

# Management Guide

For laying hens in deep litter, perchery and free-range systems



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Preface . . . . .	3
Deep litter system . . . . .	4
Perchery system . . . . .	4
Free range . . . . .	5
Requirements for pullets . . . . .	5
Housing of pullets . . . . .	6
Management during the early days . . . . .	7
Litter . . . . .	8
House climate . . . . .	8 – 9
Equipment needed/minimum technical requirements . . . . .	10
Feeding of laying hens . . . . .	11
Onset of production . . . . .	12 – 13
Phase feeding . . . . .	14
Condition of the plumage and feed intake . . . . .	15
Feeding – when and how? . . . . .	16
Water . . . . .	16
Flock checks . . . . .	17
Nest boxes . . . . .	17
Floor eggs . . . . .	18
Lighting . . . . .	19
Lighting programmes . . . . .	19 – 20
Bird health . . . . .	21 – 22
Parasites . . . . .	22 – 23
Rodents . . . . .	23
Abnormal behaviour . . . . .	24
Outdoor areas . . . . .	25
Cleaning and disinfection . . . . .	26 – 27
Notes . . . . .	28
List of authors . . . . .	29

## **Preface**

The keeping of laying hens in deep litter, perchery and free-range systems requires considerably more expertise than the conventional battery cage system.

Eggs produced in this way are high quality food-stuffs which justify a higher price.

Any farmer who decides to adopt alternative production systems should first acquire a basic knowledge of layer management in alternative systems. This guide is intended to provide the necessary information.

Readers wishing to explore this subject in greater depth will find more advanced material in various sources, including publications by the German KTBL and the management programmes of breeding and multiplier companies for laying hens.

Before planning and building new facilities or converting existing buildings into deep litter or perchery housing, it is essential to obtain expert advice.

The authors

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## Deep litter system

- Designs vary considerably and can be adapted to the layout of an existing building;
- Classic form: 80 – 90 cm dropping pit covered with wooden, wire mesh or plastic slats on which feeders, drinkers and nests are mounted =  $\frac{2}{3}$  floor space and littered scratching area =  $\frac{1}{3}$  floor space;
- If the hens have unlimited access to a covered outdoor enclosure the entire barn can be covered with slats;
- Stocking density: 9 hens per  $\text{m}^2$  of usable floor space;
- Raised perches and rails encourage good dispersal of the hens across the building and provide resting areas.

## Perchery system

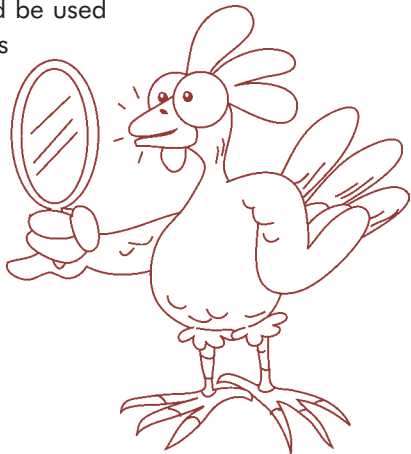
- Percheries are systems where the birds can move around on several levels.
- The levels are covered with wooden, wire mesh or plastic slats, and manure belt Ventilation can be installed if desired. As a rule, feeders and drinkers are positioned on the lower levels.
- The upper levels are mostly used as resting areas for the hens.
- Depending on the type of perchery, the nest boxes are located either within the system or outside the perchery.
- Stocking density: up to 18 hens per  $\text{m}^2$  of ground floor space;
- Controlled lighting and variable feeding times should encourage the hens to move around the different levels.

## Free range

- Deep litter or perchery system where birds have additionally access to free range.
- Wintergarden as crossing area which can be cleaned after each flock.
- Stocking density 4 m<sup>2</sup> per bird in range area

## Requirements for pullets

- **Pullets should have their beaks carefully trimmed.** The keeper should therefore liaise with pullet suppliers in good time. The pullets' bodyweight should preferably be above the breeder's standard – allow for fasting losses during transport! Pullets intended for alternative management systems should be raised in the same system, i.e. perchery hens should be raised in percheries.
- The greater the design similarities between the grower and the production facility the easier it will be for the pullets to get used to their new surroundings.
- Even pullets kept in deep litter systems should be given opportunities for learning how to fly – perches should be used before 6 weeks of age (the feed chain should preferably be raised).



