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LAYWEL

Welfare implications of changes in production systems for laying hens

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Description of housing systems for Laying hens

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1 HOUSING SYSTEMS: DEFINITION OF SYSTEM GROUPS

Laying hens are housed in a variety of different systems. In Council Directive 1999/74/EC (later in this chapter often referred to as "EU-Directive") these systems have been categorised into 3 groups: alternative systems, unenriched cage systems and enriched cage systems. The category “alternative systems” comprises a wide variety of different types of system, ranging from very simple single level systems to multilevel aviaries with or without free-range facilities. As this may influence the welfare of laying hens, for this report this category has been split in some sub-categories. The categories of housing system, as described in this report, have been arranged in order from cages through to free range.

The term "alternative systems" is used in the industry to refer to systems which are not conventional cages or to any non-cage system. An "alternative" means one of several possibilities within a certain category. Hence each of the three categories of systems is an alternative system and the erroneous use of the word to refer to only one kind of system should not be perpetuated in this report or in any future legislation. As explained below, a cage is considered here to be a system which is operated without the human carers entering it. All other systems will therefore be referred to as "non-cage systems". As also explained below, a more accurate term for "enriched cage" is "furnished cage". The three types of system considered are therefore conventional cage (CC), furnished cage (FC) and non-cage (NC).

The results of housing systems are influenced by the system components used. Positioning and layout of equipment are important to safeguard bird welfare, hygiene and performance. To clarify what is meant by certain component names, a short description is given. As the successful operation of housing systems is also largely dependent on management, some details about this are included.

1.1 Cage systems

New developments in housing systems sometimes make it difficult to distinguish between cage and non-cage systems. If the system is operated from outside and carers do not enter the system it is regarded here as a cage.

Conventional laying cages (CC) are usually small enclosures with welded wire mesh sloping floors. They provide equipment only for feeding, drinking, egg collection, manure removal, insertion and removal of hens, and claw shortening.

These cages fall into the category of the EU-Directive "unenriched cage systems"

Furnished cages (FC) provide all the equipment found in conventional cages and in addition provide equipment intended to enable hens to provide for some of their strong behavioural priorities. These extra elements may include perches, nest boxes, a litter area and extra height. These cages fall into the category of the EU-Directive "Enriched cages" if they are equipped with appropriate perches, suitable nest boxes and friable litter. The term furnished cages is used here because it gives a more accurate description. For example, adding a perch or a nest to a cage can be factually described as furnishing it whereas it is a matter of opinion whether or not it enriches it.

FCs come into a wide variety of group sizes. Up to 10 -12 birds they are generally referred to as small groups (See figures 3.1, 3.2 and 3.3). At the moment larger cages may house up to 60 birds (See figures 3.4, 3.5 and 3.7). 15 to 30 birds could be regarded as medium sized groups and above this number they would be large groups. Neither the maximum or optimum number of birds is yet defined.

There are a wide variety of FC designs. Positioning and layout of equipment is important to allow proper use and thus contribute to bird welfare, hygiene and performance. Nest boxes can be placed at the rear, the side or close to the front of the cage. This can affect bird inspection and the hygiene of eggs and birds. Litter may be provided either in boxes or on mats on the cage floor (See figure 3.6). Litter boxes may be located over the nest or at a lower level at the side or rear of the cage. Perches can be arranged in a variety of positions and heights; some are more satisfactory than others. Cage dimensions are strongly related to group size and may influence bird inspection and depopulation.

1.2 Alternative (non-cage) systems

These systems, which include those that fall into the category of the EU-Directive "Alternative systems", are operated from inside and the keepers enter them. All current alternative systems provide the birds with nest boxes and litter as well as perforated platforms. Elevated perches may or may not be included.

1.2.1 Indoor

Indoor systems may, or may not, be combined with outdoor facilities.

Single level systems contain all alternative systems where the ground floor area is fully or partially covered with litter and/or perforated floors in any combination. Birds have no access under the perforated floors. There is only one level for the birds at any one point, even if this level is stepped. (See figure 3.8).

Aviaries (Multi-level systems) consist of the ground floor plus one or more levels of perforated platforms, from which manure cannot fall on birds below. At some point across the system there are at least two levels available for birds.

There are many differences in layout. Three major categories can be distinguished.

- Aviaries with non-integrated nest boxes: aviaries with several levels of perforated floors with manure belts under them and separately arranged nest boxes (see figure 3.9) Feeders and drinkers are distributed in such a way that they provide equal access for all hens.
- Aviaries with integrated nest boxes: aviaries as above but where nest boxes are integrated within the blocks of perforated floors (see figure 3.10).
- Portal aviaries: aviaries with elevated perforated floors, the top tier of which is a single level which links the lower stepped platforms. The keeper can walk under and upon the top tier. Nest boxes are integrated in the system (see figure 3.11). Typically the litter goes fully under all the platforms, providing 100% littered ground floor.

