically on certain types of pathogen, such as Rota and Corona viruses, which may trigger off diarrhoea in a newly-born calf. Antibodies formed in the mother are then passed on to the calf with the colostrum and reduce the risk of infection.

Calf blankets keep your calf warm and protect from infections caused by cold temperatures.

Housing recommendations

- Animal marking
- Drying of the calf
- Provision of a number of buckets of lukewarm water for the cow
- Separation from mother
- Disinfection of the navel
- Placement in a cleaned and disinfected individual box

Colostrum management

- Quality control of the colostrum
- Monitoring of the colostrum intake
- Checking of passive immunisation (monitoring of IgG in the blood plasma, blood serum)
- All utensils for correct administering should be to hand, clean and disinfected; feeding bottles, feeding buckets, teats

Monitoring of the state of health

- Check drinking behaviour
- Check coat, eyes, ears
- Check consistency of droppings
- Check breathing
- Check weight
- Drawing up of protocols for actions when an animal catches a cold or for losses (taking of actions, instructions, monitoring of the actions taken)
- Check hygiene of personnel
Rearing phase
Everything points to growth

Nowadays, everything revolves around intensive growth: In the rearing phase the cells reproduce at a rapid rate, organs, such as the heart, kidneys, lungs or liver develop at breakneck speed in the first 50 days. In particular in the gastrointestinal tract, functional stomachs are formed, which enable the calf to digest raw and concentrated feed as well as milk following the colostrum phase. Monogastric animals become ruminants.

During the life of a heifer, the rumen takes on the role of a power station, gaining energy, proteins and vitamins from the feed, therefore special attention should be paid to the positive development of the rumen. This should be accompanied by a significant change in the feeding of the calf: The energy source of milk or milk substitute is exchanged for nutrient input from concentrated and raw feed. During this time the rumen papillae must develop on the previously smooth rumen wall.

1 | Development of organs
   The first few weeks are decisive:
   Only healthy calves can develop strong organs

2 | Growing into a ruminant:
   the development of the calf’s stomach compartments

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rumen</td>
<td>approx. 0.75 litres</td>
</tr>
<tr>
<td>2</td>
<td>Abomasum</td>
<td>approx. 14 litres</td>
</tr>
<tr>
<td>3</td>
<td>Omasum</td>
<td>approx. 90 litres</td>
</tr>
<tr>
<td>4</td>
<td>Reticulum</td>
<td></td>
</tr>
<tr>
<td>Forestomach</td>
<td>approx. 0.75 litres</td>
<td>approx. 14 litres</td>
</tr>
<tr>
<td>Abomasum</td>
<td>approx. 2 litres</td>
<td>approx. 7 litres</td>
</tr>
<tr>
<td>Age</td>
<td>a few days</td>
<td>12 weeks</td>
</tr>
</tbody>
</table>

As per Fiebig et al., 1984
Milk or milk substitute

In the end you decide which product best suits your farm, but you should be sure of the quality in advance. Milk substitute is easily available, requires no cooling and has defined nutrient contents – good quality has its price, you must provide storage space, mix the product with suitable equipment, feed it to the calves and allow time for all of this. Milk is directly available in the milking parlour, has a high nutrient content and can be produced less expensively in comparison – however, untreated milk may contain pathogens, and bring about illnesses in calves and treatment costs.

<table>
<thead>
<tr>
<th>Diseases</th>
<th>Activator</th>
<th>Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhoeal</td>
<td>Errors in feeding, parasites, infections</td>
<td>Hygiene in the maternity pen and everything to do with the birth</td>
</tr>
<tr>
<td></td>
<td>Rota, Corona viruses; E-coli bacteria</td>
<td>Immediate removal of the calf from the maternity pen</td>
</tr>
<tr>
<td></td>
<td>including pathogenic bacteria</td>
<td>Optimised colostrum management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Administering of vitamin A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Possible vaccination of the mother</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cleaning and disinfection of equipment, calf hutches</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Working routine: for feeding and care always move from the youngest to the eldest calf</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Keep walkways clean</td>
</tr>
<tr>
<td>Navel infection</td>
<td>Poor umbilical care, bacteria, sucking of the navel</td>
<td>Appropriate form of housing for the animals, dry bedding, treat navel with clean and disinfected hands.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Checking of the navel</td>
</tr>
<tr>
<td>Respiratory</td>
<td>Many different pathogens (viruses, mycoplasma, chlamydia, bacteria)</td>
<td>Good housing conditions</td>
</tr>
<tr>
<td>diseases</td>
<td></td>
<td>Good barn climate (humidity, air movement, concentration of harmful gases, temperature)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Good feeding conditions</td>
</tr>
</tbody>
</table>

Source: PennState University
Jud Heinrichs (2005)
Make things comfortable for yourself: calves thrive in groups

It is not only fun for the calves, but it also greatly reduces the workload for the farmer: With animal-friendly group housing you promote the animals’ health and social behaviour while making work easier for yourself and saving on barn space.