## Housing of pullets

- Pullets should be moved to the production facility at about 18 weeks of age.
- On arrival, hens should be dispersed evenly across the building (within the system) and placed close to feeders and drinkers.
- **Water and feed must be available immediately.** To make drinking easier the water pressure of nipple drinkers can be increased.
- **Make sure that the temperature in the building is comfortable!**
- The light should be left on after arrival of the birds to that they can find their way around – in extreme cases for up to 24 hours (while observing the day-night rhythm!). However, if the birds are extremely fatigued on arrival it may be advisable to turn the light off for a brief period of rest.
- Do not disturb the birds during the first 24 hours in their new quarters – checks should only be conducted in emergencies.
- **Attendants should behave calmly** – always wear the same clothing. Nervous attendants unsettle the new pullets.



## Management during the early days

- In the first few days following the move to the laying house the birds' feed intake should be stimulated. Ways of achieving this include moistening the feed, running the feed lines more frequently, using skim milk powder or a whey-fat concentrate and vitamin supplements.
- **It is essential that pullets do not lose weight after housing.** They should gain weight, or at least maintain their bodyweight.
- If the housing system allows it and stocking densities are not exceeded as a result, the hens should be confined to the area above the manure pit or the perchery until about 75 % laying performance has been reached.
- Partial closure of the scratching area (leaving a minimal portion accessible to the hens) and manual assistance for birds that cannot find their way back into the system have also proved useful.
- Light sources should be installed in such a way that the entire house and the entrance to the nests are well lit and should be programmed so that at the end of the light day only the area above the manure pit or the perchery are lit.





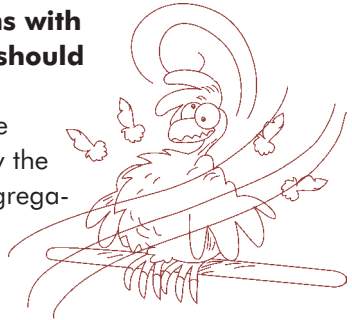
## Litter

- The type and quality of the litter are important for the hens and the house climate. Various materials may be used:
  - Sand or gravel up to 8 mm particle size
  - Wood shavings
  - Wheat, dinkel, rye straw
  - Bark mulch
  - Coarse wood chips
- Sand and gravel should be put down **dry**, wood shavings must be dust-free and straw must be of clean and fungus-free quality.
- **1 to 2 cm litter depth is sufficient.**
- Litter should be put down after placement of the hens and should preferably be spread around by the birds themselves. If temperatures are low this can prevent the formation of condensation between floor and litter.
- Changing soiled litter in heavily used areas of the barn is often unavoidable.
- A well designed outdoor enclosure is good for litter quality. Exit/entry pop-holes should be staggered.

## House climate

- **House temperatures of 18 °C are ideal for laying hens in alternative production systems.**
- A relative humidity of between 50 and 75% is tolerated by hens.
- Lower temperatures during the winter months pose no problem for hens. But high temperatures above 30 °C are less well tolerated.
- Hens that are expected to use a covered outdoor enclosure or range area must be acclimatised to the colder winter temperatures.
- The quality of the plumage should be taken into account when setting house temperatures in alternative production systems.

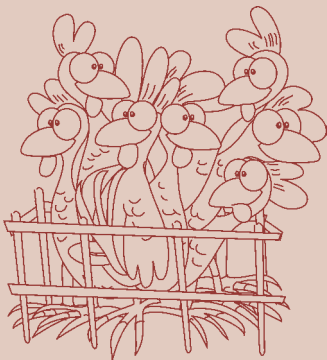
- Climate and house temperature are heavily dependent on hen activity, stocking density and pop-holes.
- **Draughts are bad for hens.**
- **If there are problems with ventilation, experts should be consulted.**
- Draughty sections of the building are avoided by the hens. They tend to congregate in warm, stuffy parts of the building. Mortalities due to crushing and the incidence of floor eggs are increased by poor ventilation.
- Ventilation should ensure that in summer warm air is rapidly extracted from the area occupied by the hens and that in winter the building does not get too cold.
- High concentrations of noxious gases should be avoided.
- **Ammonia has an adverse effect on the hens' well-being and health.**
- In buildings operating ventilation with air at negative pressure, a well constructed outdoor enclosure and the use of exit boxes or ant draught devices (strip curtains) in front of the pop-holes prevent the ventilation system from breaking down.
- The following minimum requirements for house air should be observed:



