NOVOgen White Ultra Light

Management guide

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NOVOGEN

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1. FLOCK MANAGEMENT DURING THE REARING PERIOD

Rearing is a key period for successful laying performances. During this period it is necessary to reach the target bodyweight and flock uniformity to prepare the birds for the production period. A special care has also to be given to the development of the digestive tract in order to prepare for the fast increase in consumption at the beginning of the production period. A well-managed rearing period has positive effects on:

- Quick adaptation to production system (onset of lay, floor eggs prevention)
- Egg production (peak of lay and persistency)
- Egg quality (egg weight, egg uniformity, shell strength)
- Liveability
- Fertility

To achieve those objectives, it is necessary to respect the following basics:

- Management (stocking density, drinker and feeder space, water, temperature, beak trimming...)
- Climate conditions
- Pullet training
- Lighting programme
- Monitoring bodyweight and uniformity
- Nutrition
- Biosecurity and vaccination

1.1. STOCKING DENSITY, DRINKER SPACE AND FEEDING SPACE IN REARING

→ Recommendations in floor system

	FROM DAY OLD TO 2 WEEKS OF AGE		FROM 2 TO 5 WEEKS OF AGE		FROM 6 WEEKS TO TRANSFER	
	Temperate climate	Hot climate	Temperate climate	Hot climate	Temperate climate	Hot climate
Stocking density [1]	20 birds/ m2	20 birds/ m2	15 birds/ m2	12-15 birds/m2	10 birds/ m2	8 birds/m2
Starter drinkers	1 / 80 birds	1 / 70 birds	--	--	--	--
Bell drinkers	1 / 150 birds	1 / 150 birds	1 / 100 birds	1 / 75 birds	1 / 100 birds	1 / 75 birds
Nipple drinkers	1 / 12 birds	1 / 10 birds	1 / 12 birds	1 / 10 birds	1 / 12 birds	1 / 10 birds
Starting feed pans	1 / 50 birds		--		--	
Linear chain feeders	2.5 cm / bird		4 cm / bird		6 cm / bird	
Pan feeders	1 / 30 birds		1 / 25 birds		1 / 25 birds	

[1] - In the case of 100% slat floor, stocking density can be increased by 15% from 6 weeks of age.

→ Recommendations in cage system

	FROM DAY OLD TO 2 WEEKS OF AGE		FROM 2 TO 5 WEEKS OF AGE		FROM 6 WEEKS TO TRANSFER	
	Temperate climate	Hot climmate	Temperate climate	Hot climate	Temperate climate	Hot climate
Stocking density (1)	130 cm² / bird	140 cm² / bird	220 cm² / bird	250 cm² / bird	350 cm² / bird	390 cm² / bird
Nipple drinkers	1 / 15 birds	1 / 10 birds	1 / 15 birds	1 / 10 birds	1 / 12 birds	1 / 10 birds
Linear chain feeders	2.5 cm per bird		4 cm per bird		6 cm per bird	

1.2. STARTING UP STRATEGY

→ All systems

- Before the arrival of the chicks , feed should be accessible. Feeders should be well filled and feed should be spread over chick paper especially close to the drinking lines. This will stimulate the chicks to use the drinking equipment.
- Feed must be regularly renewed to keep it fresh and attractive.
- Before arrival the drinking lines must be checked, so that fresh water is provided and leakage is prevented.
- Triggering the nipples or water cups encourages the birds to drink
- Unload the chicks close to drinkers and feeders.

→ System specificities

- Floor system

  - Additional starter drinkers and feeders can be used in the first 2 weeks
  - If brooding takes place in only one part of the house, do not exceed a stocking density of 20 chicks per available m2. Thus allowing chicks to spread quickly over the whole house within the first 7 days.
  - In case of use of circular brooder guards:

    >Choose a diameter of 3 to 4 m at day-old but ensure the ring can be enlarged 48 hours after the arrival

    > Ensure that the brooder guards can be easily removed after the birds have familiarised themselves with the location of the drinker and feeder systems. Usually, guards can be removed 5 to 7 days after arrival.

- Cage system

  - Use soft mat and/or paper on the bottom of the cage to improve the ease of movement and comfort of the chick in the first few days. Paper must be removed from day 7 at the latest.

1.3. CLIMATE STRATEGY

Before and after arrival and starting up of the chicks, the below information can be used as guidelines for optimal performance. Be aware that those setting depends highly on local climate conditions and must be adapted accordingly.

→ Before chicks arrival

- After hatch, a chick is poikilotherm. This means that it can't fully regulate its own bodytemperature. Therefore it is important that the housing climate is supported at such a way that the thermoneutral bodytemperature of 40ºC is achieved.
- Raise the house temperature at least 36 hours before chick arrival to 29°C-30°C
- Pre-heat the whole house 30 to 40 hours prior to chick arrival ensuring the floor and system is fully warmed before placement to 35°C.

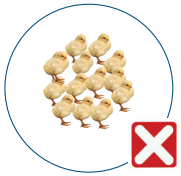
→ After chicks arrival

- Never overheat the chicks and give them a choice within the desired temperature range.
- Take into account the temperature at chick level.
- Depending on the brooder design, place the brooders high enough above the litter (at least 1.5 m) at an angle, to allow for uniform distribution of the chicks.
- Check the chicks body temperature after start up to adjust the house temperature by gently touching the chick cloaca with the probe of an ear thermometer. The optimal chick body temperature is 40-41 °C. It is important to measure the body temperature of a sufficient numbers of chicks distributed in different parts of the house.

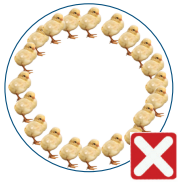
Control of chick temperature

Check the distribution and behaviour of the chicks to enable you to adapt and manage the temperature of the House:

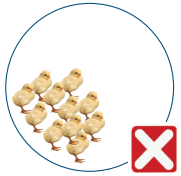
- Good distribution and activity = correct temperature and climate
- Chicks cuddle and/or avoid large areas of the barn = temperature is too low or presence of air draft
- Chicks are panting and are lying on the ground with their wings spread = temperature is too high



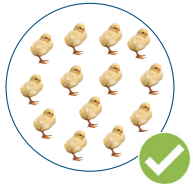
Too cold



Too hot



Air draft



Optimal

Temperature and relative humidity recommendations

	Under the brooder	Near the circular guard	Room temparature	Relative humidity
Before arrival (2 - 3 days)	30 °C	30 °C	30 °C	55 - 60 %
Before arrival (1 days)	35 °C	35 °C	35 °C	55 - 60 %
Week 1	35 - 33°C	32 - 31 °C	30 - 28 °C	55 - 60 %
Week 2	32 °C	30 - 28 °C	28 - 26 °C	55 - 60 %
Week 3	28 °C	28 - 26 °C	26 - 24 °C	55 - 60 %
Week 4			22 - 20 °C	55 - 60 %
Week 5			22 - 20 °C	60 - 65 %
Week 6			22 - 20 °C	60 - 65 %
Week 7			22 - 20 °C	60 - 70 %
Week 8			21 - 19 °C	60 - 70 %
Till transfer			20 - 18 °C	60 - 70 %

Temperature and relative humidity are important climate parameters, but not the only ones. An optimal ventilation in the rearing house is important to obtain the right oxygen level, a uniform air and temperature disitribution and for the removal of dust and ammonia. If mechanical ventilation is used, the ventilation settings are calculated based on:

- The right temperature based on the age of the chicks
- Constant RH (between 50-70%). Too dry air can damage the oral epithelium.
- An O2 level around 20%
- CO2 with direct heating < 5000 ppm
- CO2 with indirect heating < 3000 ppm
- CO < 10 ppm
- Ammonia< 10 ppm
- Inspirable dast < 3,5 mg/m³

Based on those settings the recommendations for minimum ventilation results in:

- 0,08 m³/bird/hour at arrival
- 0,7 m3 per kg housed in animal, when outside temperature colder than 10⁰C.
- 1,0 m3 per kg housed animal, when outside temperature warmer than 10⁰C.

1.4. GRIT AND GRAIN

To maintain an active feeding behaviour and to help the development of the digestive tract and encourage the birds to scratch the litter, it is advised to give grit and grain to the birds from 4 to 5 weeks of age:

- Grit (insoluble stone particles of 2 to 4 mm): 3 to 5 g per week per bird, distributed over 2 or 3 days.
- Grain (broken maize, wheat): 3 g per bird every day, or every other day
- This is thrown on the litter, a few hours before the dark period

2. LIGHTING PROGRAMME

Sexual maturity and production are largely influenced by the changes in day length to which pullets are exposed. Carefully chosen lighting programmes will help to optimise the performance of breeders stocks. Sexual maturity and bodyweight at sexual maturity influence the production, the egg size and the liveability, so the total number of hatching eggs per hen housed.
It is difficult to advise a universally optimum and perfect lighting programme. The following lighting programmes are examples and have to be considered as a guideline to help formulate a lighting programme adapted to your own situation.

To establish your own lighting programme, it is important to take into account the following factors:

- Your location (changes in light duration (day length) during the year)
- The characteristics of the rearing unit (light-controlled, semi-dark or open house type)
- Season of the year (increasing or decreasing day length)
- Temperature (light duration at the highest temperature)
- Date of the hatch (what is the natural day length at the bodyweight targeted when light stimulation will take place for onset of lay?)
- Growth of the flock
- Past records of performance obtained in this rearing unit
- Avoid any unwanted external lights in the dark house. It can affect the lighting program and efficiency and induce feather pecking.

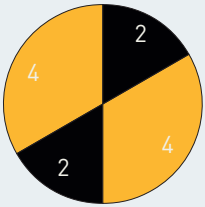
→ Lighting programme during the first weeks of the rearing period

In order to encourage skeletal development and growth, a slow step-down lighting programme is advised for all housing conditions.
The decrease in artificial light duration during the day is then adjusted according to the housing type. For an open house system (and above 20° Latitude), determine the natural light day length that the birds will encounter before 16 weeks of age. This will then help determine the maximum day length the flock will be given and help avoid an unwanted early light stimulation before the flock has matured sufficiently. Early light stimulation will be promoted by a natural increase in day length during rearing.
In dark rearing houses (and when allowed by the local regulation), it is possible to use an intermittent lighting programme during the first two weeks of age. It allows synchronisation of the chicks' behaviour for; eating, drinking and resting. It can have a beneficial effect on the weakest chicks which are stimulated by the stronger ones and improves the flock uniformity. After two weeks, switch to a regular step down lighting programme.

Intermittent lighting programme

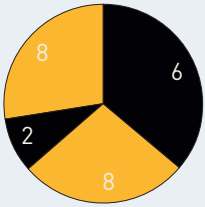
WEEK 1

- 4 hours light
- 2 hours darkness
- 4 hours light
- 2 hours darkness



WEEK 2

- 8 hours light
- 2 hours darkness
- 8 hours light
- 6 hours darkness



→ Lighting programme from 8 weeks of age till 2-5% of production

In order to control sexual maturity and to avoid early sexual maturity at an inadequate and immature bodyweight, it is important to avoid every day any increase in light duration (due to a natural increase in day length) during this period.
According to the season in a dark house system a stable day length can be used between 10 weeks of age and 2-5% of production. It will help to avoid a sexual maturity at a too early age. The

light duration during this period can also be adapted according to the growth of the pullets (10, 11 or 12 hours could be used when growth is slow).
In an open house system, the most difficult system for controlling sexual maturity, the natural day length at which the pullets will be exposed to at 19 weeks of age will determine the light duration at the plateau to avoid any increase of light duration before 19 weeks of age.