You must pay attention to the following parameters

- Depending on the feeding procedure and age, 10 – 30 calves can be held per pen.
- The age difference should be a maximum of 10 days.
- Sufficient barn area for each animal
  - 1.5 to 2 m² (11.8 to 21.5 ft²) per animal at feeding time
  - Where held outside, at least 2.5 m² (26.9 ft²), of which 1 m² (10.8 ft²) for lying down
- The feeding station width should be at least 40 cm (15.7 “).
- Feeding fence for individual fixing.
- Separate drinking and feeding areas should be available for each group.
- Dry and free of draughts
- Sufficient breathing space for each animal
- 6 to 7 m³ (212 - 247 ft³) per animal
- Fresh water from automatic water troughs
- Requirement per animal and day: 10 % of the body weight
- Calves maintain their body temperature constant at an ambient temperature of 8 - 27 °C (46 - 81 F)
- The ideal outside temperature is 21 °C (70 °F)
- For newly born calves not below 10 °C (50 °F)
- The humidity should be between 50 – 70 %.

Colostrum immediately after birth

First milk/milk powder

Water
  - from 1st week (possibly earlier, dependent on climate and temperature)

Hay
  - from 2nd week, from 3rd week also wilted silage, maize silage

Concentrated feed
  - from 3rd week

up to 3 months
The advantages pay off in group housing

Calves are social beings. They like to feed, drink and relax in a herd. Group housing suits their nature, satisfies their natural activity and promotes social behaviour. In short, the calves feel completely at ease, which is shown by their daily weight gain. Their health rises to a high level: Group housing means that there is a low risk of illness and, on the contrary, the calves’ immunity increases and free movement promotes the maintenance of healthy hooves.

The workload reduces to a minimum: Feeding, bedding and manure removal can be efficiently handled. Automatic drinking and feeding systems can also reliably take over the mixing and supply of fresh feed at freely selectable times. Finally, with the aid of electronic recognition systems (electronic ear markings/responders) computer-based monitoring can be ensured. Simply take a look: With herd management you have a direct view of the growth of every calf.
Animal-friendly and successful – automatic feeding on demand

Today the calves decide themselves: Controlled ad-libitum feeding or feeding on demand promises a growth of up to 1000 g/day (35 oz./day) in the first weeks of life. This special feeding technique is successful and, therefore, becoming more popular. However, efficiency and time-savings can only be achieved with the use of automatic calf liquid feed and concentrated feed systems. GEA Farm Technologies offers you all the peripherals with which you can automatically manage controlled feeding and which you can seamlessly integrate into your herd management. Every young animal receives exactly the amount of liquid and concentrated feed it needs for healthy growth up to the optimal time for weaning.

The theory of weaning

The quicker the rumen is fully functionally developed, the quicker the time for weaning approaches, thus leading to a reduction in rearing costs. Weaning too early, however, leads to under-provision – the calf’s growth is put back by weeks. The development of the rumen can be ideally controlled using liquid feed and concentrated feed systems from the DairyFeed J series and it can be monitored until the optimal time for weaning. And you can literally remain a spectator while this is happening: DP CalfFeeder displays the development profile of every calf individually on the monitor.

1 | The perfect drinking position for your calves!

1 Oesophagus
2 Rumen
3 Reticulum
4 Omasum
5 Abomasum
DairyFeed J automatic calf feeders

– healthy growth for the new generation

An individual supply for each animal is the key to success. DairyFeed J automatic calf feeders can be programmed as required.

According to their entitlement, the individually set formula is prepared – either with fresh milk or milk powder – quickly, hygienically and reliably. The calf drinks from the sucking station at an optimum temperature as it would from a cow. A level control, an automatic calibration system and an additional dosing unit ensure a perfect mix around the clock. The integrated management program gives information on the drinking behaviour of every animal. This allows you to optimally keep an eye on their health!