1.2.2 Outdoor

In combination with the above mentioned alternative systems some additional area is provided. This can be either one or both of the following possibilities:

- Covered verandas: a covered area outside, but connected to the hen house, is provided and can be available during daylight hours. This area has a concrete, or other suitable floor, usually covered with litter. The climate is similar to that outside except for rain (because of protecting devices). In some countries this area is referred to as a Wintergarten.
- Free-range: an outside uncovered area is provided, mainly covered with vegetation. Hens have access from fixed or mobile houses to this area via popholes in the wall of the henhouse and in the covered veranda, if present. Several pens may be used in rotation, or mobile houses may be moved, to control parasites and maintain good pasture quality. Areas near to the house may be covered with free draining material to maintain good hygiene both outside and within the house.

1.3 Others

Several systems do not fit into the previous categories, because they are obsolete or rarely used nowadays, e.g.:

- Litter-less or fully littered floor systems: obsolete as they do not meet the requirements of the EU-Directive (e.g. "perches must not be mounted above the litter").
- Tents: rarely used, but maybe suitable for certain situations.
- Percheries: obsolete as they do not appear to meet the requirements of the EU-Directive (e.g. "the levels must be so arranged as to prevent droppings from falling on the levels below").

2 SYSTEMS COMPONENTS

2.1 Components for the hen

2.1.1 Feeders

Feed is supplied by means of linear or circular troughs. These are generally well distributed to give easy access. Linear feeders can be either chain feeders, hopper feeders or those with flex auger or other conveyors to transport the feed. The trough can be either inside or outside the area accessible for the bird. If the feeder is outside this area, the hens can use only one side whereas feeders running through the accessible area can be used on both sides. Although the EU-Directive does not mention the latter system for enriched cages circular feeders are applied in FCs as well.

2.1.2 Drinkers

Water is supplied in open water systems or by means of nipple drinkers. Open water systems include bell drinkers and cups of various sizes. Closed water systems include low and high-pressure nipple drinkers. Access to at least 2 nipple drinkers is provided.

2.1.3 Cage gates

Cage gates are usually constructed of sliding horizontal bars which reduce trapping and feather wear, facilitate easy inspection and improve feed trough access. Fully opening cage gates which allow almost the whole of the cage front above the feed trough to open (except for constructional margins) are now available on most makes of cage (Elson, 1990). Together with gentle handling, this should reduce bone breakage when cages are depopulated.

FCs often may be equipped with similar cage gates as conventional cages. If feeders are located within the cage, there is no need for horizontal cage gate bars, so other designs sometimes are chosen (e.g. vertical bars or wire mesh).

2.1.4 Claw shorteners

Abrasives are provided in cages to shorten and blunt claws. A wide variety of such devices are now in use. These include perforated egg baffles, ceramic or other stones, abrasive paste, adhesive abrasive strips, abrasive faced metal plates. Some are more effective and durable than others (Elson, 2003). Also the effects of the abrasive may vary between different genotypes. The abrasive devices are generally fitted on the baffle plates behind feed troughs. The EU-Directive does not require claw shorteners in alternative systems.

2.1.5 Floors

Most cage floors are constructed of rectangular welded wire mesh of various sizes and galvanised or otherwise treated to give them durability and a smooth finish. This is important to avoid foot and egg damage. Most often the wire mesh is about 50 mm by 25 mm, but 75 mm by 25 mm welded wire or plastic mesh of thicker gauge is sometimes used without apparent foot problems. In alternative systems perforated floors constructed of plastic mesh or slats or of timber slats are in widespread use. Such floors often incorporate perches under, over or within them – see section on perches. Some FCs also have plastic slats as their floor surface.

The floors usually have a slight slope (max. 8^o) so that eggs roll to the front or onto the egg belt. A well-chosen combination of materials, construction and slope is important to prevent foot problems

2.1.6 Perches

Perches are available in a variety of materials and shapes. Materials used include wood, plastic and metal. They should not have sharp edges. They can be arranged at various heights and positions. In FCs they are usually positioned slightly above the cage floor. If the feed trough is inside the cage, often a perch is positioned on top of it. In alternative systems perches may be located over, within or at the side of the perforated platforms, over feed troughs or on A-frames.

2.1.7 Nest boxes including expulsion systems

Nest boxes include single and colony models. They provide a separate, secluded space for egg laying, to which hens have easy access. The bottom can be lined with various materials, including artificial grass mats, rubber mats, plastic mesh or litter.