→ Increasing day lenght to stimulate egg production

After the appearance of the first eggs, the increase of artificial light duration should be adjusted according to the production level. An increase of light duration of 30 minutes or 1 hour per week is suggested.

→ Lighting programme during production

Never decrease the artificial light duration during the production period as this can lead to an early decline in egg production.

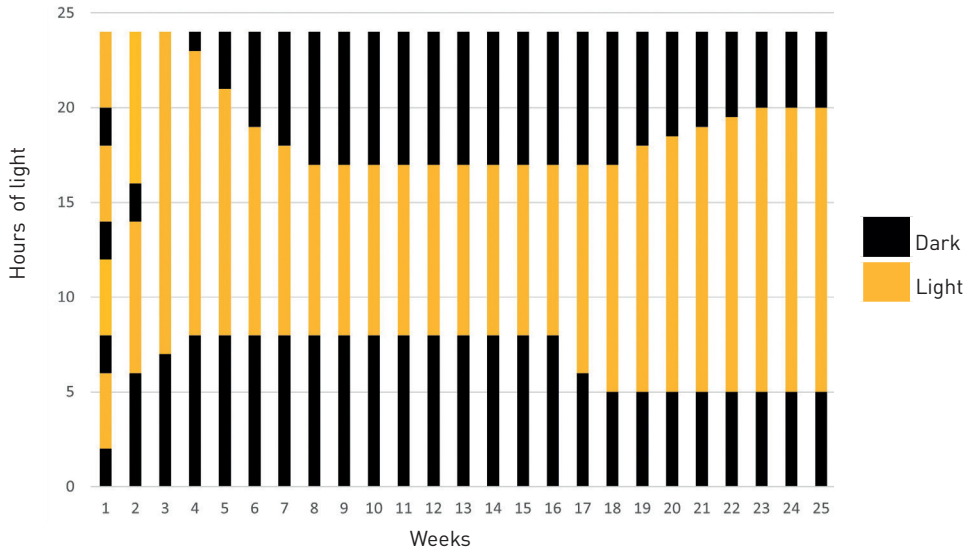
→ Light intensity

A higher light intensity during the brooding period will encourage growth by promoting higher levels of activity of the flock and a higher feed intake. After 2 or 3 weeks and according to the behaviour of the chicks, the light intensity may be reduced to match the field conditions and the light intensity the birds will be exposed to during the production period (degree of darkness of the rearing house and the laying house).

Situation: Please note that in order to define the optimal lighting programme for your conditions, it is necessary to consider which of the following applies:

- From dark rearing house to dark laying house
- From dark rearing house to semi dark or open laying house
- From semi dark or open rearing house to dark laying house
- From semi dark or open rearing house to semi dark or open laying house.

Example of lighting programme in light controlled rearing and laying houses



2.1. LIGHTING PROGRAMME IN LIGHT-CONTROLLED REARING HOUSES

AGE (WEEKS)	AGE (DAYS)	LIGHT DURATION IN HOURS	LIGHT INTENSITY
0	0-2	22.00	20-40 lux
1	3-7	20.00	20-30 lux
2	8-14	19.00	10-20 lux
3	15-21	18.00	5-10 lux
4	21-28	18.00	5-10 lux
5	29-35	17.00	5-10 lux
6	36-42	17.00	5-10 lux
7	43-49	16.00	5-10 lux
8	50-56	16.00	5-10 lux
9	57-63	15.00	5-10 lux
10	64-70	14.00	5-10 lux
11	71-77	13.00	5-10 lux
12	78-84	12.00	5-10 lux
13	85-91	11.00	5-10 lux
14	92-98	11.00	5-10 lux
15	99-105	11.00	5-10 lux
16	106-112	11.00	5-10 lux
17	113-119	11.00	5-10 lux
18	120-126	11.00	5-10 lux
19	2-5 % of production	12.00	5-10 lux
20	+ 6 days	13.00	5-10 lux
21	+ 12 days	14.00	5-10 lux
22	+ 15 days	15.00	5-10 lux
23	+ 18 days	16.00	5-10 lux
24	+ 21 days	16.00	5-10 lux
25	Till the end	16.00 [1]	5-10 lux

[1] - *Midnight lighting: It is possible to use an additional 1.00 to 1.30 hours of light in the middle of the dark period in order to promote an optimal feed intake during the first weeks of production or to compensate for the adverse effect of high temperature during the summer. This extra light period may be introduced and removed during the production period at any time after the increase in light duration at the start of lay.*

[2] - *Light intensity and light stimulation should be adapted to local environment and flock condition.*

2.2. LIGHTING PROGRAMME IN SEMI – DARK OR OPEN REARING HOUSES

AGE (WEEK)	AGE (DAYS)	LIGHT DURATION IN HOURS	LIGHT INTENSITY OPEN HOUSE	LIGHT INTENSITY SEMI DARK HOUSE
0	0-2	22.00	20-40 lux	20-40 lux
1	3-7	20.00	20-30 lux	20-30 lux
2	8-14	19.00	20-30 lux	10-20 lux
3	15-21	18.00	20-30 lux	10-15 lux
4	21-28	18.00	20-30 lux	10-12 lux
5	29-35	17.00	20-30 lux	10-12 lux
6	36-42	17.00	20-30 lux	10-12 lux
7	43-49	16.00	20-30 lux	10-12 lux
8	50-56	16.00	20-30 lux	10-12 lux
9	57-63	15.00	20-30 lux	10-12 lux
10	64-70	14.00 (or NDL)	20-30 lux	10-12 lux
11	71-77	13.00 (or NDL)	20-30 lux	10-12 lux
12	78-84	12.00 (or NDL)	20-30 lux	10-12 lux
13	85-91	11.00 (or NDL)	20-30 lux	10-12 lux
14	92-98	11.00 (or NDL)	20-30 lux	10-12 lux
15	99-105	11.00 (or NDL)	20-30 lux	10-12 lux
16	106-112	11.00 (or NDL)	20-30 lux	10-12 lux
17	113-119	11.00 (or NDL)	20-30 lux	10-12 lux
18	120-126	11.00 (or NDL)	20-30 lux	10-12 lux
	2-5 % of production	+ 0.30	20-30 lux	10-12 lux
	+ 6 days	+ 1.00	20-30 lux	10-12 lux
	+ 12 days	+ 1.00	20-30 lux	10-12 lux
	+ 15 days	+ 1.00 (or 16.00)	20-30 lux	10-12 lux
	+ 18 days	+ 1.00 (or 16.00)	20-30 lux	10-12 lux
	+ 21 days	+ 0.30 (or 16.00)	20-30 lux	10-12 lux
	Till the end	16.00 [1]	20-30 lux	10-12 lux

NDL: Natural Day Length

[1] - *Midnight lighting: It is possible to use an additional 1.00 to 1.30 hours of light in the middle of the dark period in order to promote an optimal feed intake during the first weeks of production or to compensate for the adverse effect of high temperature during the summer. This extra light period may be introduced and removed during the production period at any time after the increase in light duration at the start of lay.*

[2] - *Light intensity and light stimulation should be adapted to local environment and flock condition.*

3. FLOCK MANAGEMENT DURING THE PRODUCTION PERIOD

3.1. STOCKING DENSITY, DRINKER SPACE AND FEEDING SPACE IN PRODUCTION

	FLOOR		CAGE SYSTEM	
	Temperate climate	Hot climate	Temperate climate	Hot climate
Stocking density / useable area [1]	8 birds/m2	6 birds/m2	750 cm2/bird	800 cm2/bird
Bell drinkers	1 cm / bird	1,5 cm / bird		
Nipple drinkers	1 / 10 birds	1 / 8 birds	1 / 10 birds	1 / 8 birds
Linear chain feeders	10 cm / bird	10 cm / bird	10 cm / bird	10 cm / bird
Pan feeders	1 / 20 birds			
Perches	15 cm / bird (> 30 cm between perches and > 20 cm between wall and perch)			
Pop Holes	2m / 1000 birds (higth > 35cm / width > 40 cm)			
Nest	Individual nest = 1 nest / 7 birds Group nest = 1m2 / 120 birds			
Litter area	> 250 cm2 / bird			

[1] - *In the case of 100% slat floor, stocking density can be increased by 15% after transfer*
[2] - *Depending on country regulation, greater minimum space are requested. Always comply with the law.*

3.2. TRANSFER

Transfer is advised around 16 to 17 weeks of age.

- This is done before the layingof the first eggs.
- The transfer should be done one week after the last planned vaccination.
- The transfer can be done three (3) days after deworming of the flock.

In order to minimize the stress at transfer time, it is important to:

- Rear the birds on a similar drinking system as they will encounter on transfer.
- Increase light intensity to encourage water consumption
- Maintain temperature as close as close as possible to the temperature experienced by the pullets at the end of the rearing period.

3.3. LIGHTING PROGRAMME DURING THE PRODUCTION PERIOD

The light duration after transfer should be adjusted to match the light duration experienced at the end of the rearing period. The post transfer light duration should be at least the same length as during the rearing phase. It may be longer according to the plan for light stimulation. As the birds remain sensitive to changes in light duration, never decrease the day length during the entire production period.

3.4. LIGHT INTENSITY MANAGEMENT DURING THE PRODUCTION PERIOD

It is possible after the peak of lay to reduce progressively the artificial light intensity. This may limit feed wastage, excessive activity of the birds and reduce the risk of mortality. Please take into account that light intensity should remain well distributed all over the house.

3.5. FLOOR EGGS PREVENTION

Floor eggs is a multifactorial problem often related to management issue at the onset of lay or house and equipment design. We have indicated herebelow some important recommandations to maintain a good nesting behaviour:

- At the start of production, it is very important to collect floor laid eggs frequently. We recommend collecting every hour until the early afternoon. Floor eggs that are not

removed become an incentive for other hens to lay in the same place. During this period, the farm attendant should try to identify those hens laying on the floor and place them onto the nests.
- Hens should not be disturbed while laying: avoid flock inspection and feed distribution during the main laying period

- Nest:
  - Sufficent numbers
  - Easy access
  - Comfortable floor: use material such as Astro Turf, rubber floor, litter...
  - Uniform repartition within the house
  - Entrance of the nest should be well lighted and the inside of the nest darker
  - No draught in the nest area
  - Possibilty to use a light nest to switch on 1 hour before the house light switch on. It enables the brids which are laying earlier to find the nest.

- Ensure a uniform and sufficient light in the whole house. Any darker area is favourable to a floor laying behaviour.
- Birds should sleep on top of the system and not on the litter

- The litter depth at the onset of lay should not exceed 2-3 cm
- When allowed by local regulation, an electric fence around the outside of the litter or slatted areas and along the walls and partitions may be useful. It should be fixed at 5 cm from the wall and 12 cm above the litter.