With the capability to feed around 20 to 30 animals from each sucking station, depending on the model, DairyFeed J automatic calf feeders offer the perfect solution for every farmer. It’s your choice!

If you do not use an automatic calf feeding system, the MilkBuggy can also ease the distribution of liquid feed for you.

MilkBuggy

– mobile for perfect feeding

The MilkBuggy considerably eases the workload by simply bring the trough to where it is needed at any time. The agile and mobile dosage vehicle has a precise filling system with which the individual mix for every group of animals can be exactly dosed. The mixer and heating ensure that there is a perfect consistency and an ideal temperature. Dispensing can take place quickly using the powerful pump. The MilkBuggy sets healthy supply to the calves into motion!
DairyFeed J 1100 concentrated feed systems

– individually up to weaning

With the speedy and individual distribution of concentrated feed you perfectly support the calf in its early development. DairyFeed J concentrated feed systems are therefore a sensible supplement to GEA Farm Technologies calf feeders.

Through the constant matching of data between the different machines you provide feed and drink in ideally dosed proportions until the calf is ready to be weaned. Control functions additionally secure a complete feed supply of the rations and also report any irregularities in feed intake. Promote growth with DairyFeed J concentrated feed systems and at the same time save on feed!

UVPure

– a winner even in this phase

Make your calves’ milk even more valuable: Charge for charge and fully automatically, UVPure frees the milk of pathogens without destroying valuable ingredients, such as immunoglobulins, proteins or vitamins. In this way you can give strength to your calves at exactly the right time!

DP CalfFeeder

– development at a glance

The DP CalfFeeder software is the ideal aid and monitoring tool for rearing within the herd. DP CalfFeeder provides detailed data on all calves at all times and displays development in a table or graph, where desired. The visualisation makes information such as the drinking behaviour or the speed of drinking at the trough more transparent. Based on these data, important management decisions can be taken quickly and safely.
Hygiene tips to promote the rearing phase

Small calves feel especially comfortable in dry bedding. The double-surface bay combines animal comfort with the demands on hygiene and daily routine.

Barns
• Straw lying areas provide optimal conditions for lying.
• The feeding area should have a solid floor to guarantee hygienic access to drink, feed and water.
• Large gates simplify manure removal and placement in the box.

Troughs containing milk or milk powder
• Make sure that the calves drink in an upright position
  – The calves drink more slowly, salivation is increased and the oesophageal groove reflex is supported.

Auxiliary materials and cleaning agents
• ZorbiSan Plus, the natural bedding conditioner for professional hygiene management of young animals, promotes dry and clean lying and walkway surfaces.
• For the cleaning and care of items such as the calf feeders we recommend the professional cleaning agents from GEA Farm Technologies.
Housing recommendations

Initial care

Physiologically appropriate feeding schedules

• Straw lying areas provide optimal conditions for lying.
• The feeding area should have a solid floor to guarantee hygienic access to feed and water.
• Large gates simplify manure removal and replacement in the pen.

Feeders containing milk or milk powder

• Make sure that the calves drink in an upright position
  – The calves drink more slowly, salivation is increased and the oesophageal groove reflex is supported.

Auxiliary materials and cleaning agents

• ZorbiSan Plus, the natural bedding conditioner for professional hygiene management of young animals, promotes dry and clean lying and walkway surfaces.
• For the cleaning and care of items such as the calf feeders we recommend the professional cleaning agents from GEA Farm Technologies.
Growth phase
**Intensively boost your investments**

The big leap into life has been mastered with the beginning of the first growth phase. Now it’s a matter of intensively promoting your well developed investments. The young animals have now been weaned, so milk and milk substitute must be replaced by protein and energy-rich feed, as the calf’s weight of around 100 needs to be more than doubled to 240 kg (529 lbs) in just a short period of time.

**Age and weight**

*essential for early oestrus, insemination, calving*

800 to 850 g (26 - 27 oz.) daily, please! Through a speedy gain in weight at 15 months the calf reaches a weight of 300 - 360 kg (661 - 794 lbs) which is ideal for the first insemination. The animal is also in the best condition for its first calving: Between the 22nd and 24th month the ideal weight of around 610 kg (1345 lbs) can be reached. The values given above are approximate and can vary from breed to breed. A rule of thumb says that around 85–90 % of the weight of a fully grown cow is a weight for the first calving.