To prevent hens from staying in the nest boxes overnight and thus soiling the nest floor, expulsion systems may be used. There are basically two systems. One gently pushes and keeps hens out during the night. The other type is a door that in closed position prevents hens from entering the nest box, but allows hens to exit. Both systems are usually mechanised.

2.1.8 Litter area

In alternative housing systems, the litter area is usually the floor surface of the hen house, or part of it, covered with litter. Often the floor is made of concrete, but other materials can be used as well. The litter area can also be located in boxes or on shelves. These can be large, as in some floor systems with wire floors and elevated litter boxes.

In FCs the litter area may be much smaller and needs frequent replenishment. In this system litter is provided on mats or in litter boxes. The former are often artificial grass mats fitted over the cage floor area. Any eggs laid on litter mats may roll onto the cage floor and thus onto the egg belt.

Opening and closing litter areas for certain periods may be used as a management practice to minimise floor eggs and to facilitate finding food and water.
Types of litter used include sawdust, wood shavings, chopped straw, peat and sand. In some commercial FCs dry feed mash is used as litter.

Automatic litter supply systems can be used with suitable materials.

2.1.9 Popholes

Popholes allow hens access to the free-range area or to a covered veranda. They are distributed along the entire side of the hen house to allow all hens easy access to free range or covered veranda. The number of popholes is usually related to the number of hens in the house. In some cases instead of using popholes farmers simply open the doors of the henhouse to enable hens to go outside.

2.1.10 Lighting

In practice photoperiod length is usually between 12 and 17 hours in layers, often increasing as the hens increase in age (for gonadal stimulation). Good production results can also be achieved with intermittent photoperiods (alternating short periods of light and darkness).

Light intensity necessary to keep a normal laying rate is 5 to 7 lux (Sauveur, 1988; Lewis and Morris, 1999). Morris (2004) showed a photoperiodic threshold at around 2 lux, but suggested that slightly higher values are sensible to recommend for laying houses because it is convenient for workers and allows for some variation in intensity in different parts of the house). Light intensities well over 10 lux are usually avoided to prevent serious feather pecking.

An even light distribution is desirable to minimise problems such as floor eggs, pecking or smothering. Where there is natural light, apertures are often shaded or baffled to avoid direct sunlight and thus arranged in such a way that light is distributed evenly within the accommodation.

For the first few days after housing light may be fairly bright. Later the light intensity should be such as to prevent health and behavioural problems.

2.2 Management components

2.2.1 Inspection systems (catwalks, trolleys)

When multi-tier systems (both cages and alternatives) are present inspection and removal of birds in some tiers may be difficult. Catwalks between tiers enable keepers to readily service birds. Trolleys or stepladders may also be used. These may be trolleys attached to one or more sides of the cage system, or free standing ones that pass through the aisles. They may be equipped with containers for various materials.

2.2.2 Manure removal and storage

Frequent removal of manure from the henhouse and manure drying reduces the ammonia concentration in the air.

Manure removal is generally mechanised using scrapers or belts. They may have air-drying systems ventilating and drying the manure. Air temperature can be increased with heating systems and/or heat exchangers using the heat of outgoing ventilation air to heat incoming fresh air.

A removal system is used to convey the manure from the end of the building to the container or storage area. Alternatively the storage may be underneath the building in a separate room.

Another approach is to store the manure in a pit underneath a perforated floor or below the house where it is stored and subsequently processed or spread on the land.

2.2.3 System Management

The effect of systems and system components on the welfare of hens is not only dependent on the design, but also on the management of the system. Even the best design can lead to failures if the management is not adequate. It is hard to give strict definitions of proper management. Some general aspects are given.

REARING OF PULLETS:

- success in the laying period will greatly depend on the housing and management in the rearing period. To facilitate a smooth start to the laying period it is advised to rear the pullets in a system

that is similar to the system they will be housed in during the laying period and to transfer them into it well before onset of lay.
- feed and light management of the pullets will influence the production results later in life. Stimulation too early may lead to more egg laying problems. As the challenges hens meet in the laying period are different for cage systems and alternative systems, the rearing management should be focussed on the demands of the laying period.

FEED AND WATER:

- Access to feed and water is influenced by: the distribution of feeders and drinkers in the system, the frequency of supply, the amount of water and feed available per batch.
- Good distribution of feeders and drinkers is important to allow easy access for all birds.