- Drinking and feeding systems in floor system:

  - It should not be located more than 2-3 meters of the nest
  - Feeding system should be located as high or low as possible (according to the system), to allow an easy circulation of the hens. Chain feeders can be directly fixed on the slats.

- Specific case of Floor-Slats system:

  - Stricly respect the proportion of 2/3 slats and 1/3 floor
  - Possibility to use ladders to facilitate access to the slats
  - Install the drinking and feeding system in the slats area
  - After transfer, possibilty to block the hens in the slats area for a maximum of 3 to 5 days. In this situation, be careful to the nest access.

4. MONITORING BODYWEIGHT AND UNIFORMITY

The main objective is to reach the appropriate bodyweight and uniformity targets at different stages of the bird's development:

- At the early stage (0 – 7 weeks: period of frame development)
- At sexual maturity with an even growth curve (a low bodyweight at sexual maturity could affect later performances)
- At the start of lay to the peak of production (a growth of at least 300g from 5% of lay until 30 weeks means that the bird's needs for egg production and growth are covered)

4.1. BODYWEIGHT CONTROL

- The birds must be sample weighed weekly from the first week. During the first 4 weeks, collective weights can be taken in batches of 5 or 10 birds using a bucket. Subsequently, the birds can be weighed individually.
- From 26 weeks of age, weigh the birds every 2 weeks and then monthly from 35 weeks of age,
- Weigh a sufficient number of birds (around 100) cornered using lightweight screens or frames in 2 or 3 places in the house. For an accurate interpretation of the result, it is important to weigh all the birds caught in the sample. Weights can be recorded on a weighing sheet which is available from our technicians. It is good practice to walk the house first to stir the birds up to allow for a more realistic sample to be penned.
- After weighing, average body weight and uniformity are calculated and immediately plotted on NOVOGEN growing curve chart. The analysis of the growing curve helps to accurately adjust the feed allowance (the quantities indicated in our feed section are only to be considered as a guideline) and when required, to take the appropriate steps to correct the uniformity.

4.2. UNIFORMITY CONTROL

The uniformity target is set to ensure 80 % of the body weights are in a range between + 10 and -10 % of the flock mean body weight. The following factors play an important role in achieving and maintaining good uniformity:

- access to feed and water (see equipment standards)
- health status of the flock
- disease and parasitism
- quality of beak treatment
- temperature and ventilation

5. MANAGING MALES

In modern parent stock breeders, the males represent a small share of birds but they are responsible for 50% of the genetic value of the flock. During rearing, the target is to obtain the best uniformity and lowest mortality in order to select the very best males before the start of production.

The standard proportion of males on arrival of the chicks is 12%

→ REARING

- Males can be reared together with females as long as the farm management system makes it possible to follow the growth and uniformity recommendations. If the target is not reached, the males can be reared separately for a more specific management.
- Ensure an excellent condition of the floor (dipper litter, soft mat in cage...)
- Respect the minimum stocking and equipment densities (see chapter 1 Flock management during the rearing period)
- Ensure the optimum comfort temperature (see chapter 1 Flock management during the rearing period)
- Weekly monitoring of bodyweight and uniformity. A good bodyweight uniformity is related to uniform testes development.
- If farm debeaking is done, it must be carried out in a less invasive but much more precise way than for females.

→ TRANSFER

- At transfer, select the best males according to their bodyweight and condition.
- The recommended percentage of males in production is 9-10%, with a maximum density of 8 birds/m2.
- If the males are reared separately, their percentage can be reduced to 5-6% depending on their behaviour and up to 5% of production. Overly mature males may affect the growth of the females by reducing access to the feeders.
- Extra males are best kept in a separated pen. From 5% egg production, males can be progressively re-introduced when it is dark, by adding 0.5% per week in order to reach a total of 9%.

→ PRODUCTION

- In order to select the best males, they must be weighted weekly as per the females until 30 weeks of age and every 4 weeks afterwards.
- Controlling the males' weight, uniformity and activity will make it possible to immediately detect if the relationship between the males and females is correct in order to obtain a synchronism of sexual maturity:

  - Heavy males usually mature too early in comparison to the females. Be careful in that situation as they may be too aggressive.
  - Light males may not be mature enough which could affect fertility
  - Too many males might results in more fighting, less mating activity, disruption of social groups and lower fertility.

- Regular control of males' health status, cloaca and claw condition.
- Avoid stressing the flock (maintenance, vaccination...) during the males' activity periods, which are mainly early morning and late afternoon.
- Ensure a good comfort for the males: Litter, slats and equipment condition must be checked frequently in order to avoid lameness in the males.

6. BEAK TREATMENT

6.1. BEAK TREATMENT MONITORING

- Beak treatment is sometimes undertaken where either light intensity cannot be controlled due to the design of the house or when other kind of challenges chronically stress out the birds. The beak treatment procedure is performed to prevent feather pecking and cannibalism under these conditions.
- Beak treatment is a delicate operation and should only be carried-out by well-trained and experienced operators. Poor beak treatment can affect the ability of the birds to eat and drink correctly and leads to unevenness. Attention should be paid to local regulations regarding beak treatment and it is advisable to seek veterinary advice to ensure the procedures are being correctly applied.
- Two different methods can be used for beak treatment. The first one consists of an infrared treatment of the beak at day-old in the hatchery by using a specific machine. The second method can be practiced at 7-10 days by using a hot blade. With this second method and under some specific conditions, where permitted, a second beak treatment may be undertaken at 8-10 weeks.
- Before beak treatment with hot blades (in countries where this is permitted):

  - check that the birds are healthy
  - do not treat the beaks when the birds are reacting to vaccinations
  - add vitamin K to the drinking water (to prevent haemorrhaging)
  - check that the temperature of the blades is high enough to prevent haemorrhaging, but not too high which may risk chicks being burned.

Infra-red beak treatment machine

Pullet with a treated beak

- To limit the effect of beak treatment with hot blades on the feed consumption and water intake, it is important to increase the water level in the drinkers and the pressure in the pipes. Ensure that the depth of the feed in the feeders is correct.

As outlined above, in addition to the technical recommendations, any local code or regulation concerning animal welfare should be respected.

6.2.FULLY BEAKED FLOCKS MANAGEMENT

In case of fully beaked flocks, different measures are necessary to prevent the consequences on selective feed intake and potential damage due to pecking:

- Strictly respect the feeding and drinking spaces and the stocking density standards before starting up. It will ensure a good uniformity of the flock and avoid risks of competition and fights between the birds.
- Keep the birds calm by avoiding any stress: equipment malfunction, visitors, any sudden changes in the management (light intensity, number of feed distributions, feed formulation...).
- Provide distractions for the birds to keep them busy: wood shaving pack, oyster shell, plastic strings... All the toys could help to maintain a good behavior. But layers get used to the toys very quickly, they need to be changed regularly, each week for example, otherwise, they stop playing with.
- Distribution of grit and grain on the floor can also enhance litter scratching.
- There is a strong relationship between feeding time and pecking, the shorter the feeding time the higher the risk of pecking. Also, the feed presentation is of high importance. If the particles are too big, it will reduce the feeding time and increase the risk of feather pecking and feed selection. If they are too fine it will induce poor appetite.
- Be on the alert for the absence of fluff or small feathers on the floor. It can mean that the birds are eating the feathers due to a nutrient deficiency in fibre source and it can easily turn into feather pecking. It can be confirmed by the presence of feather in the intestine. It is sometimes possible to reduce the level of

feather pecking by increasing the fibre content of the feed, particularly insoluble fibres. It is also possible to add alfalfa or straw on the floor to provide additional fibre for the bird.
- Feed has to be well balanced in energy, amino acid, nutrient, fibre... Any deficiency in the feed can induce feather pecking.
- Placing some gas concrete blocks in the house as they can help to smoothen the sharp end of the beak and thereby prevent pecking and selective feed intake.
- It is important to maintain a suitable climate (ventilation, temperature). Hens that feel uncomfortable are inclined to start feather pecking.
- Special attention has to be given to the lighting. Light intensity and duration are important for preventing pecking. It is sometimes possible to reduce pecking by dimming or colouring the lights. In dark house, it is important to avoid any unwanted light source from outside during the night period.
- In production, it is recommended to dim the light a few days after the adaptation in the production house and to keep the nest in a dark area.
- Respect the health program and avoid parasitic proliferation.

7. CARE OF HATCHING EGGS ON FARM

The aim is to protect embryo liveability which leads to improved hatchability and chick quality. The eggs must not be incubated before 24 weeks of age, and a minimum egg weight of 51 - 52g should be ensured.
The egg at oviposition contains an embryo of 30 000 to 60 000 cells which must be preserved. With high quality care, the fertile egg will produce a healthy chick, whereas careless management will greatly affect hatchability and chick quality.

7.1 EGG HANDLING

Maintaining the embryo viability is the main priority from oviposition to storage in the hatchery. The main risk for the embryo comes from bacterial contamination immediately after the egg has been laid. As it cools down, the egg content retracts and air enters through pores in the eggshell. If the environment (litter, nest floor) is dirty, bacteria will invade the shell and they will be difficult to eliminate.
Dirty nests and floor eggs are often the main reason for eggs exploding in the setters and for chick contamination by Pseudomonas and Aspergillus. The nests must therefore be maintained clean at all times. They should also be equipped with a closing or ejection system to avoid nest occupation and staining at night.
Depending on ambient temperatures, the temperature in the nests may reach 30°C, as the hens produce heat and the litter acts as an insulating material. If eggs are left for too long in these conditions, the embryo starts to develop and becomes more sensitive to subsequent environmental change. This becomes more acute as the flock ages.
Egg should be cooled down uniformly and gradually to ensure embryo viability. Several factors are involved in the egg-cooling rate and are important to consider: egg collection frequency and the nest type (Manual or automatic).
Eggs must be collected at least 4 times a day in temperate climates and more often in cold or hot climates. They should be collected using either new carton trays or previously washed and disinfected plastic or setter trays.
The incidence of hair cracks resulting from large numbers of eggs in the nest or over supply of eggs on the transportation belt should also be taken into consideration.

→ RULES OF THUMB TO MAINTAIN THE EGG QUALITY AFTER OVIPOSITION:

- An egg is a living organism and should be handled with care
- The integrity of the hatching egg must be preserved at all times
- Ensure careful handling to protect the eggshell and the content
- Avoid hair cracks by

using suitable plastic or new carton egg trays
- Collect the eggs at least 4 times a day
- Nest hygiene must be irreproachable at all times to avoid contamination
- Floor eggs must be managed separately to avoid cross contamination with nest eggs
- In the collection room:

  - Ensure uniform cooling with sufficient airflow
  - Maintain the temperature around the egg at around 20°C (Range 18-20°C)

7.2. EGG DISINFECTION

Hatching eggs must be disinfected as soon as possible after oviposition during the cooling period. Various methods are available (see table below).