O <sub>2</sub>	Not less than 20%
CO <sub>2</sub>	Below 0.3%
CO	Below 40 ppm
NH <sub>3</sub>	Below 20 ppm
H <sub>2</sub> S	Below 5 ppm

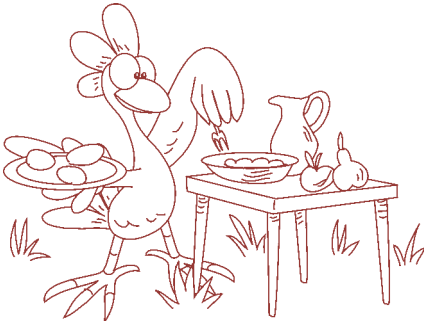
## Equipment needed / minimum technical requirements

Darkness	Min. 8 hours or natural dark phase
Feeding place	Trough space 10 cm/bird; circular feeder 4 cm/bird
Drinkers	Circular drinking trough 1 cm/bird; 10 birds/nipple
Distances	Max. 8 metres to feeder/drinker
Nest boxes	5 hens/individual nest; in communal nests 120 hens/m <sup>2</sup>
Proportion of litter	At least 33 % of floor area
Droppings pit	80 – 90 cm deep to hold droppings from one batch if there is no manure scraper / 7° gradient to nest
Perches	15 cm/hen; distance between perches 30 cm
Exit pop-holes	Minimum dimensions: 45 cm high / 500 hens per metre



## Feeding of laying hens

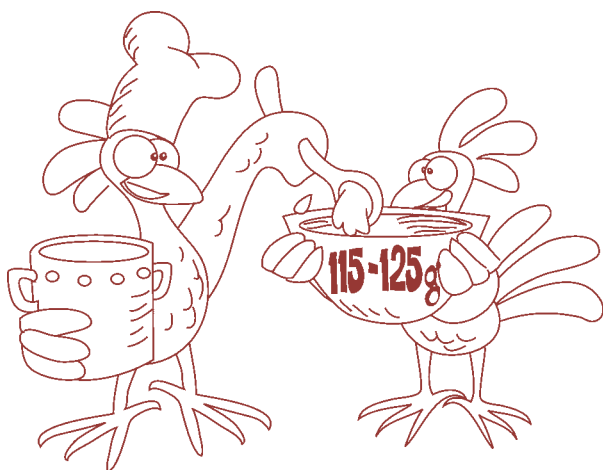
- Because of increased movement and activity by hens in alternative systems, their maintenance requirement is 10 % higher than that of caged hens (15% in the case of free-range hens).
- Based on an average feed consumption of 110 g / hen and day, the extra feed allowance for floor-reared hens is + 6.6 g feed / hen per day and for free-range +10 g feed / hen per day (11.4 ME MJ/kg) .
- The prerequisites for a good and adequate nutrient intake by the hens are a sufficiently high dietary energy content and sufficient feed consumption.
- The economic scope for manipulating nutrient density is limited. A sufficiently high feed intake per bird per day is therefore the key to ensuring that hens perform to their genetic potential.
- The feed intake capacity of laying hens is determined by:
  - Bodyweight
  - Laying performance
  - Ambient temperature
  - Condition of plumage
  - Energy content of the ration
  - Consistency of the feed
  - Genetic potential
  - Health status
  - Development of stomach/intestines