LIGHT:

- The type of light source in combination with the positioning of the lights defines the distribution of light in the house. The location of the lights should be chosen to minimize the amount of shaded areas and thus the risk of floor eggs.
- The management of daylength (the pattern of light and darkness) will influence the onset of lay and affect the distribution of the hens within the system. A proper dawn and dusk period will enable hens to perch and will minimise floor eggs.
- Different light intensities may be applied in different parts of the systems, e.g. the litter area may be slightly lighter than other areas in the system. Nestboxes usually have lower light levels to create a shaded place for the birds to lay eggs.

PERCHES:

- The use of perches will depend on several factors, including genotype, rearing experience, the available perch length and the provision of an acceptable perch position.
- Perch position can also influence soiling of the hens and litter, calmness of the flock and (vent) pecking.

POPHOLES:

The height of the popholes usually allows easy passage of the hens. Having more popholes or popholes with sufficient width can prevent one of a few hens blocking the passage of other hens. Large popholes not only give hens access to the outside area, but may also enable other animals to enter the house. Vertical bars spaced about 15 cm apart are sometimes used to prevent larger animals entering. The large openings may influence the climate in the house, especially in case of cold, wet and windy weather. If they open onto wet muddy areas, the litter within the house can quickly deteriorate. Popholes may be protected e.g. with a small roof above, slats or free draining material around them and baffles to minimise wind entry.

3 DETAILED SYSTEM DESCRIPTIONS

3.1 Cage systems

3.1.1 Conventional laying cages

Conventional cage systems come in a wide variety of shape and size. In general the cages are made for 5 hens, but other group sizes are also available and used. Especially with the future changes in legislation larger cages are made and bought, so that these can be furnished later at the time it is required by law. Side partitions of cages can be solid or made of wire. The wire side partitions can deteriorate feather cover, but prevent part of the ventilation possibilities.
Most CCs are made of galvanized metal, but parts may be constructed with plastic. In Sweden a complete plastic cage was build.
The earlier cage models were positioned in one level (flat deck cages). Later on cage levels were stacked, sometimes up to 10 or more levels. When more than 3 levels are present devices are needed to be able to inspect all cage levels. To prevent manure from dropping on lower cage levels various devices are used. Scrapers or manure belts can transport manure to the center or end of the cage row where it drops in a pit or is further transported to manure storage. If the storage is underneath the henhouse, cages are usually placed in A-frames. The sloping back of the cage is covered with self-cleaning curtains or boards that deflect droppings.

Feed is provided in a feed trough running outside the cage area. Feed is distributed by means of chains, flex augers or hopper feeders. Water is provided mostly by means of 2 nipple drinkers per cage.

Cage doors usually have horizontal bars to enable hens to distribute evenly over de feeder space, without the necessity to move their heads back and forth through the cage doors. Research has indicated that horizontal bars reduces feather wear in the neck region. To open the cages doors usually slide aside ore can be unhooked and pushed inwards the cage.

Cages with manure belts can have manure drying systems. These mostly consist of air tubes blowing heated fresh air over the manure.

MANUFACTURERS OF CCS:

D:	Big Dutchman, Hellmann, Meller, Salmet, Specht	USA:	Chore Time
I:	Facco, Tecno, Valli	F:	Piers
E:	Aruas, Zucami	Can:	Valco