**Attention: Health brings growth**

A calf which has retarded growth in its first six months hardly has a chance to catch up on this. Attempts to compensate for the deficit lead mainly to the building of fat with its known negative consequences, such as a lack of fertility, more inseminations for each pregnancy or problems in calving.

**A good weight increase promises good conditions**

In the course of the growth phase the increase may be improved upon even further. Studies show that calves which put on weight each day by more than 1,000 g (32.2 oz.), and come through this phase healthy, become large animals (around 10 cm = 3.9 ”) larger, measured by the height of the sacrum, see O. Steinhöfel, I. Lippmann dlz, Vom Start weg fit, Sonderheft 17).
From the playing field to free stall barn life

The form of housing changes as the calves get older: Pens with straw bedding are exchanged for free sheds tailored to size which include bays for lying. In this way young calves are trained for later life in the free stall barn. However, it remains important that groups are formed of animals of the same age and that the same size is retained.

Intensive growth demands intensive feeding

The quality of the feed takes on a decisive importance for the growth phase, because the young animals have sensitive noses: Good wilted silage, good hay, grass, a limited amount of maize silage and also up to 2 kg (4.4 lbs) of concentrated feed are the best ingredients for a tasty feed ration.

It must be rich in energy and easily digestible: Quantities and expected increases in weight

Composition of a feed ration for a male calf weighing 180 kg (397 lbs)

- 15 % CP (raw protein)
- 37 % SP (soluble protein)
- 29 % RUP (rumen-stable protein)
- 29 % NSC (sugar and starch content in the feed)
- 70.3 % TDN (totally digestible ingredients)

The example has been set up for a Holstein-Friesian with key figures which are normal in the North American region.
### Housing recommendations

- Relocation
- Calculation of the feed rations
- Checking of the feed storage and feed quality
- Monitoring of the water quality
- Monitoring of growth by weighing or measurement
- Assessment of the feed situation of the male calf
- Checking of bedding (we recommend ZorbiSan) and manure removal

### Guideline values for energy supply to reared cattle (MJ ME/day) (based on GfE 2001)

<table>
<thead>
<tr>
<th>Live weight kg</th>
<th>150</th>
<th>200</th>
<th>250</th>
<th>300</th>
<th>350</th>
<th>400</th>
<th>450</th>
<th>550</th>
</tr>
</thead>
<tbody>
<tr>
<td>TM/kg/day</td>
<td>3.2–3.6</td>
<td>4.0–4.7</td>
<td>4.9–5.7</td>
<td>5.6–6.7</td>
<td>6.3–7.5</td>
<td>6.8–8.2</td>
<td>7.3–8.9</td>
<td>8.7–10.5</td>
</tr>
<tr>
<td>Daily increase (g)</td>
<td>30.5</td>
<td>36.0</td>
<td>52.6</td>
<td>60.8</td>
<td>69.1</td>
<td>72.2</td>
<td>79.9</td>
<td>95.4</td>
</tr>
</tbody>
</table>

### Guideline values for protein supply to reared cattle (g/day) (based on GfE 2001)

<table>
<thead>
<tr>
<th>Live weight kg</th>
<th>150</th>
<th>200</th>
<th>250</th>
<th>300</th>
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<th>400</th>
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<td>6.8–8.2</td>
<td>7.3–8.9</td>
<td>8.7–10.5</td>
</tr>
<tr>
<td>Daily increase (g)</td>
<td>400</td>
<td>480</td>
<td>560</td>
<td>650</td>
<td>755</td>
<td>840</td>
<td>940</td>
<td>1165</td>
</tr>
</tbody>
</table>

### Guideline values for the requirement of trace elements and vitamins

- **Iron**: 50 mg/kg TM
- **Cobalt**: 0.20 mg/kg TM
- **Copper**: 10 mg/kg TM
- **Manganese**: 45 mg/kg TM
- **Iodine**: 0.25 mg/kg TM
- **Zinc**: 45 mg/kg TM
- **Selenium**: 0.15 mg/kg TM
- **Vitamin A**: 4000 I.E./kg TM
- **Beta-carotene**: 15 mg/kg TM
- **Vitamin D**: 500 I.E./kg TM
- **Vitamin E**: 15 mg/kg TM

### Recommendations for feeding with volume / trace elements, vitamins

- Recommendations for feeding with volume elements (g/day) for male and female reared cattle (based on GfE 2001)
Puberty phase
Things already revolve around the milk

With puberty an important development comes about: The young females develop udders and sexual organs. The better the tissue at the mammary gland and reproductive system develops, the higher the milk yield for all subsequent lactations.