## Onset of production

- Prior to 18 weeks of age pullets are not yet fully grown and should therefore not be fed a layer ration. This prevents premature onset of egg laying. At that age the hens in the laying house should therefore receive a pre-lay ration. This should be fed for a period of about two weeks.
- When a flock has reached about 5 % production the ration is switched to a high quality complete layer starter. The time for feeding the pre-lay ration and the optimum changeover date should be agreed with the pullet producer.
- Just before and at the start of laying activity a reduction in feed intake is often observed, in some cases to well below 100 g / bird per day. This is too low and efforts should be made to raise the feed intake to 115 g / bird per day as quickly as possible. This can be achieved by:
  - Ensuring that the feed has a sufficiently homogeneous consistency until it is consumed
  - Feeding several times a day (6 – 8 feedings)
  - Running feed lines several times a day for short periods
  - Running feed lines empty at regular intervals (ideally every day, but at least once a week)
  - Moistening the feed with water or other suitable liquids
  - Feeding whey or a whey-fat concentrate
  - Illuminating the feeding stations
- An adequate nutrient intake during this time should be ensured by providing a ration with a high nutrient density (11.6 – 11.8 ME MJ/kg) and correspondingly higher amino acid concentrations. **Nutrient deficiency of hens at the start of laying activity leads to irreversible losses in egg production.**

- Premature use of a layer ration (calcium > 3 %) is undesirable; a pre-lay ration is recommended. This should be agreed with the pullet supplier.
- At the beginning of the production period laying hens should rapidly achieve an adequate feed intake. Undersupply of nutrients at the onset of lay places a strain on the hens' metabolism and can lead to fatty liver syndrome.
- The actual daily feed intake per bird per day can vary considerably in practice.
- Normal laying performance in alternative systems requires both a high dietary nutrient density and an even feed intake.
- **The objective is a daily feed intake of at least 115 – 125 g per hen** (depending on breed and management system).



## Phase feeding

- The basis of any feeding programme should be the hens' nutrient requirement. This changes constantly as the hens get older. To cater for changing dietary needs, at least three different ration types should be provided:
  - A layer starter (phase 1) with a high nutrient density for a good start to production
  - A phase-2 ration for good laying persistence with reduced levels of protein, amino acids and linoleic acid and adequate levels of calcium and phosphorus
  - A phase-3 ration formulated for optimum shell quality and egg weights

Example of a commercial phase-feeding programme:

Nutrient	Phase		
	1	2	3
	19-35**	36-50 **	51**- End
ME MJ/kg	11.6	11.4	11.4
Crude protein %	18.0	17.0	16.5
Methionine %	0.40	0.38	0.35
Lysine %	0.90	0.80	0.75
Calcium %	3.70	3.70	4.00
Phosphorus % *	0.55	0.50	0.45
Sodium %	0.15	0.15	0.15
Linoleic acid %	2.00	1.75	1.40

\* if phytase is used    \*\* age in weeks

- The most efficient way of providing hens with an adequate feed and nutrient supply is to set up one feed silo for each age group. In larger operations it is advisable to supply each unit from two silos. This makes regular cleaning of the silos easier and enables a rapid change in diet if necessary.

## Condition of the plumage and feed intake

Intact plumage throughout the laying period complies with animal welfare regulations and is essential for animal health. The feathers protect hens against loss of body heat and prevent increased feed consumption.

Impact of plumage on daily energy requirement for maintenance:

%	Plumage					
	100	90	80	70	60	50
Additional maintenance requirement kcal	0	7.2	14.4	21.6	28.8	36
Additional feed requirement g/day*	0	2.6	5.2	7.8	10.4	13

Ration with 2770 kcal, or 11.6 ME MJ/kg



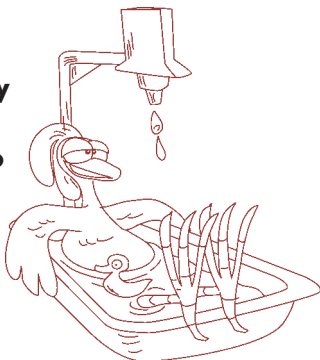


## Feeding – when and how?

- During the first three hours of the light period feed lines for young flocks should be run hourly. For the remainder of the light day feeding at three-hourly intervals is recommended.
- Hens should eat sufficient food before the end of the day so that they have adequate nutrients for egg formation during the nocturnal rest period.
- If extra calcium is to be provided via the feed lines the last feeding of the day is the best time to do this.