Important points for proper fumigation:

- disinfect as quickly as possible once the eggs have been laid, when they are still warm
- fumigate at a temperature of 24°C, with 80% relative humidity
- use 40 ml of 30% formalin solution + 20 g of potassium permanganate, or 10 g of formalin powder, for each m3 of space
- fumigate for 20 minutes, followed by thorough ventilation of the fumigation chamber

The traditional method is formalin. Other methods have been developed recently such as hydrogen peroxide, quaternary ammonium compounds, chlorine, UV rays, ozone, or dipping in a disinfectant solution. Always follow the manufacturer's instructions specific to the treatment applied.

7.3. EGG STORAGE

Methods for egg disinfection

PRODUCT / EFFECT ON	BACTERICIDAL	SPORICIDAL	FUNGICIDAL	VIRUCIDAL	TOXIC ANIMAL/ HUMAN	EFFICIENCY WITH ORGANIC MATTER
FORMALDEHYDE[1]	(+)	(+)	(+)	(+)	(+)	(+)
QUATERNARY AMMONIUM	(+)	(-)	(+-)	(+-)	(-)	(-)
PHENOLS	(+)	(+-)	(+)	(+-)	(+)	(+-)
PARACETIC ACID	(+)	(+)	(+)	(+)	(-)	(+-)
GLUTARALDEHYDE	(+)	(+)	(+)	(+)	(+-)	(+-)
CHLORINE	(+)	(+)	(+-)	(+-)	(+-)	(-)
HYDROGEN PEROXYDE	(+)	(+)	(+)	(+)	(+-)	(+-)

[1] - *Formalyne is hazardous to human health and should only be used when permitted by the local regulation in force*

The eggs must cool down gradually to reach the physiological zero (26-27°C), the temperature at which embryo development will stop. This temperature must be reached within 6 to 8 hours, the eggs can then be placed in a cool storage room.
Please note there can be a risk of condensation on the shell as eggs warm up rapidly following storage at low temperatures. This must be avoided as it may cause egg contamination.
Air conditioning is strongly recommended in the egg storage room if the temperature is likely to exceed 22°C in summer.

→ EGG STORAGE PARAMETERS ACCORDING TO STORAGE DURATION

Depending on how long the eggs will be stored for, the temperature and humidity must be adapted.

Egg storage parameters according to storage duration

	TEMPERATURE (°C)	RELATIVE HUMIDITY (%)	TURNING	SMALL END UP
1-2 days	19	70	No	No
3-4 days	17	80	No	No
5-6 days	16	80-85	No	No
7-8 days	14	80-85	No	No
9-12 days	12	80-85	Yes	Yes
13-16 days	12	80-85	Yes	Yes
17-20 days	10-11	80-85	Yes	Yes

8. WATER MANAGEMENT

Water is the first and most important requirement for poultry, it drinks around 1.8 times more than it eats. Therefore, water management and quality is a priority to ensure optimal flock performances.

8.1. WATER MANAGEMENT DURING THE REARING PERIOD

- Before start up
  - Check the quality of the drinking water and the pipelines.
  - Clean and rinse the water pipelines.
  - Make sure that the water temperature is around 20 to 25ºC.

- After start up
  - Provide water ab libitum.
  - Keep the water pressure as low as possible. It will help the chicks find the water
  - Adjust the height of the drinkers according to the chick size and growth. Ensure that the chicks can drink without any difficulties.

8.2. WATER QUANTITY

The ratio water/feed is generally mentioned as being close to 2.0, but in reality it depends more on the environmental temperature. In a hot temperature climate, this ratio increases as the birds will drink more and eat less. In this condition, it is recommended to supply cool water to the birds. Water temperature above 20 ºC should be avoided.

Water consumption is an important indicator to follow. Therefore, it is recommended to install a water meter on the water line. This equipment is inexpensive and easy to install. A low consumption can indicate a shortage of water supply or a sanitary problem on the flock. Waste of water can also be detected thanks to the water meter.

The below table gives some indication on water consumption according to the environmental temperature (source: ITAVI, 2012).

House T ºC	Water/Feed ratio		Water consumption in production (ml/bird)
	Rearing	Production	
15	1.6	1.7	210
20	1.7	1.8	205
25	2.3	2.1	230
30	3.0	3.1	320

8.3. WATER QUALITY

- A water sample for analysis should be taken at the entry point of the house to check the quality of the water supply, and at the end of the system to check the efficiency of the disinfection system.
- Sample once or twice a year. More samplings should be performed especially when using a local water supply (surface well, deep well, etc...)
- Clean the pipe system during the sanitary break between flocks.
- Clean drinkers on a regular basis

Water quality measures interpretation (O.M.S & E.U)

	CRITERIA		RISK
Physicochemical recommendations	pH (5.5 < pH < 6.5)	pH > 8	Antibiotic and vaccine loss of efficiency Reduction of chlorine treatment efficiency Favours the growth of detrimental Gram negative bacteria (Salmonella, E. coli, etc...)
		pH < 4	Urinary and/or digestive problems Skeletal weakening Water system corrosion
	Hardness (< 150mg/l)	> 500mg/l	Reduces solubility of some antibiotics and vitamins Tartar development in the water system, but poultry is quite tolerant to high hardness
		< 50mg/l	Trace minerals deficiency and influence on eggshell strength Water system corrosion
	Iron (≤ 0.2 mg/l) Manganese (≤ 0.05 mg/l)	Iron > 1 mg/l and/or Manganese > 0.4 mg/l	Decrease in water intake Reduction in chlorine treatment efficiency Increases bacterial development
	Nitrates (≤ 50 mg/l)	> 50 mg/l	Digestive troubles at high concentration Reduces vaccine efficiency
	Organic matter (≤ 2 mg/l)	> 5 mg/l	Look for source of contamination (water supply, biofilm)
	Nitrites (≤ 0.5 mg/l)	> 0.5 mg/l	Enhances biofilm development Can be toxic at low concentration
Bacteriological recommendations	Total flora (≤ 100 germs/ml)	> 100 germs/ml	Faecal germs contamination can be detrimental in itself as a direct source of pathogenic agents (ex: E. coli), but also serve as an indicator for other contaminants (like parasites or viruses)
	Salmonelle (0 germs/ml)	> 0 germs/ml	
	E. Coli (0 germs/ml)	> 0 germs/ml	

Main physicochemical treatments

	PH	HARDNESS		IRON / MANGANESE
Treatment	Mineral acidification: chloride or sulphuric acid Organic acidification: formic, propionic, lactic... acid	Neutralization (water < 10°F)	Softening (water > 15°F	Iron / Manganese removal
Effect	pH reduction Small dose can be enough Bacteriostatic or bactericidal action depending on the acid used Potentially positive effect on digestive system (not for the mineral acids)	Increase of pH and hardness	Hardness reduction	Iron / Manganese removal

Main antibacterial treatments

	CHLORINE	CHLORINE DIOXIDE	HYDROGEN PEROXIDE
Principle of action	Mixed in the water Free residual chlorine (FRC) is reacting with bacteria and has to be measured at the end of the water line.	Soluble gas made from the mix of sodium chlorite and chlorehydric acid. The gas is injected in the water.	Mixed in the water Recommended to be used with paracetic acid for the pipes cleaning during the flock (intermittent treatment)
Methods	Initial dosage of 1 to 4 mg/l of active chlorine 0.3 to 0.6 mg/l of free chlorine at the end of the pipe line. To check every 2 weeks with a DPD coloured system. For a better efficiency, avoid high level of iron, manganese and organic matter and a pH > 7.5.	Maximum initial dosage of 1 mg/l 0.3 to 0.5 mg/l of FRC at the end of the pipe line. To check every 2 weeks (reactant DPD). For a better efficiency, avoid high level of iron, manganese and organic matter. No effect of the pH on the treatment	Initial dosage depends on the product concentration 30 to 50 mg/l of hydrogen peroxide at the end of the water line. For a better efficiency, avoid the presence of organic matter. No effect of the pH on the treatment
Installation and running cost	--	++	++
Monitoring the efficiency	At the end of the water line with a colorimetric test: reactant DPD	With a colorimetric test: reactant DPD (level of chlorine dioxide = 1.9 free chlorine)	Level of hydrogen peroxide to be measured with reactive strips.
Efficient against...	Bacteria (at a concentration of 0.2 mg/l at the end of the water line), fungi, algae and virus.	Bacteria, fungi, algae, virus and spores.	Bacteria, fungi, algae, virus and spores.

Other existing water disinfection systems: electrolysis, UV sterilization, Copper sulphate...

9. NUTRITION

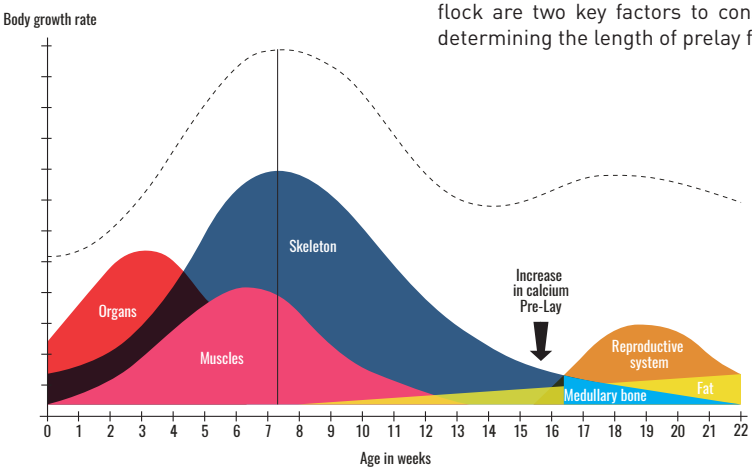
Some important points for the **Rearing Period** :

• Starter Feed
- It is recommended to formulate a highly concentrated starter feed via using highly digestible raw materials. This feed is crucial to have the best muscle and skeleton at the end of week 5. This feed should be a in crumble form to maximize feed intake in order to reach standard body weight.
- Usage of a good quality oil is also beneficial for energy source. An emulsifier can be justified to increase the efficiency of added fats. Increasing sodium level in starter feed will stimulate feed consumption. Normally, starter feed is given from day zero to end of 5 weeks, but if target body weight is reach earlier, it possible to switch to the next feed. If target body weight is not achieved at the end of 5 weeks, continue giving the same feed for 1-3 weeks more.

• Grower Feed
- It is usually given from 6 weeks to end of 10 weeks of age. Grower feed is less dense than starter feed. In this case, raw materials that have different density and digestibility can be used. However, this feed should also be designed to support skeletal and muscular growth because chicks need to grow maximum from day zero till 8 to 10 weeks. Grower feed is usually mash feed but it can be also in crumble form.

• Developer Feed
- It has quite low nutrient density. Crude fibre level should be as high as possible (4 - 6.5%) in this period. Adding fibre and maintaining feed granulometry in the diet increases gut size and improves feed intake capacity. This is one of the important factors for hen to reaches a good peak of production as well as a good persistency. There are several raw materials that can be used as source of fibre in the diets to develop the feed intake capacity. Usage of oil (1-2 %) will reduce dustiness of the mash feed in grower and developer feed.