Feed in a balanced manner

Do not feed too much and not too little during puberty: If feeding is too intensive, fat cells form easily in the udder area. These are essentially out of place here, because they restrict the growth hormone which is responsible for the formation of the milk gland tissue. A lower milk yield is the consequence. At the same time the young body needs large amounts of energy and proteins for the targeted weight.

Therefore, constantly keep an eye on the animals in the puberty phase. Regular weighing or measurement of the chest circumference ensures that the growth graph line rises in a straight line. Also check whether feeding with mineral and trace elements is working well.

Welcome to the herd

Let the future come: The young animals are now big and old enough for the parlour system in which they will also be kept as a cow. The earlier they become familiar with the cubicles, the easier they can be later led into the free stall barn. Every 3–6 months the animals can move to another group.

GEA Farm Technologies brings the comfort of the meadow into the parlour: The young animals are happy to make themselves comfortable in cubicles which offer plenty of freedom of movement and on mattresses that are suited to the natural behaviour patterns of the animals.
Cubicles for 7–12 month old cattle

A perfect climate in the barn: Avoiding draughts and accumulations of heat

Fresh air livens up young cattle. For the best health and growth they also need a protective micro-climate, as they cannot store their body heat for long periods. The secret of a good barn climate is therefore found in a ventilation system which exchanges the air constantly but in a controlled manner, under every kind of weather condition and at any temperature, without creating draughts. This transport corridor moves humidity and heat from the barn, as it does pathogens and harmful smells.

At the level of the young animals

Don’t make any compromises: Volumes of circulated air of 2 - 3 m³ / min (71 - 106 ft³ / min) are ideal. As the latest research shows, heat stress is also a restricting factor in the growth of young animals. In order to discover the perfect design for a ventilation window, a roof opening or a mechanical ventilation system for your particular barn, we recommend taking individual advice!

### The demands on ventilation systems change with age

<table>
<thead>
<tr>
<th>Age</th>
<th>Hot climate</th>
<th>Mild climate</th>
<th>Cold climate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Months</td>
<td>2.8 m³ / min (99 ft³ / min)</td>
<td>1.4 m³ / min (49.5 ft³ / min)</td>
<td>0.5 m³ / min (17.6 ft³ / min)</td>
</tr>
<tr>
<td>2 – 12 Months</td>
<td>3.7 m³ / min (131 ft³ / min)</td>
<td>1.7 m³ / min (60 ft³ / min)</td>
<td>0.6 m³ / min (21.2 ft³ / min)</td>
</tr>
</tbody>
</table>

**Dimensions**

- Minimum length of the box 185 cm (73")
- Width 80 - 90 cm (32 - 35")
- Length of the division 160 cm (63")
- For single and double rows
- 2" rail and 1.5" front tube

**Mattresses**

- Allows young animals to relax comfortably
- Saves on bedding
- Depending on the form of the mattress (e.g. with a surface mat, rubber, with or without studs)

**Recommended eaves heights of free sheds**

<table>
<thead>
<tr>
<th>Division of rows</th>
<th>Minimum eaves height</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-sided</td>
<td>3.65 m (12&quot;)</td>
</tr>
<tr>
<td>2 or 4</td>
<td>4.30 m (14&quot;)</td>
</tr>
<tr>
<td>3 or 6</td>
<td>4.90 m (16&quot;)</td>
</tr>
</tbody>
</table>
Always the best for barn or pasture rearing

Feeding between 7 and 12 months follows seamlessly the recommendations of the growth phase. The good quality of all feed is a priority, however the proportion of concentrated feed should be lowered at the end of the puberty phase. Differing guideline values apply for barn and pasture rearing.

Requirements for protein input
The nutrient needs of young cattle are determined by various factors. The recommendations of individual countries can often not be compared, as there is no uniform basis. DE: digestible raw protein, US: raw protein. For this reason it is intended not to give detailed recommendations here.