## Water

- Water should be of potable quality. Well water should be analysed regularly.
- Keepers of laying hens should always ask themselves: **Would I drink this water myself?**
- Feed and water intake are closely correlated. The normal ratio is twice as much water as feed (2:1).
- If temperatures are high or hens are sick they drink more.
- **Hens that are unable to drink enough water do not eat.**
- Regular inspections of the drinking system are strongly recommended.
- A water meter is a worthwhile investment.
- **Drinking facilities should be regularly cleaned, paying special attention to supply tanks.**



## Flock checks

- Immediately after the start of the light period in the morning a thorough tour of inspection should be made to check that the following are in good working order:
  - Drinkers
  - Feeders
  - Lights
  - Nest boxes
- The house climate should be checked and the condition of the flock and the hens' behaviour assessed.
- At the start of lay multiple inspections are recommended to collect any floor eggs.

## Nest boxes

- Nest boxes should be easily accessible to the hens, preferably by positioning them in a central location in the shed.
- The entrance to the nest should be well lit, while the interior of the nest area should be kept dark.
- Do not allow pullets access to the nest until shortly before laying activity starts (about 10 days before). This increases the attractiveness of the nest.
- During the laying period the nest should be opened 2 – 3 hours before the start of the light period and closed 2 – 3 hours before the end of the light period.
- Avoid soiling of nests and broodiness by closing the nests overnight!
- Barring night-time access prevents hens from spending the night in the nest, which also makes it less attractive to mites.
- Tilting floors are effective in expelling hens from the nest and also help keep the floor of the nest clean.

## Floor eggs

The incidence of floor eggs can be reduced by considering the following in the design of the building and the management of young flocks:

- All parts of the building should be well lit – dark corners and heavily littered scratching areas encourage hens to lay floor eggs.
- Draughty nests bother hens during egg laying.
- The entrance to the nest must be clearly visible to the hens.
- Additional lighting of the interior of the nest can increase nest acceptance at the start of lay.
- The litter depth should not exceed 2 cm at the beginning of the laying period - light-coloured litter is preferable to dark.
- Feeders and drinkers should not be more than 2 – 3 metres away from the nest area.
- Drinkers in the vicinity of the nest entice the birds into this area.
- Perforated floors that slant towards the nest at an angle of about 7° motivate the hens to lay eggs in the nest.
- If there are level walking surfaces in front of the nests, barriers should be installed every two meters to stop hens from parading along the nests and blocking access to them.
- Pullets should be moved to the production facility at about 18 weeks of age.
- Nest boxes should be opened 10 to 14 days before the start of lay.
- Do not disturb the hens during the main laying time and avoid feeding at this time if possible.
- No flock inspections during the main laying time!
- Floor eggs should be collected promptly, if necessary several times a day.
- If floor eggs occur, increase the daylength by turning the light on earlier in the morning.
- Electric fencing and draughts keep hens out of problem areas.

## Lighting

- The best light source for laying hens is a high frequency lamp emitting light within the natural spectrum (frequency range over 2000 Hz).
- Fluorescent tubes or energy-saving lamps (50 – 100 Hz) have what is referred to as a „disco effect“ on laying hens. This type of lighting induces stress, feather picking and cannibalism (which does not occur with incandescent lamps).
- **Lights should have dimmers.**

## Lighting programmes

- **Do not shorten the daylength during the laying period!**
- **Coordinate programmes for the growing and production phase. Laying hen keepers and pullet producers should liaise on this (daylength and light „on/off“ times).**
- If the laying house has windows there are several options:
  - either keep the windows blacked-out completely until the maximum daylength is reached (according to the programme)
  - or coordinate the times for opening or covering the windows with the lighting programme.
- **In central Europe the natural daylength increases to about 17 hours by the end of July and then shortens to about 8 hours by the end of December.**
- If the hens have access to covered outdoor enclosures / range areas or if windows and ventilation shafts cannot be light-proofed to keep out natural daylight, this should be taken into account.
- When moving hens to „open“ laying houses it is essential to prevent excessive photostimulation

and hence stress through an abrupt lengthening of the day (in spring and summer). Illumination should be increased by not more than 2 – 3 hours.