• Prelay Feed
-Used before a flock starts to eat layer 1 feed. It helps to compensate lack of body weight and improve uniformity. The development of organs such as ovaries, oviducts, and liver involved in egg production is supported by the extra protein contained in this feed. It also supports the development of Ca-accumulation in medullar bones. This is why prelay feed should have around 2.5 % Ca and higher protein than developer feed. Prelay feed is a kind of transition feed, so proper use of prelay feed prepares better the flock for the laying period. The introduction of pre-layer feed is dependent to the bird's sexual maturity, age and body weights. It usually starts 10-12 days prior first eggs until 2- 5 % laying rate. Body weight and uniformity of the flock are two key factors to consider when determining the length of prelay feeding.



Corporal evolution of pullet growth according to the age

Some important points for the **Laying Period** :

- Phase feeding is recommended for a successful production performance. To maximise reach of Novogen genetic potential, nutrients of each feed is suggested based on maintenance needs of birds, standard egg mass and egg shell quality as well as optimal conditions of production (20 - 22°C) and biosecurity. Do not change to next feed until you see the egg mass drops.

- Metabolic Energy: The energy requirement is given taking into account different calculation methods used around the world. In practice, these calculations take into account body weight and egg mass. Energy consumption for maintenance is important. Body weight has an effect on energy requirements; the higher the body weight, the higher the energy requirements. Please note that our energy suggestion does not consider environmental temperature, and local nutritionists need to adapt energy requirements according to local temperature and condition.

It should be noted that the metabolic energy requirement (ME) decreases as the ambient temperature rises up to 27°C. This is due to a reduction in energy requirements for maintenance. On the other hand, as the ambient temperature decreases, the ME requirement increases due to a higher need for maintenance.

- Amino acids : All NOVOGEN recommendations are made with a quality protein, with a good availability and digestibility of Amino Acids (A.A.). Recommended ideal amino acid ratios (table 1) are indicated in ranges. These recommendations are given for an average temperature in poultry farm between 20 and 22°C, with optimal conditions and good sanitary level. Any excessive pressure from the microbial population leads to an expenditure of energy and A.A. If necessary, they should be adjusted according to the observed field performances and the desired production objectives (typically feather, egg weight, etc.). Any anti-nutritional factors that may alter the bioavailability of A.A. must be controlled, taking into account the risk, and must be managed accordingly.

Ideal Amino Acid Ratio for whole period

A.A. RATIOS	STARTER	GROWER	DEVELOPER	PRELAY	LAYER
Dig. Lysine	100	100	100	100	100
Dig. Methionine	45	45	48	50	51
Dig. Methionine + Cystine	77	80	85	90	90
Dig. Tryptophan	20	20	24	22	22
Dig. Threonine	68	68	70	70	70
Dig. Valine	79	79	80	88	88
Dig. Isoleucine	69	75	76	80	80
Dig. Arginine	105	105	106	105	104

- Vitamins and Minerals: Please see vitamin and mineral recommendations in (table 2)

- Usage of coarse limestone: This is necessary for eggshell quality. It is important to use coarse limestone from prelay period onwards.

Repartition of limestone particle size

	2 - 3.5 mm	< 1 mm
Prelay	50 %	50 %
Production period - Brown	60 - 65 %	40 - 35 %
Production period - White	50 %	50 %

- Fibers: A minimum total fiber level is recommended for all their positive effects on the digestion and behaviour of the animals 4.0% is the minimum level, it should be increase according to birds behavior. Increase at least to 0.5% or 1% if you begin to see any signs of aggression between birds."

- Feed Intake: It can vary according to body weight, egg mass, farm temperature ,feathering condition, energy level of feed, and feed granulometry. Production system affects the feed intake too. Birds that are reared in alternative systems are more active than birds are in conventional cage systems. They need more energy for maintenance. As a result, we need to consider all these parameters when talking about feed intake.

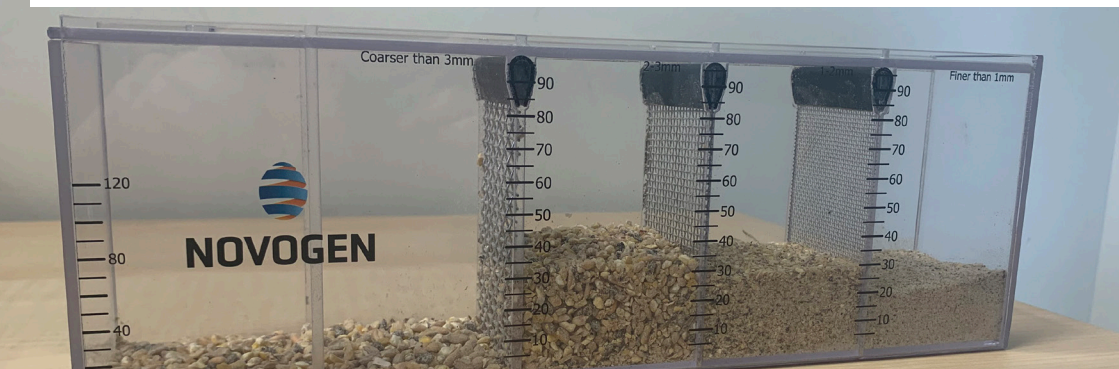
- Feed Granulometry: If the percentage of fine particles is high the feed consumption will be affected. Consequently, laying rate, body weight and egg weight decrease. Feed granulometry must be controlled and adapted as much as possible to table 3 recommendations from the beginning to the end of production.

- Feed Hygiene: Raw materials that are used should be free or have a minimum amount of pathogens. Use ingredients from a reliable supplier that can show analyses report for each batch. Cleaning procedure in all areas of feed mill should be done periodically in each downtime period. Regularly taking samples and test finished feed for enterobacteria and salmonella. Regular pest control program should be applied to minimize the population of rodent.

- Liver Protector: Increased performances enhance the use of hepato-protectors in regular cure, usually every 5 or 6 weeks. These special premixes are rich in elements helping to detoxify the liver such as: choline, betaine, sorbitol, group B vitamins, and sometimes also some plant extracts. The goal is to improve the performance of this key organ which is enormously under stressed during the laying period. Their use can start from 25 to 30 weeks of age to preserve the capacities of laying at the end of production.

Feed granulometry

PARTICLE DIAMETER	STARTER	GROWER	DEVELOPER	PRODUCTION
Inferior to 0,5 mm	max 5%	max 5%	max 5%	max 5%
From 0,5 to 1 mm	max 15%	max 15%	max 15%	max 15%
From 1 to 2 mm	50-60 %	45-55 %	25-35 %	20-30 %
From 2 to 3,2 mm	10-20 %	15-25 %	25-35 %	30 -40 %
Superior to 3,2 mm	Max 0 %	Max 0 %	Max 10 %	Max 10 %



Added vitamins and minerals recommendation per kg

		REARING PERIOD	PRODUCTION PERIOD
Vitamin A [1]	IU	10 000	10 000
Vitamin D3	IU	3 000	3 200
Vitamin E	IU	30	85 - 100
Vitamin K [1]	Mg	3	4
Thiamine B1	Mg	2.5	4
Riboflavin B2	Mg	8	10
Niacin B3	Mg	45	50
Pantothenic acid B5	Mg	14	16
Pyridoxine B6	Mg	5	5.5
Biotin B7	Mg	0.25	0.30
Folic acid B9	Mg	2	2.5
Cobalamine B12	Mg	0,025	0,03
Choline	Mg	300	400
Coccidiostat		as required	
Antioxidant [3]	Mg	100-150	100-150
Manganese, Mn [2]	Mg	90	100
Zinc, Zn [2]	Mg	80	100
Iron, Fe [2]	Mg	40	70
Copper, Cu [2]	Mg	10	15
Selenium, Se [2]	Mg	0.25	0.35
Iodine, I	Mg	1.5	2

The levels of vitamins and minerals are for standard conditions, they can vary according to activities and challenges. Different level might be possible according to local regulations.

[1] *Where the heat treatment is applied to diet, higher levels of vitamins may be required.*
[2] *Usage of chelated minerals can increase bioavability of themtheir bioavailability*
[3] *Inclusion of antioxidants may improve premix stability during storage conditions*

Layer's premix with vitamins & trace-elements

9.1. EXAMPLE OF DIET SPECIFICATIONS FOR REARING PERIOD

	Starter	Grower	Pullet / Developer	Pre-Lay
	0 - 5 weeks	6 - 10 weeks	11 - 15 weeks	16 weeks to 2%
	Crumble	Crumble or Mash	Coarse Mash	Coarse Mash
EM Kcal / Kg	2900 - 3000	2800 - 2900	2650 - 2750	2700 - 2750
EM MJ / Kg	12.13-12.55	11.71-12.13	11.08-11.50	11.30-11.50
EM Kcal / lb	1318 - 1362	1270 - 1318	1205 - 1250	1227 - 1250
% Crude protein	20.0 - 21.0	18.0 - 19.0	15.0 - 16.0	17.0 - 17.5
% Crude fiber	2.5-4.5	3.0 - 5.5	3.5 - 6.5	3.5 - 5.5
% Crude fat	2.5 - 5.0	2.5 - 5.5	2.5 - 5.5	3.0 - 6.0
% Tot. Lysine	1,12	0,95	0,74	0,81
% Tot. Methionine	0,50	0,43	0,36	0,41
% Tot. Methio + Cystine	0,86	0,76	0,63	0,73
% Tot. Tryptophan	0,21	0,19	0,18	0,18
% Tot. Threonine	0,76	0,65	0,52	0,57
% Tot. Valine	0,88	0,75	0,59	0,71
% Tot. Isoleucine	0,77	0,71	0,56	0,65
% Tot. Arginine	1,18	1,00	0,78	0,85
% Dig. Lysine	1,00	0,85	0,65	0,72
% Dig. Methionine	0,45	0,38	0,31	0,36
% Dig. Meth & Cystine	0,77	0,68	0,55	0,65
% Dig. Tryptophan	0,19	0,17	0,16	0,16
% Dig. Threonine	0,68	0,58	0,46	0,50
% Dig. Valine	0,79	0,67	0,52	0,63
% Dig. Isoleucine	0,69	0,64	0,49	0,58
% Dig. Arginine	1,05	0,89	0,69	0,76
% Calcium	1.05 - 1.10	1.00 - 1.10	0.95 - 1.05	2.30 - 2.50
% Available Phosphorus	0.45 - 0.50	0.42 - 0.45	0.37 - 0.40	0.42 - 0.45
% Sodium	0.18 - 0.20	0.16 - 0.18	0.16 - 0.18	0.16 - 0.18
% Chlorine	0.20 - 0.25	0.18- 0.25	0.16 - 0.25	0.15 - 0.25
% Potassium	0.60 - 0.90	0.60 - 0.90	0.60 - 0.90	0.60 - 0.90

- The energy level of the pullet feed 11 - 15 weeks and pre-lay should be equal to that of the laying feed at the beginning of lay (or a little bit above)
- In hot climates, it is recommended to increase amino acid levels by 5% to compensate for lower consumption.
- Take into account average body weight of the flock when considering changing the diet, rather than the age of the flock.