- 14 – 15 % raw protein in the pre-adolescent phase
- The raw protein should be 30 – 35 % soluble
- The amount of protein decreases with increasing live weight (age), the amount of fat increases

Barn rearing
- Good wilted silage
- Good hay
- Limited amount of maize silage
- Gradually reduce the provision of concentrated feed
  - 2 kg (4.4 lbs) at approx. 7 months
  - 1.5 kg (3.3 lbs) from 9 months
  - 1 kg (2.2 lbs) from 12 months

Pasture rearing
- Good quality grass and hay
- Additional concentrated feed, gradually reducing
  - 2 kg (4.4 lbs) at approx. 7 months
  - 1.5 kg (3.3 lbs) from 9 months
  - 1 kg (2.2 lbs) from 12 months
Utilise feed, don’t waste it

Well-run farms attempt to design the energy input to animals in an optimal manner and not simply to the maximum. Because automatic feeding does not necessarily guarantee effective use. And before valuable energy from the feed is ineffectively wasted, it is worthwhile taking a look at the complex relating factors which decide whether feed utilisation is being carried out optimally. It is desirable, in any case, to find the ideal relation of feed intake to growth, since this will help to reduce feed costs in the long term.

Influences on feed utilisation from all sides

In general, large animals need more feed for growth. In comparison, fat animals have a lower rate of feed utilisation. Further factors are the genetics of a breed, the relevant growth phase and the typical growth rate for that period. Additional influences are body condition and the state of training. This is determined by the form of housing in the barn, on the pasture and the related paths taken. Stress due to heat or cold also plays a part. Finally, the period of time that the feed remains in the rumen appears to be no less important: The longer this is, the better, for instance, for the digestibility of concentrated feed containing starch.

From our experience, and due to all the complex interrelations, discussions with a reliable feed consultant are an advisable supplement, since all plans regarding feed and its ingredients are, ultimately, dependent on their regional availability and quality at a particular time.

Mechanical ventilation

- Latest research results have shown that heat stress slows down the growth of young animals
- An air exchange which provides a good climate maintains animals health and promotes top growth

<table>
<thead>
<tr>
<th>Condition</th>
<th>Demand on energy input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold water</td>
<td>Increase in energy</td>
</tr>
<tr>
<td>Wind</td>
<td>Increase in energy</td>
</tr>
<tr>
<td>Cold, hard lying areas</td>
<td>Increase in energy</td>
</tr>
<tr>
<td>Well-managed free stall barns</td>
<td>Reduction in energy</td>
</tr>
<tr>
<td>Heat</td>
<td>Increase in energy – however, with a reduced feed intake</td>
</tr>
</tbody>
</table>
**Beware: Keep any eye out for unwelcome guests**

The bigger something is, the more interest in it increases. As their age increases, and in particular when they are turned out to pasture, young animals discover that parasites take a liking to them: Mites, lice, biting lice or botflies, as well as stomach and lung worms or liver flukes, attempt to use the animals from the inside and outside as hosts. Rapid weight losses with obvious infestation are just as serious as a slow-down in development due to sub-clinical manifestation: Treatment costs, loss of yield or deaths lead to significant losses in rearing and production.

**Management through prophylactics and subsequent checking**

Preventative measures which improve the hygiene of feed or the condition of the pasture move into the focus of management. In doing so, it is worth paying attention that ecto- and endo-parasites are denied the possibility of attacking from the very start or, where there is an acute infestation, that the spreading of the parasites is safely prevented. Following this, the successful course of the puberty phase must be checked through measurement and weighing.

**Feed promotion**

- Take out measures to reduce parasites in the production of feed (e.g. alternate mowing and grazing of pasture)
- Avoid the intake of infectious larvae

**Pasture hygiene**

- Aim for a low contamination of the pasture land, interrupt manure treatment
- Do not bring any young animals onto contaminated pasture
- Let animals out to pasture in age groups
- Pay attention to factors, such as herd density and previous use of pasture
- Choose a suitable date for driving out the animals, the drier the better

**Herd size**

- The use of anthelmintics and anti-parasitic agents at the beginning of the pasture season as a prophylactic on the animals

**Housing recommendations**

- Barn change or pasture
- Calculation of the feed rations
- Checking of growth by weighing or measurement

- Pest control and prophylactic measurements like deworming and pasture management
- Claw health
- Vaccinations
Everything points to fertility

The fertility of the young cattle starts, the reproductive cycle begins, the climax of puberty has been reached: Heifers are the most fertile animals and the ones which have made the most progress in rearing. Now it is a matter of determining the timing of the oestrus and making use of genetic potential by targeted mating. Given the opportunities in this situation you should leave nothing to chance and put in place appropriate management aids: For example, the CowScout S activity sensor removes the time-consuming task of observing the heifers around the clock.