- Daylength should be increased (according to the programme) by 30 or 60 minutes weekly to 14 hours. Adjustments should always be made in the morning.
- In open housing the lighting programme during the spring and summer months is determined by the lengthening of the natural day, which peaks at about 17 hours of daylight.
- **When the natural day shortens from July onwards, the 17-hour daylength should be kept constant until the end of the laying period by using a time clock.**



## Bird health

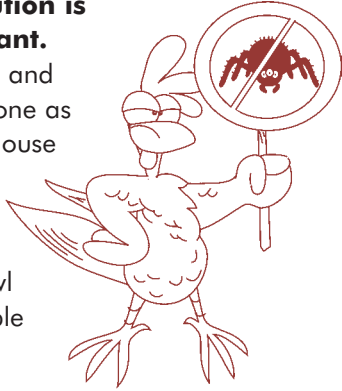
- Growing pullets are vaccinated against several viral diseases (Marek's disease, IB, ND, Gumboro, ILT), one bacterial (Salmonella) and one parasitic infection (coccidiosis).
- In alternative systems the infection pressure from fowlpox and EDS is usually higher and, depending on the region, pullets should also be vaccinated against these diseases.
- Combined vaccinations against IB, ND, EDS, in some cases also ART, are popular.
- Booster vaccinations against ND are required by law and vaccinations against IB are advisable at 5-10-week intervals.
- If the Salmonella pressure is high an additional vaccination on top of those usually given during the rearing period, is required. This should be done with Salmovac, an adsorbed vaccine.
- Bacterial infections due to E. coli, erysipelas and Pasteurella multocida are common in alternative management systems. An infectious outbreak depends on the type of causal agent, the infection pressure and the condition of the flock. Here too, immunity can be conferred by combined vaccinations.
- Effective treatment of bacterial infections is almost impossible in laying hens. This is why a prophylactic vaccination with flock-specific vaccines is advisable. This outlay can help prevent high losses and emergency slaughter of flocks.
- Causal agents of erysipelas and Pasteurella infections are usually found in rodents living near infected birds. **Effective control of mice and rats is an important preventative measure.**
- E. coli infections are promoted by regional MG (Mycoplasma gallisepticum) infections and should be minimised by vaccinating hens against MG.

- Clostridia can be kept at bay by proper sanitation in the scratching area, outdoor enclosure and range.
- **Only two drugs are still approved in Germany for the treatment of bacterial infections (E. coli) in laying hens.**
- **There are no drugs on the market against coccidia, Pasteurella, erysipelas etc.**
- **If mortalities are high or if there are other signs of sickness in the flock, a veterinarian should be consulted immediately.**

## Parasites

- Roundworms and threadworms occur in chickens (transmission with the droppings).
- If an infection is suspected the hens in the flock should be examined. Worm eggs are visible in the droppings. If helminth infection is diagnosed the flock should be wormed.
- Red mite is a major problem in alternative production systems.
- Mites damage health and reduce productivity and in heavy infestations they can be responsible for high mortality rates (by transmitting diseases).
- Infestation causes stress in the flock (feather pecking, cannibalism, reduced egg production).
- **It is advisable to check flocks regularly for mites.**
- Common hiding places of mites are:
  - corners of nest boxes
  - under the top covering of the nest roof
  - feeder legs, trough connectors
  - crossbars of perches
  - dropping boards
  - corners of walls
  - vertical tubes of perches

- Mites should be controlled with suitable insecticides or other suitable products. These should be applied in the evening as mites feed at night.
- When applying insecticides take care to reach all places where mites hide. The quantity of product applied is not what matters but **its thorough and even distribution is extremely important.**
- Treatments for mites and beetles should be done as soon as the laying house has been evacuated – while the barn is still warm – otherwise the insects crawl away into inaccessible places.