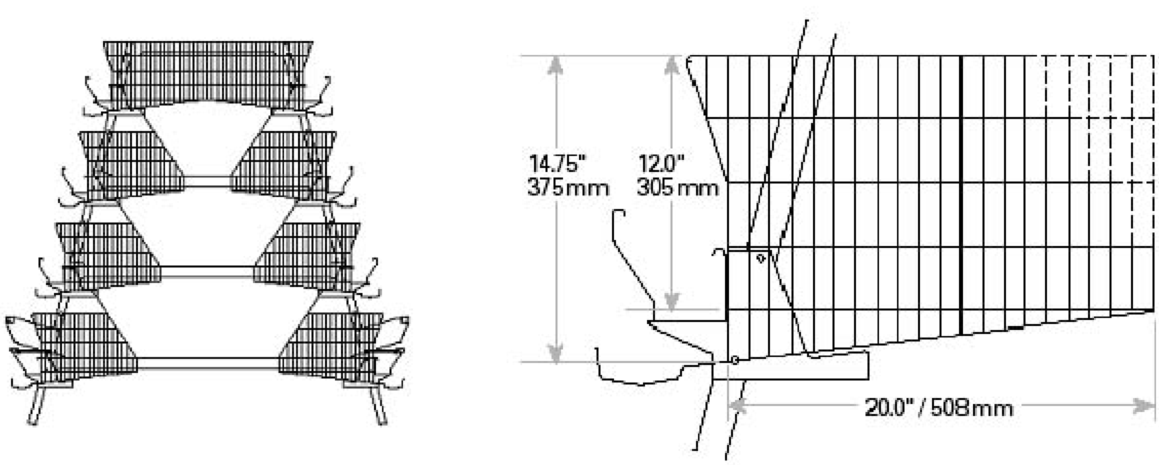
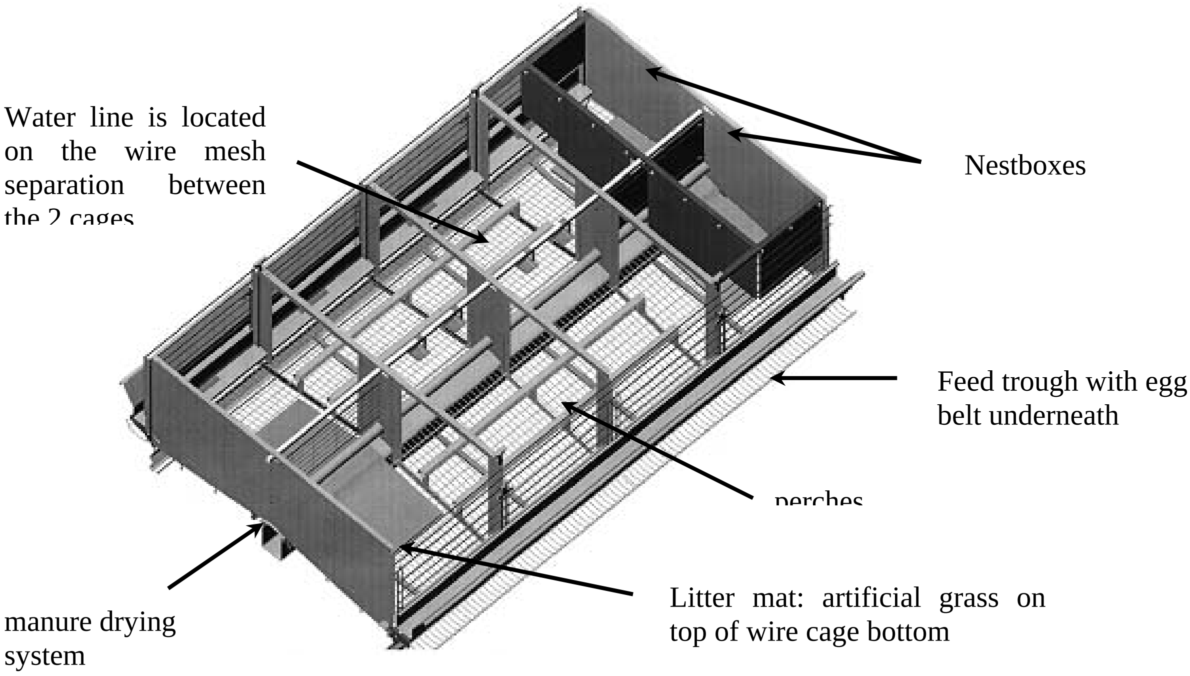


Figure 3.1: example of A-frame cage system.

Figure 3.2: Schematic drawing of 2 large furnished cages



3.1.2 Large furnished cages

Large furnished cages, especially the earlier models, are often derived from broiler parent cages. Although there is no clear limit to the size of the cage, nowadays groups up to 60 hens are formed. One system is made for groups of 115 hens, but technical results are not known. The depth of the cages is usually much more, often more than twice the depth of a CC. Therefore they are stacked with only one cage row per level (so not connected to each other with the back of the cages). The more shallow cages can be connected with the back. To create space for large groups of hens, those cages are then very long.
Cage bottoms are sloping, so that eggs can roll onto an egg belt. Often cage bottoms are made of wire mesh, but also plastic slats are used.

Usually feed is provided with feed troughs outside the cage. The deeper cages can have a feed trough running through the cage or can even be equipped with feeding pans. Cage doors are usually of a sliding type and similar, but larger than doors of CCs. If feeders are inside the cage, cage doors do not need to have horizontal bars.

Nestboxes are located on one side or in one corner of the cage. Ideally eggs roll directly from the nest onto the egg belt and do not need to roll throught the cage. However, in some models eggs roll over a part of the cage wire floor before ending on the egg belt. This is not in favour of egg quality, but the construction sometimes is chosen to have enough feeding space in the cage. If the nest is placed in the front of the cage, there is less feeding space and less overview over the system, making controlling more difficult.

Cage height is often more than 45 cm, as this facilitates an easier view through the deep systems. Sometimes the height makes it possible to create two living levels by installing elevated perches.If a feeder is running throught the cages often a perch is installed on top of it.