9.2. EXAMPLE OF DIET SPECIFICATIONS FROM 18 TO 45 WEEKS (with a daily egg mass of 55 - 57g)

	Layer 1					
	294-310 kcal/hen/day					
	1.238-1.297 mj/hen/day					
Ingested quantity (g/d)	**Need g/ bird / day**	**100**	**105**	**110**	**115**	**120**
% Crude protein	19	19	18.1	17.3	16.6	15.9
% Crude fiber		3.5 - 6.0				
% Crude fat		2.5 - 6.0				
% Tot. Lysine		0,96	0,91	0,87	0,83	0,80
% Tot. Methionine		0,49	0,46	0,44	0,42	0,41
% Tot. Methio + Cystine		0,86	0,82	0,78	0,75	0,72
% Tot. Tryptophan		0,21	0,20	0,19	0,18	0,18
% Tot. Threonine		0,67	0,64	0,61	0,58	0,56
% Tot. Isoleucine		0,77	0,73	0,70	0,66	0,64
% Tot. Valine		0,84	0,80	0,77	0,73	0,70
% Tot. Arginine		1,01	0,96	0,91	0,87	0,84
% Dig. Lysine	0,82	0,82	0,78	0,75	0,71	0,68
% Dig. Methionine	0,42	0,42	0,40	0,38	0,36	0,35
% Dig. Meth & Cystine	0,74	0,74	0,70	0,67	0,64	0,62
% Dig. Tryptophan	0,18	0,18	0,17	0,16	0,16	0,15
% Dig. Threonine	0,57	0,57	0,55	0,52	0,50	0,48
% Dig. Isoleucine	0,66	0,66	0,62	0,60	0,57	0,55
% Dig. Valine	0,72	0,72	0,69	0,66	0,63	0,60
% Dig. Arginine	0,85	0,85	0,81	0,78	0,74	0,71
% Calcium	4,10	4,10	3,90	3,73	3,57	3,42
% Available Phosphorus	0,42	0,42	0,40	0,38	0,37	0,35
% Sodium	0,17	0,170	0,162	0,155	0,148	0,142
% Chlorine	0.15-0.25	0.15-0.25	0.15-0.25	0.15-0.25	0.15-0.25	0.15-0.25
% Linoleic acid (Min.)	-	1,30	1,25	1,20	1,15	1,10

• The consumption levels listed above correspond to the usual observed consumption after 22 weeks.

9.3. EXAMPLE OF DIET SPECIFICATIONS FROM 46 WEEKS TO DEPLETION (with a daily egg mass of 52 - 55g)

	Layer 2					
		290-306 kcal/hen/day				
		1.221-1.280 mj/hen/day				
Ingested quantity (g/d)	**Need g/ bird / day**	**100**	**105**	**110**	**115**	**120**
% Crude protein	18.00	18.00	17.14	16.36	15.65	15.00
% Crude fiber				3.5 - 7.0		
% Crude fat				2.5 - 6.0		
% Tot. Lysine		0,96	0,91	0,87	0,83	0,80
% Tot. Methionine		0,49	0,46	0,44	0,42	0,41
% Tot. Methio + Cystine		0,86	0,82	0,78	0,75	0,72
% Tot. Tryptophan		0,21	0,20	0,19	0,18	0,18
% Tot. Threonine		0,67	0,64	0,61	0,58	0,56
% Tot. Isoleucine		0,77	0,73	0,70	0,66	0,64
% Tot. Valine		0,84	0,80	0,77	0,73	0,70
% Tot. Arginine		1,01	0,96	0,91	0,87	0,84
% Dig. Lysine	0,80	0,82	0,76	0,73	0,70	0,67
% Dig. Methionine	0,41	0,41	0,39	0,37	0,35	0,34
% Dig. Meth & Cystine	0,72	0,72	0,69	0,65	0,63	0,60
% Dig. Tryptophan	0,18	0,18	0,17	0,16	0,15	0,15
% Dig. Threonine	0,56	0,56	0,53	0,51	0,49	0,47
% Dig. Isoleucine	0,64	0,64	0,61	0,58	0,56	0,53
% Dig. Valine	0,70	0,70	0,67	0,64	0,61	0,59
% Dig. Arginine	0,83	0,83	0,79	0,76	0,72	0,69
% Calcium	4,30	4,30	4,10	3,91	3,74	3,58
% Available Phosphorus	0,40	0,40	0,38	0,36	0,35	0,33
% Sodium	0,16	0,160	0,152	0,145	0,139	0,133
% Chlorine	0.15-0.25	0.15-0.25	0.15-0.25	0.15-0.25	0.15-0.25	0.15-0.25
% Linoleic acid (Min.)	-	1,20	1,15	1,10	1,05	1,00

10. HEALTH PROGRAMME

It is impossible to devise a health programme to adequately suit all geographic areas. For this reason, it is strongly recommended to consult a local specialist to establish a prevention programme adapted to the region.
This guide limits its comments to the description of some rules for the use of vaccines and other treatments. To be successful, respecting these rules is as important as choosing the right products:

- Staff should be properly trained to carry out veterinary operations. It is useful to create a Standard Operating Procedure Manual, that describes in full details the way to perform each vaccination or treatment.
- All the necessary equipment (sprayers, syringes, etc.) must be correctly maintained, and checked before each use.
- Each operation should be planned and supervised by a technically competent person.
- Vaccines and treatments should be stored in appropriate conditions, in suitable quantities considering the requirements and supply time.
- Report carefully in the flock records the details of all operations: date, time, vaccine batch number, route, etc.
- Finally, it is useful to have the help of a laboratory in order to anticipate health problems ahead of time and to assess the efficiency of the :

  - control of disinfection, water and feed quality
  - serological monitoring
  - post mortem examination, routine parasite checks

10.1. VACCINATION

The vaccination programme has to be defined and regularly updated with a local veterinarian.

- Vaccine rules:

  - Only vaccinate healthy flock
  - Always check the conformity of the vaccines with the vaccination programme. In case of doubt, immediately contact your local veterinarian.
  - Keep records of vaccine serial numbers and expiry dates
  - Use clean and specific vaccination equipment

- Vaccine preparation

LIVE VACCINE

- Live vaccines are fragile and should be prepared with care.
- Vaccine storage should be monitored, to make sure it is kept as per manufacturer recommendations (usually between 2 to 6°C). Regularly check the temperature of the storage equipment.
- For freeze-dried vaccines, dilute the powder into mineral water or with the provided diluent if appropriate carefully injected with a syringe.
- The quality of the water used for live vaccine should be checked: no disinfectant, suitable amount of iron, manganese and magnesium, no organic matter.

INACTIVATED VACCINE

- Inactivated vaccines are administered through adjuvants. The adjuvant can shock the birds if injected too cold, so it is advised to slowly warm them up before use (25 to 30°C). To ensure quality injection, needles should be sterile before use, and changed regularly. A good base number is to change every 1,000 birds, but more importantly make sure that it is not damaging the muscle as it would cause unnecessary pain and be detrimental to the vaccine up- take.

Vaccination methods and description

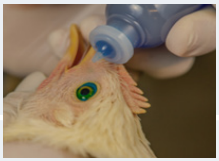
VACCINATION METHODS	GENERAL DESCRIPTION
Drinking water	• Do not use disinfectant or chlorine in a period of 48 hours before vaccination and 24 hours after. • Check each drinkers condition and cleanliness • Cut the water around 2 hours before vaccination. It also depends on the current temperature (one should be more cautious in hot climates and use lesser time) • Prepare the vaccine: - Clean your hands - Prepare the required volume of water in a clean tank. A good base number is 15 to 20% of the previous day water consumption. - Neutralize the residual chlorine with Sodium Thiosulfate (16g/1000l water) mix and let it act for 10 minutes. - Mix the solution vaccine + diluent with the neutralized water for 1 minute • Distribute the vaccine • Let the birds drink the vaccine solution. It has to be consumed within 2 hours • During the distribution, walk among the birds to move them and stimulate drinking behaviour. • Once the vaccination solution has been consumed, give water without chlorine • To check the proper vaccine take, a water colorant can be used. More than 90% of the birds should have a coloured tongue after the distribution.
Subcutaneous / intramuscular injection	• Use specific vaccination equipment • Set the syringe at the required dose: the dose corresponds to the dose of vaccine to be injected or, for mixed vaccine, the sum of the doses of mixed vaccines • Hold the birds by the wings and inject the vaccine at the indicated location • Regularly check the consumed volume of vaccine according to the number of vaccinated birds • Beware of defusing syringe when the bottle is getting empty • Regularly check the needle condition • Comfortable working conditions are the key to a successful vaccination
Spray	• It is recommended tospray in the morning and in a calm atmosphere (avoid feed distribution right after the vaccination and dim the light). • Gather the birds • Turn off the ventilation and heating systems to avoid losses due to evaporation or dispersion • Preferably use mineral water • Check the condition and cleanliness of the spraying machine • Prepare the vaccine and fill up the spraying machine tank with the solution of vaccine and water • Spray at 30-40 cm high / Make sure the droplets size is adapted to the vaccine used / Spray along the whole building length back and forth/ Do not spray if the birds pills up • Wait for 5-10 minutes before switching the light, heating and ventilation systems back on

Drinking water vaccination installation

Coloured tongue

Spray vaccination

VACCINATION METHODS	GENERAL DESCRIPTION
Eye drop	• Prepare the vaccine • Hold the bird to be vaccinated with the head tilted to one side • Drop one drop of vaccine into the eye. • Be sure the vaccine spreads over the eye before releasing the bird.
Wing web	• Use the provided stylet • Hold the bird on the side and spread the wing • The ideal transfixion area is in the wing membrane facing the elbow • Dip the stylet in the vial and insert it through the wing. • Avoid damaging the blood vessels.



Eye drop vaccination

Applications of vaccines

(indicative only, check with your local veterinarian)

BASIC VACCINES APPLICATIONS

DISEASE	ADMINISTRATION METHODS	APPLICATION PERIODS
Marek	Intramuscular / subcutaneous / in-ovo	Day-old
Newcastle Disease (ND)	Drinking water / Spray / Subcutaneous / Intramuscular / in-ovo	Depending on the local epidemiological context this can start at day 1
Gumboro	Drinking water / in-ovo	Depending on the local epidemiological context and/or quantity of antibodies of maternal origin
Infectious Bronchitis (IB)	Drinking water / Spray / Subcutaneous / Intramuscular	Depending on the local epidemiological context, usually at day 1 with regular boosters
Avian encepha-lomyelitis (AE)	Drinking Water / Wing Web	Usually around 12 to 14 weeks of age

OPTIONAL VACCINES APPLICATIONS

DISEASE	ADMINISTRATION METHODS	APPLICATION PERIODS
Coccidiosis	Spray / drinking water	Day-old
Infectious Laryn-gotracheitis (ILT)	Eye drop / Spray / Injection (recombinant vaccines) / in-ovo / Wing web	Depending on the vaccine and the local epidemiological context
Fowl Pox	Wing Web	8 to 12 weeks
Mycoplasmosis	Spray / Eye drop / Subcutaneous / Intramuscular	Depend on local epidemiological context and vaccine used
Salmonella	Drinking Water / Spray / Intramuscular	Usually based on live vaccines 6 weeks apart and a booster with inactivated 4 weeks before lay
Pasteurellosis	Wing web /Subcutaneous / Intramuscular	Depending on local epidemiological context
Infectious Coryza	Subcutaneous / intramuscular	Depending on local epidemiological
Egg Drop Syndrome (EDS)	Subcutaneous / Intramuscular	Usually inactivated vaccine before lay

10.2. PARASITES AND INSECTS MONITORING

The below tables give some indications on the main parasites and insects source of troubles in a layer poultry farm. The treatments have to be defined and regularly updated with a local veterinarian.