## Rodents

- Housing for laying hens should be free of rats and mice. Rodents carry disease and are often the cause of bacterial infections in the flock.
- If there is heavy rodent infestation the pests should be exterminated quickly and efficiently by a trained specialist.
- The use of suitable building materials, regular maintenance of the fabric of the building and sealing of openings in the exterior wall (wire grills in front of ventilation shafts) reduce rodent numbers.
- Broken stones and shingle (laid in a 1 – 2 m wide strip along exterior walls) are avoided by rats and can deter them from coming near the laying house.



## Abnormal behaviour

Watch out for and monitor abnormal behaviours (feather pecking / cannibalism). A sudden onset of abnormal behaviour can have a variety of reasons. Consider the following:

- Nutrition and health – bodyweight, uniformity, signs of infections;
- Stocking density – overcrowding and insufficient feeding and drinking stations cause stress;
- House climate – temperature, humidity, air velocity, pollution by dust and/or noxious gases;
- Light intensity / light source – excessively bright light or flickering light (fluorescent tubes or energy-saving lamps, < 2000 Hz );
- Ecto- and endoparasites – infested birds are stressed and have diarrhoea;
- Feed consistency – very finely ground meal-type rations or pelleted feed encourage abnormal behaviour;
- Dietary protein /amino acid content – deficiencies cause problems;
- Supply of calcium and sodium – deficiencies cause stress.

## Outdoor areas

- A combination of covered outdoor enclosure and range is recommended;
- Rotational grazing and growing of grass or cereal have proved beneficial;
- Put down coarse gravel, shingle, wood chips or other stabilising materials in the area close to the barn (tar products are unsuitable).;
- If the outdoor area is heavily used, carry out regular ground maintenance and disinfection;
- After rain do not allow puddles to form in the range area;
- Drinkers in the pasture area, outdoor enclosure and barn should be of the same type;
- Make use of trees, shrubs, mobile roofs, disused trailers etc. as protection against vermin and to give shade;
- Access to outdoor areas should be managed according to the weather conditions;
- Do not allow hens outside until 6 hours after the start of the light period (lighting programme) and make sure they eat plenty of food before going outside;
- Pullets going outside for the first time need to be trained in the use of the outdoor area. Pullets visiting a pasture with good vegetation tend to eat many plants, stones, etc., which can greatly reduce their feed intake.
- **Failure to consume sufficient food during this phase of peak egg production severely jeopardises the hens' nutrient supply. This leads to weight loss, reduced production and increased susceptibility to disease in the flock.**
- It is advisable to cut the pasture before it is used for the first time. Young flocks should be introduced gradually to using the outdoor area.
- Free-range systems should be protected from vermin and predators.

## Cleaning and disinfection

- As soon as the hens have been moved out it is advisable to treat walls and ceilings with insecticides while the barn is still warm.
- All movable equipment (drinkers, feeders) should be taken outside.
- Litter and manure should be removed from the building;
- Litter must be removed completely and disposed of as far away as possible (> 1 km);
- 24 h before the washing operation the interior of the building (walls, ceilings, remaining furniture) should be soaked (using fat- and protein-dissolving products);
- Clean the barn with pressure washers, starting with the ceiling and working down to the floor (paying particular attention to ventilation elements, pipelines, edges and top surfaces of beams);
- Make sure the barn is well lit during the cleaning operation so that dirt is clearly visible;
- After cleaning, rinse surfaces and furniture with fresh water;
- Stabilising materials from the section of range just outside the building should be removed and replaced at the same time as the litter;
- Any furniture taken outside and the exterior of the building, including outdoor concreted areas, should also be washed down;
- Dirty drinkers are potential hazards and should therefore be cleaned and disinfected;
- Drinker lines should be thoroughly flushed out after disinfection. **Disinfectant residues in drinkers must be avoided.**
- Remove all left-over feed from the farm – clean, wash and disinfect all parts of the feeding system and feed silos;
- Carry out any necessary repair work after the cleaning operation has been completed;

- When the facility has been completely assembled, the building should be disinfected.
- **Appropriate steps should be taken to check the efficacy of the disinfection.**













This Management Guide was created with help from the companies and individuals listed below:

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