Open offer: Space for heifers
Make things as comfortable as possible for your heifers: Cubicles in the free stall barn which are tailor-made in size provide a maximum freedom of movement, optional mattress systems ensure the best conditions for lying. Excellent possibilities for efficient and individual care of the animals, monitoring and working are provided by the GEA Farm Technologies automatically locking feed fences.
Reduced energy input required for free-ranging animals

On entry into the first heifer phase and at a weight of around 350 - 400 kg (772 - 882 lbs) it is necessary to reduce the proportion of energy and protein in the feed. The recommended guideline values vary according to the weight and desired increase and can be read off from the tables (see p. 27). The provision of mixed rations, which can be given ad libitum, is the most suitable. Sufficient fresh water in perfect condition is also a must.

And otherwise? Let a pregnant heifer occasionally roam free. Putting out to pasture promotes the metabolism but also the formation of bones and muscles.
Heat detection – find the right time and use it

Appropriate management aids, such as the CowScout and Rescounter II activity sensors help to accurately recognise the signs of the first heat! Early, precisely and successfully: The more precisely the time of the heat is recognised, the more successful insemination will be. And this has a double advantage: Where pregnancy is diagnosed at an early phase, it is not just the health of the heifers which profits but also the efficiency of rearing.

Weight, age, calving – when is the best time for conception?

Purely mathematically, the optimum age for conception can be easily calculated in reverse: The starting point is a desired timing of problem-free first calving of 22 – 24 months. With a gestation period of 270 – 290 days the pregnancy must therefore be commenced at 13 – 15 months. At this time – and more decisive than the age – an ideal weight of 2/3 of the desired weight for calving should also have been reached.

Pointing the way: Monitoring ensures pregnancy and success in breeding

Once the period of fertility has begun it is worthwhile to invest a few minutes, which you possibly save through automatic heat detection, in the selection of the right bull. At the time of highest fertility you will be able to make the most progress in the breeding of your heifers. The well-being of the heifer and the bull have a big influence on the course of the birth and the development of the calf. For a first conception it is desirable to aim for a simple birth. The GEA herd management system provides full support on fertility and management matters: Plan your milk production based on healthy, long-living cows!
Time of maturity: The next generation grows up

The pregnant heifers need particular attention. In order for the last six months before calving to pass by trouble-free, special attention must be paid to hygiene and, at the same time, feeding should be optimised. It is best that the heifer group remains on its own. Separated from the normal cows or dry cows, the pregnant animals run the least danger of becoming infected with pathogens or bacteria. The feeding of the group can be individually planned and optimally carried out.

The free stall barn also grows

The heifer group moves into a free stall barn with size-adapted cubicles. It is even more essential than ever to avoid heat stress. A suitable ventilation system ensures an exchange of air so that there can be a continuous intake of dry feed, even on warm days.

GEA cubicles for 19–25 month-old heifers, shortly before calving

**General**
- One feeding station per heifer, at least 75 cm (30 ‘) 
- Sufficient walkway surface for freedom of movement
- High standard of comfort for lying

**Dimensions**
- General box size:
  - Length: 2.45 m (8 ’) 
  - Width: 1.1 m (3.6 ’) 
- Rail length 2 m (6.6 ’) 
- Rail width 0.85 m (2.8 ’) 

Lactation in sight: Optimising body condition

The nearer to the time of calving, the more important body condition becomes: The pregnant mother must have resources in reserve to provide a good start into lactation and to subsequently get it through this period. Body Condition Scoring (BCS) or weighing with the Taxatron scale gives reliable information on the animals’ health. The DairyPlan C 21 herd management system provides all the necessary functions for correct recording of the BCS. The whole of the development of the animal can be analysed in detail using displays of the information in the form of graphs and tables.