Main parasites and insects in layer poultry farm

		DESCRIPTION	SIGNS	TREATMENTS
Internal parasites	Ascaridia galli	- Roundworm that can measure up to 12 cm - It is the most common layer paraite - Adult female lays eggs in the intestine that pass in the faeces. - Contamination by eggs ingestion, the larvae reaches the infectious stage after 2-3 weeks. The adult can live for one year.	- anaemia, intermittent diarrhoea, bodyweight loss, egg production decrease, loss of fertility in males	- Litter sanitation measures - Strict cleaning and disinfection between two flocks - Chemical treatment: Benzimidazoles, avermectins, levamisole, etc...
	Capilaria	- Threadworm that can measure up to 8 cm - Parasite from the digestive tract located in the oesophagus, crop, small intestine or caecum according to the species. - The eggs pass in the faeces and reach the infectious stage within 3-4 weeks - After ingestion, it can produce sever inflammation and sometimes haemorrhage - More common problem in deep litter houses	- Young birds are more sensitive - Bodyweight loss, apathy, egg production decrease, can lead to death	
	Cestodes	- Tapeworm that can measure up to 4 cm. - Their development cycle includes an intermediate host (insect, snails, slugs, beetles, ants, earthworms, houseflies...). The hens are being infected by eating this host. Consequently, this parasite is uncommon in closed house farm. - Once in the intestine, it reaches its maturity at around 3 weeks of age	- In case of heavy infection: bodyweight loss, feed intake decrease specially with young birds, egg production decrease	

		DESCRIPTION	SIGNS	TREATMENTS
External parasites	Red Mites	- Blood sucking during night periods - Remain hidden in cracks and crevices during the light periods. - About a day after feeding, the female lays eggs in cracks and crevices of the house - Fast increase of population	- Behaviour modification due to the disturbance (pecking, nervousness...) - Egg production decrease - Anaemia that can induce higher mortality and FCR increase - Blood stains on the egg shell - To be detected and treated as soon as possible to avoid heavy infection by using specific trap	- Chemical products: Organophosphorus based (phoxim, azametiphos, dichlorvos...)Pyrethroids based (cyfluthrin, permethrin...) Spinosad based - Natural products: Silica, sodium bicarbonate, extracts and essential oils of medicinal and aromatic plants... - Cyclic lighting programme (when allowed) - Importance of cleaning and disinfection measures between two flocks
Insects	Fly (Musca domestica)	- Female can lay up to 1000 eggs and start laying 4 to 8 days after mating. - Egg development is optimum in manure with 40-70% humidity. - Larvae are feeding on decomposing organic matter - Adults can live 2 weeks in summer and up to 2 to 3 months in winter..	- Passive agent of pathogens spread (virus, bacteria, parasites) - Disturb the hens and reduce the egg production - Flies dropping increase the number of second grade eggs	- Maintain less than 25% water in the manure (ventilation, avoid waste of water, proper broken eggs disposal, regular removal of the manure) - Chemical treatment should target both adults (organophosphates, pyrethroids, carbamates...) and larvae (cyromazine, triflumuron, some organophosphates...) - Biocontrol: acaras, beetles, natural predators... - Alternate the active molecules to limit risks of resistance
		- Female can lay up to 800 eggs - Larvae burrow into the ground for insulation as they pupate - Life cycle (from egg to adulthood) of 2 months to a year depending on season and temperature	- Passive carrier of pathogens (Marek virus, salmonella, E. Coli, aspergillus...) - Penetrate in insulation equipment causing heavy damages	- Strict cleaning and disinfection between two flocks - Chemical treatment should target adults (preferably on the walls), and the larvae (preferably on the litter, under the feeding pans and/or drinkers)

11. LITTER

11.1. LITTER QUALITY

Depending on the system, litter can be used to cover the floor in rearing. The main materials used for litter are chopped straw (wheat, barley...) and wood shaving. It is recommended to use wood shaving coming from non treated wood. Depending on the local availabilities, other material like rice hull and cellulose pellet can also be used. The choice of the litter is an important compenent on the success of rearing by ensuring a confortable environment while avoiding potential diease conditions. Moreover, litter is used by birds for dust bathing, foraging and scratching, which help reduce feather picking.

Different qualities must be taken into account for the choice of the litter:

- Thermal insulation from the cold coming from the ground. It depends of the litter material and depth. It is very important during the first week, as long as the chicks are poikilotherm.
- Abosrption of humidity from manure and birds breath. It is particulary important in cold and wet weather when ventilation is low.
- Low level of dust to avoid respiratory disease.
- Safe for the chicks by avoiding being a source of contamination (virus, bacteria, mould).
- Comfortable and not harmful for the chicks

Ensure the shed is fully warmed before distributing the litter. If the gap of temperature between the floor and the room is too important, ie the floor is not warm enough, litter will become stick and wet from below.

Wood shaving litter in rearing

11.2. LITTER MANAGEMENT

In order to maintain an optimal litter quality all along the flock:

- Keep under control litter humidity
- Avoid any leaking or spillage from water system (nipples, bell drinkers...).
- Floor system:

  - In rearing, litter depth should be 5 cm high
  - Additional fresh litter can be distributed on top of the existing litter to keep low moisture content

- Aviary system:

  - 2 cm of litter is sufficient.
  - In production, excess of litter should be frequently removed to avoid the floor area to be too confortable as it could induce some floor laid eggs. It also allow to reduce dust content.

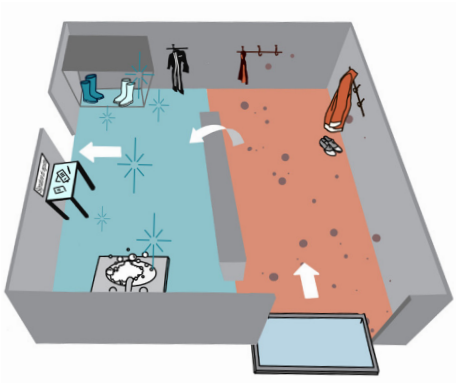
12. GENERAL FARM RULES

Ideally, the best rule of management is to have one age and one breed per site to ensure the "all-in, all-out" principle is followed at all times. The choice of the site for the farm, including the layout of the houses, must prioritise the elimination of all possible sources of contamination. Biosecurity protection is reinforced by hygiene controls.

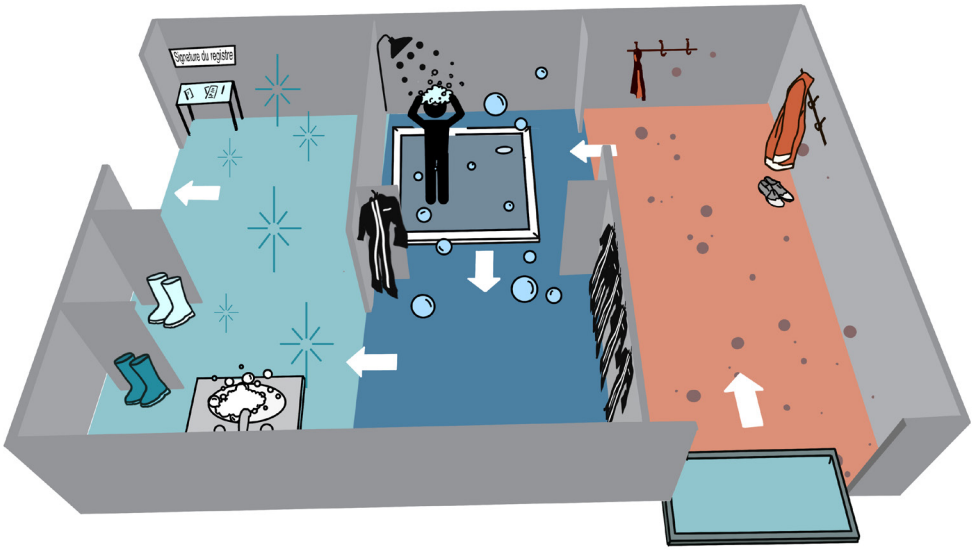
A changing room should be made available at the entrance of the site. It must be used by everybody entering the farm (incorporating both a shower and a change of clothes).

When the old flock is removed and before the arrival of the new flock, all houses and equipment must be thoroughly cleaned and disinfected according to strict procedures and protocols. This should be followed by a rest period of at least 10 days.

Entrance to the farm:
Minimum procedure



Entrance to the farm: Maximum procedure



13. CLEANING AND DISINFECTION OF POULTRY HOUSES

Between each flock, cleaning and disinfection of the houses, their annexes, surroundings and access ways are essential to ensure the optimal health conditions required for the incoming flock to maximise its profitability.

13.1. OPERATIONS PRIOR TO CLEANING

- Water tank, pipes and nipples:
  - Empty the complete water system.
  - Clean and de-scale the complete system with an acid solution and leave for 6 hours to soak.
  - Rinse twice with clean water
- All the equipment (nests, feeders, drinkers etc.) are removed and stored on a concrete area.
- The entire ventilation system (air inlets and outlets, fans, heating and ventilation ducts if they are present) and individual radiant or pancake type brooders are brushed and vacuum cleaned.
- Litter is removed.

13.2. WASHING

When washing, ensure local regulations regarding wash down water are observed. As a rule, always ensure that the dirty water is directed towards a pit or suitable internal drain and does not run outside to the house surroundings or access roads and pathways.

→House

- Soak and remove the remaining organic matter
- Apply a bactericidal and fat removing detergent using an appliance capable of dealing with foam products.
- Some hours after soaking, wash with a high pressure washer (>50kg/cm²) or with hot water, in the following order:
  - Internal roof surfaces, from the top downwards.
  - Walls, from the top downwards.
  - Finally, pits and concrete floors.

→Equipment

- Nests, drinkers and feeding equipment:
- Soak and remove all organic matter.
- Apply a bactericidal and fat removing detergent using an appliance capable of dealing with foam products.
- Ensure every piece of equipment gets a thorough wash, followed by rinsing.
- Prior to the final rinsing, immerse the removable parts of the nests (perches and nest box bottoms) for 24 hours in a disinfectant solution.
- Dry on a clean disinfected concrete area (different to that used for washing).

13.3. PLACING EQUIPMENT BACK INTO THE HOUSE

The vehicles used for this operation must have been carefully washed and sprayed with disinfectant.