Litter can be provided in boxes or on mats. Both systems can be combined with automatic litter supply. Boxes need a closing mechanism, being a door or wire partition.

To prevent extreme dark places in large FCs it important to pay attention to the lighting of the system. This means either placing lights in the aisles on different levels ore have lights in each cage.

MANUFACTURERS OF LARGE FCS:

D:	Big Dutchman, Farmer Automatic, Hellmann, Meller, Salmet, Specht	I:	Valli
NL:	Jansen PE, Vencomatic	S:	Victorsson

3.1.3 Medium Furnished cages

Medium furnished cages house 15 - 30 hens per cage. Often these cages are shallow and two rows are connected with the back of the cages. Other models however are also available, where the cage runs all across a level to the other aisle. The height of the cages is often 45 cm or not much more.
Bottoms of the cages are sloping to the aisles to have eggs roll onto the egg belt. Mostly wire mesh bottoms are used. In some cases in the area of the nestbox the wire is plastified.

Feed troughs are outside the cages. Nipple drinkers are inside the cages. The number of nipples is depending on the cage size.

Nestboxes are in a corner or on a side of the cage. As cage height is limited, perches are usually installed in one level, slightly above the cage floor. Litter is provided in boxes or on mats and can be automated fully.

MANUFACTURERS OF MEDIUM FCS:

D:	Big Dutchman, Farmer Automatic, Hellmann, Meller, Salmet, Specht	S:	Victorsson
NL:	Jansen PE, Vencomatic	I:	Valli, Tecno

Figure 3.3: Furnished cage for medium group size
Medium sized group (18 hens) in FC with hard wood perches. To meet the required 15 cm per bird and still provide the hens enough space for movement one of the perches is positioned angled to the other.

3.1.4 Small furnished cages

Small furnished cages house up to about 15 hens. Mostly these cages are shallow and two rows are connected with the back of the cages.The height of the cage is limited to 45 cm or slightly more. Cage bottoms are made of sloping wire mesh, allowing eggs to roll onto the egg belt. To save space nestboxes and litter area are often placed above eachother and are therefore limited in height.
Cage doors are mostly very similar to those in CCs.

Feed troughs are outside the cages. Usually 2 nipple drinkers per cage are installed.

Nestboxes are in on a side of the cage and usually run over the full depth of the cage. As cage height is limited, perches are usually installed in one level, slightly above the cage floor. Litter is provided in boxes and supply can be automised.

MANUFACTURERS OF SMALL FCS ARE:

D: Big Dutchman, Farmer Automatic
I: Facco, Tecno, Valli, Zucami
S: Victorsson

Figure 3.4: Furnished cage for small group

Litter box is on top of the nestbox
The perch is positioned parallel to the feed trough. The feed trough is running outside the cage. Underneath it is the egg belt.

Figure 3.5: Furnished cage for small group (8 hens)

Various behaviours in a furnished cage with 8 birds. One birds is in the litterbox, one bird is wingflapping and several birds are perching

Figure 3.6: Furnished cage for small group

Small group (8 hens) of medium brown hybrids in FC with hard wood perch, side nest box with Astroturf floor pad and litter dust bath box over the nest.

3.2 Single tiered non-cage systems

In non-cage systems the space of the hens is also used by carers to control the system. The single tiered systems are basically very simple in set-up. Some variation however is possible. The floor is usually partly litter, partly slatted floor. The percentage litter floor and percentage slatted floor can vary. Often 1/3 of the area is covered with litter, but more litter area is also seen.The slats can be made of wood, plastic or wire mesh. Underneath the slats a manure pit or a manure removal systems (e.g. scrapers, belts) is placed. Usually the slatted floor is in the middle of the henhouse, with litter floors on both sides, but there are also houses where slatted floors are running alongside both walls and where litter is in the middle of the house. Often the nestboxes are positioned over the slatted floor, but they can also be placed over the litter. Nestboxes can be automated or hand collected, with a artificial grass bottom or with litter. Also the size of each nest can vary largely, from single nestcboxes for one hen at a time to group nests.