Housing recommendations

**Rearing**
- Relocation
- Calculation of the feed rations with special attention on the close-up group before calving

**Management**
- Monitoring of growth by weighing or measurement
- Body condition scoring with the scale Texatron
- Monitoring of pregnancy
- Removal of hair from the area around the udder for hygiene reasons
- Optimal water and feed supply
- Good feed hygiene
A good birth and a happy end

If you are an experienced calving assistant you have most probably long since taken good precautions: All equipment which is necessary for the birth and for the care of the calf is clean, disinfected and easy-to-hand in a fixed location. Sufficient feed has been provided and the trough is well filled with water. Nevertheless, calving has to be learned: The cow, the calf, animal welfare and economic aspects must all be harmonised. Therefore, please do not lose patience if the heifer takes a further four hours once the amniotic sac has burst.

Hygiene all around helps your calf onto its feet

Hygiene has top priority at the birth: In order to keep the risk of infection as low as possible the calving box must be freshly disinfected and bedded down before relocation. No sick animals should be kept in the immediate environment. Nevertheless, it is ideal to have a soft surface for moving and lying, from which the heifer has eye contact with the rest of the herd. The same conditions apply after the birth: All remnants of a calving must be removed immediately, because excrement, urine, blood or the placenta are fertile breeding grounds for germs. Thoroughly cleaned, disinfected and with new bedding, the calving box is well prepared, because the next pregnant heifer will certainly not be long in coming!

Stop by and take a look:
ideal birth assistance from the very start

During calving it can be seen how all influences, such as feeding, housing and mating, as well as preparations for the birth, come together at the end of the heifer phase. Perfect growth at all phases of the calf’s life particularly helps to effectively prevent calving disorders, such as dystocia, inflammation of the uterus or ovarian cysts.

Once the birth has started, keep a regular eye on progress as much as possible. The best conditions for this can be achieved by an easily viewable and accessible calving area. Every person involved should make a personal contribution to ensuring a high degree of hygiene by having clean hands, arms and clothing. If pulling the calf out needs to be considered, moderate assistance should be provided only during contractions and with a maximum of two people. Great caution should be taken in the use of mechanical birthing aids, because their force is difficult to estimate. Keep the telephone number of your vet to hand, so that necessary advise and assistance is possible.
**Top performance demanded:**

the many aspects of feeding

It is only natural that top performance is demanded from all sides by calving heifers. Even while the heifer itself is growing, its own calf demands its share and reduces the feed intake of the mother. Thus, heifers require a great amount of energy but themselves eat less. Therefore, the rule in feed management applies once more: high feed quality, perfectly provided and submitted easily.

The requirement of a heifer in energy and protein is significantly higher in comparison with a dairy cow. So, make sure that plenty of minerals are provided: An energy deficit at the beginning of lactation, triggered by feed which is low in nutrients, because it is inferior, rained upon or spoiled, quickly ruins health and fertility. Ketosis may follow if the heifer must mobilise reserves by reducing body fat.

Thus, ensure that the animals neither lose weight nor become fat prior to calving. A heifer which eats plenty of feed at this phase will also eat well after calving. However, if the feed level prior to calving is too high, the birth canal can become fattened, and a difficult birth may follow or the metabolism may be disturbed at a later phase. If feed supply is optimal and balanced you will make the best overall start to lactation.

**Demands on the design of the calving pen**

**General**

- Can be used as a single or group maternity pen
- The pen must have sufficient space with a soft surface for moving and lying
- Calving animals should have eye contact with the herd
- Ideally close to milking equipment in clean surroundings, easy to clean
- Access should be free, individual and mechanically simple
- All instruments required are clean and positioned near to the calving area

**Size, dimensions**

- Single maternity pen: at least 3 x 4 m (10 x 13 ‘) 
- Group maternity pen: 8 m² (86 ft²) per cow

**Housing recommendations**

- Relocation to a freshly bedded and disinfected calving bay
- Cleaning and disinfection of all utensils required for the birth
- Good personal hygiene – wear gloves
On to success and growth with lively calves

We hope that our guidebook has whet your appetite: lively calves provide a healthy basis for your milk production. Even small changes in housing, feeding and hygiene improve the success in rearing. The result is high yielding cows producing high quality milk with the best components in their future life. Speak to us about your methods and ideas. We can assist you with our range of skills and solutions. Efficient, sustainable and profitable: Total solutions from GEA Farm Technologies.
We live our values.
Excellence • Passion • Integrity • Responsibility • GEA-versity

GEA Group is a global engineering company with multi-billion euro sales and operations in more than 50 countries. Founded in 1881, the company is one of the largest providers of innovative equipment and process technology. GEA Group is listed in the STOXX® Europe 600 index.