13.4. DISINFECTION

- Water pipes
  - Prepare a highly concentrated chlorine solution (200 ppm) in the water tank.
  - Open the tank to fill the pipes with this solution and leave for 24 hours. Afterwards, drain the water circuit. Do not forget to seal the water tank to protect it from dust.

• House
- House and equipment disinfection is achieved using a homologous bactericidal, virucidal and fungicidal disinfectant, applied with a hand held or low pressure sprayer or a foam-producing machine.
- The list of homologous approved disinfectants may vary from one country to another. We recommend that you consult the relevant local Authorities for a list of approved disinfectants and the required concentrations when used for poultry applications.

•Feed Storage Silos
- Scrape, brush wash and after drying, fumigate using fungicidal candles following the manufacturer's guidelines.

• Heating and ventilation ducts (if they are present)
- Disinfection using fungicidal, virucidal and bactericidal candles following manufacturer's guidelines.

• House surroundings and road and path access ways.
- Spread a disinfecting product, such as:
  >caustic soda (50 to 100 kg/1000 m2).
  >or quicklime (400 kg/1000 m2).

13.5. SANITARY PRECAUTIONS
Place clean boots and overalls in the changing room. Replenish footbaths with an appropriate disinfectant.

13.6. ASSESSING DISINFECTION EFFECTIVENESS
• Visual examination
- Check for dirt stains in the house and on the equipment.

• Bacteriological analysis
- Contact plates or swabs are applied to equipment and to different places in the house. These are rapidly forwarded to a laboratory for bacteriological assessment following an agreed protocol with the laboratory.

13.7. RODENT CONTROL
Rodents may be vectors of numerous bacterial diseases such as salmonellosis.
Rodent control is often based on the use of toxic baits which generally contain anticoagulants. These are left in places frequented by the rodents following a site risk assessment. A poorly prepared rodent control programme may give variable or poor results. We therefore advise using a specialised rodent control service.

13.8. RESTING PERIOD
This starts only when all the above operations have been achieved and lasts for at least 10 days, in order for the house to dry properly.

13.9. BEFORE THE NEW FLOCK ARRIVES
• 3 days before the new flock arrives, a residual insecticide is sprayed on all surfaces.
• Fresh litter is placed (never use mouldy material) and its surface sprayed with a larvicidal insecticide.
• Equipment is prepared in the brooding area.
• 24 hours before the new flock arrives, the final disinfection is performed by fogging.
• To be careful with disinfection fo vehicles coming to the farm

14. PERFORMANCE TABLES

Age	Age	Consumption	Female BodyWeight (gr)		Male BodyWeight (gr)	
(Week)	(Days)	g/bird	Min.	Max.	Min.	Max.
1	0 - 7	10	60	62	65	68
2	8 - 14	16	115	125	125	135
3	15 - 21	25	190	200	205	215
4	21 - 28	34	265	285	295	315
5	29 - 35	42	350	370	380	405
6	36 - 42	46	425	455	460	495
7	43 - 49	51	505	535	555	590
8	50 - 56	54	580	620	655	700
9	57 - 63	55	650	690	765	810
10	64 - 70	57	720	760	865	925
11	71 - 77	59	785	835	985	1 050
12	78 - 84	61	855	905	1 100	1 175
13	85 - 91	64	910	970	1 205	1 285
14	92 - 98	66	980	1040	1 295	1 380
15	99 - 105	68	1040	1100	1 375	1 465
16	106 - 112	69	1085	1155	1 450	1 540
17	113 - 119	72	1145	1215	1 510	1 615
18	120 - 126	74	1215	1290	1 580	1 680

Age	Body Weight (min)	Daily Feed Intake	Lay	Mortality	Cum. Eggs	Average Egg Weight	Hatching eggs	Cum. HE number	Hatch female / DOC	DOC per week	Cum. number of DOC
Week	g	g/bird	%	%	/HH	g	%	/HH	%		/HH
18	1250	71 -79	-	0,1	-	-	-	-	-	-	-
19	1310	74 -82	-	0,2	-	-	-	-	-	-	-
20	1360	84 -92	5,0	0,3	-	-	-	-	-	-	-
21	1410	94 -102	30,0	0,4	2	48,8	-	-	-	-	-
22	1455	104 -112	65,0	0,5	7	51,3	-	-	-	-	-
23	1495	107 -115	85,0	0,6	13	53,1	60	3,5	28,7	1,0	1,0
24	1530	109 -117	90,0	0,7	19	54,3	94	9,4	34,2	2,0	3,0
25	1560	110 -118	92,8	0,8	26	55,3	95	15,6	36,6	2,2	5,3
26	1585	111 -119	93,5	0,9	32	56,1	95	21,7	38,1	2,3	7,6
27	1605	112 -120	94,0	1,0	39	56,7	96	28,0	39,5	2,5	10,1
28	1620	112 -120	94,5	1,1	45	57,2	96	34,2	40,5	2,5	12,6
29	1630	112 -120	94,9	1,2	52	57,6	96	40,5	41,3	2,6	15,2
30	1640	112 -120	94,9	1,3	58	58,0	96	46,8	42,0	2,6	17,9
31	1650	112 -120	94,9	1,4	65	58,4	96	53,1	42,5	2,7	20,5
32	1660	112 -120	94,9	1,5	71	58,7	97	59,5	43,0	2,7	23,3
33	1670	112 -120	94,9	1,6	78	58,9	97	65,8	43,1	2,7	26,0
34	1680	112 -120	94,9	1,7	84	59,1	97	72,2	43,3	2,7	28,7
35	1690	112 -120	94,9	1,8	91	59,4	97	78,5	43,5	2,8	31,5
36	1698	112 -120	94,9	1,9	97	59,6	97	84,8	43,5	2,7	34,2
37	1704	112 -120	94,7	2,1	104	59,8	97	91,1	43,5	2,7	37,0
38	1706	112 -120	94,5	2,2	110	59,9	97	97,4	43,4	2,7	39,7
39	1708	112 -120	94,3	2,4	117	60,0	97	103,6	43,4	2,7	42,4
40	1710	112 -120	94,1	2,6	123	60,1	97	109,8	43,3	2,7	45,1
41	1712	112 -120	93,8	2,8	130	60,2	96	116,0	43,3	2,7	47,8

Age	Body Weight (min)	Daily Feed Intake	Lay	Mortality	Cum. Eggs	Average Egg Weight	Hatching eggs	Cum. HE number	Hatch female / DOC	DOC per week	Cum. number of DOC
Week	g	g/bird	%	%	/HH	g	%	/HH	%		/HH
42	1714	112 -120	93,5	2,9	136	60,3	96	122,1	43,2	2,6	50,4
43	1716	112 -120	93,2	3,1	142	60,4	96	128,2	43,1	2,6	53,0
44	1718	112 -120	92,9	3,3	149	60,5	96	134,2	43,0	2,6	55,6
45	1720	112 -120	92,6	3,4	155	60,6	96	140,2	42,9	2,6	58,2
46	1722	112 -120	92,3	3,6	161	60,7	96	146,2	42,8	2,5	60,7
47	1724	112 -120	92,0	3,8	167	60,8	95	152,1	42,7	2,5	63,3
48	1726	112 -120	91,7	3,9	173	60,9	95	157,9	42,6	2,5	65,8
49	1728	112 -120	91,4	4,1	180	61,0	95	163,8	42,5	2,5	68,2
50	1730	112 -120	91,1	4,3	186	61,1	95	169,6	42,4	2,5	70,7
51	1732	112 -120	90,8	4,5	192	61,1	95	175,3	42,3	2,4	73,1
52	1734	112 -120	90,5	4,6	198	61,2	95	181,0	42,2	2,4	75,5
53	1736	112 -120	90,2	4,8	204	61,2	94	186,7	42,1	2,4	77,9
54	1738	112 -120	89,9	5,0	210	61,3	94	192,3	42,0	2,4	80,3
55	1740	112 -120	89,5	5,1	216	61,3	94	197,9	41,9	2,3	82,6
56	1742	112 -120	89,1	5,3	222	61,4	94	203,5	41,8	2,3	84,9
57	1744	112 -120	88,7	5,5	228	61,4	94	209,0	41,7	2,3	87,2
58	1746	112 -120	88,3	5,6	233	61,5	94	214,4	41,6	2,3	89,5
59	1748	112 -120	87,9	5,8	239	61,5	93	219,8	41,5	2,2	91,8
60	1750	112 -120	87,5	6,0	245	61,6	93	225,2	41,3	2,2	94,0
61	1752	112 -120	87,1	6,2	251	61,6	93	230,5	41,2	2,2	96,2
62	1754	112 -120	86,7	6,3	256	61,7	93	235,8	41,0	2,2	98,3
63	1756	112 -120	86,3	6,5	262	61,7	93	241,0	40,8	2,1	100,5
64	1758	112 -120	85,9	6,7	268	61,8	92	246,2	40,5	2,1	102,6
65	1760	112 -120	85,5	6,8	273	61,8	92	251,4	40,3	2,1	104,6

Age	Body Weight (min)	Daily Feed Intake	Lay	Mortality	Cum. Eggs	Average Egg Weight	Hatching eggs	Cum. HE number	Hatch female / DOC	DOC per week	Cum. number of DOC
Week	g	g/bird	%	%	/HH	g	%	/HH	%		/HH
66	1762	112 -120	85,1	7,0	279	61,8	92	256,5	40,0	2,0	106,7
67	1764	112 -120	84,7	7,2	284	61,9	92	261,5	39,8	2,0	108,7
68	1766	112 -120	84,3	7,3	290	61,9	92	266,5	39,5	2,0	110,7
69	1768	112 -120	83,9	7,5	295	61,9	92	271,5	39,3	2,0	112,6
70	1770	112 -120	83,5	7,7	301	62,0	91	276,4	38,8	1,9	114,5
71	1772	112 -120	83,0	7,9	306	62,0	91	281,3	38,3	1,9	116,4
72	1774	112 -120	82,5	8,0	311	62,0	91	286,2	37,8	1,8	118,2
73	1 776	112 -120	82,0	8,2	316	62,1	91	291,0	37,3	1,8	120,0
74	1 778	112 -120	81,5	8,4	322	62,1	91	295,7	36,8	1,7	121,8
75	1 780	112 -120	81,0	8,5	327	62,1	91	300,4	36,4	1,7	123,5
76	1 782	112 -120	80,4	8,7	332	62,1	90	305,0	35,9	1,7	125,2
77	1 784	112 -120	79,8	8,9	337	62,2	90	309,6	35,4	1,6	126,8
78	1 786	112 -120	79,2	9,0	342	62,2	90	314,2	34,9	1,6	128,4
79	1 788	112 -120	78,6	9,2	347	62,2	90	318,6	34,4	1,5	129,9
80	1 790	112 -120	78,0	9,4	352	62,2	90	323,1	33,9	1,5	131,4

NOVOGEN FRANCE
5 rue des Compagnons
Secteur du Vau Ballier
22960 Plédran

+ 33 (0)2 96 58 12 60
contact.novogen@novogen-layers.com

A shared ambition
novogen-layers.com

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