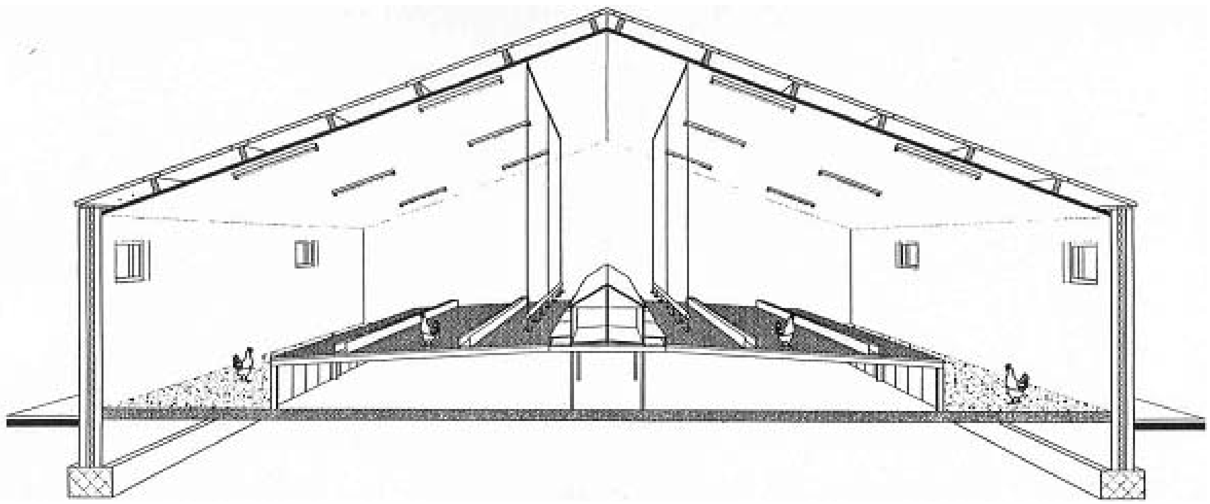
Feed is usually provided on top of the slatted floors, although this depends on the available space. For organic farming often the feeders are placed over the litter, Different type of feeders are possible, but over the slatted floor chain feeders do fit best. Water can be provided by means of nipples, cups or bell drinkers.

Perches are available and are usually placed in A-frames on the slatted floor.

MANUFACTURERS OF SINGLE-TIERED NON-CAGE SYSTEMS:

D: Big Dutchman, Farmer Automatic,
Salmet, Specht
NL: Jansen PE, Vencomatic
I: SKA

Figure 3.7: Cross section of single tiered non-cage system



3.3 Multi-tiered non-cage systems

3.3.1 Aviaries with non-integrated nest boxes

The earlier type of aviaries have stacks of elevated floors and separate units of nestboxes. Between the elevated floors and the nestboxes an aisle covered with litter is positioned to enable carers to walk through the system and to provide litter to the hens. The elevated floors often have a slight slope to allow eggs to roll towards the side of the floors. Often there is a perch positioned along the side of the perforated floors with enough space underneath to cover mislaid eggs and thus protect them from claws or pecks of birds. Under each elevated floor a manure belt is positioned to prevent manure from falling on the lower levels and to transport manure out of the henhouse. The nestboxes (individual or group nests) can be lined in one row or in more rows above eachother.

Between the elevated floors there is a space of at least 45 cm heigh as this is the minimum height required by law. On the elevated floors water and feed is provided. Water is usually provided through nipple drinkers, but cups are also possible. Feed can be provided by means of chain feeders or feeding pans.

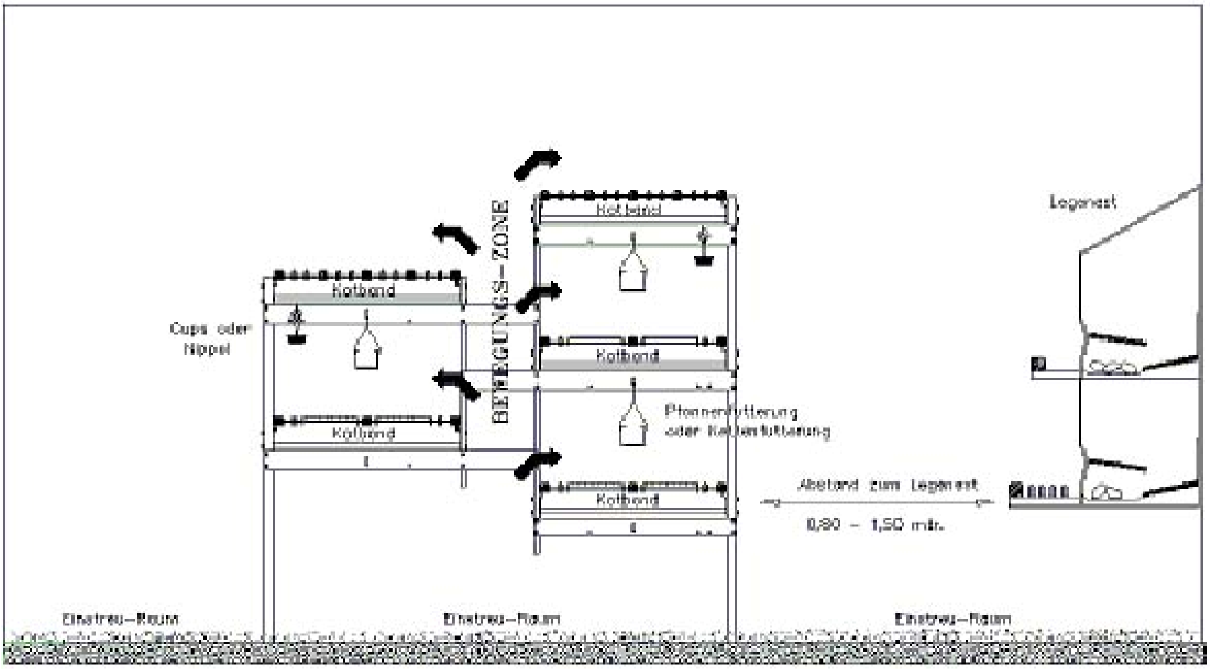
Perches are located over the elevated floors. The top floor usually has many perches, the lower floors often have only perches along the sides of the floors.

Litter is provided on the bottom of the henhouse. In some systems the entire floor is covered with litter and birds can walk underneath the elevated floors. Other systems have the area underneath the elevated floors blocked, so that hens have to jump onto the slatted floors to continue.

MANUFACTURERS AVIARIES WITH NON-INTEGRATED NEST BOXES:

D:	Big Dutchman, Farmer Automatic, Fienhage, Salmet, Specht	S:	Oli-Free
NL:	Jansen PE, Vencomatic	CH:	Volito

Figure 3.8: Cross section of Aviaries with non-integrated nest boxes



3.3.2 Aviaries with integrated nestboxes

The later type of aviaries have stacks of elevated floors with units of nestboxes integrated in the same stack. Often stacks with integrated nestboxes are alternated with stacks without nestboxes. Between the different stacks of floors an aisle covered with litter is positioned to enable carers to walk through the system and to provide litter to the hens. The elevated floors often have a slight slope to allow eggs to roll towards the side of the floors. Often there is a perch positioned along the side of the perforated floors with enough space underneath to cover mislaid eggs and thus protect them from claws or pecks of birds. Under each elevated floor a manure belt is positioned to prevent manure from falling on the lower levels and to transport manure out of the henhouse. The nestboxes (individual or group nests) usually are lined in 2 rows connected with the back of the nests.

Between the elevated floors there is a space of at least 45 cm heigh as this is the minimum height required by law. On the elevated floors water and feed is provided. Water is usually provided through nipple drinkers, but cups are also possible. Feed can be provided by means of chain feeders or feeding pans.

Perches are located over the elevated floors. The top floor usually has many perches, the lower floors often have only perches along the sides of the floors. Perches are also placed in front of the nestboxes.

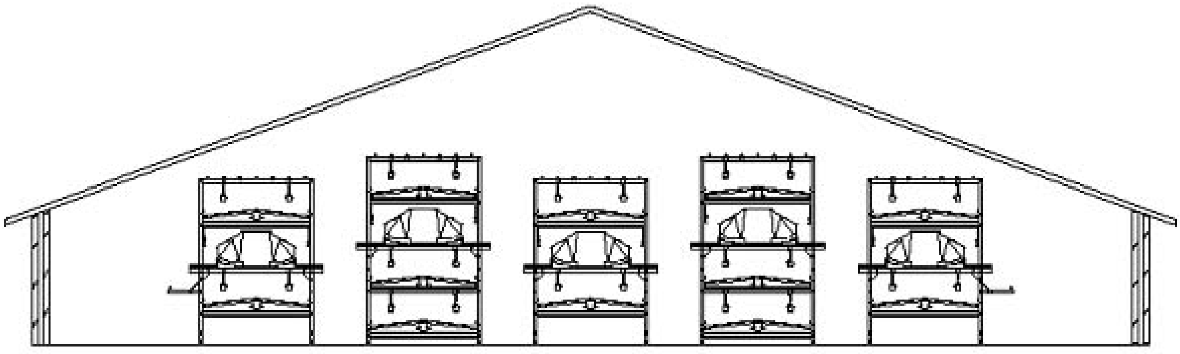
Litter is provided on the bottom of the henhouse. In some systems the entire floor is covered with litter and birds can walk underneath the elevated floors. Other systems have the area underneath the elevated floors blocked, so that hens have to jump onto the slatted floors to continue.

MANUFACTURERS AVIARIES WITH INTEGRATED NESTBOXES:

D: Big Dutchman, Farmer Automatic,
Fienhage, Salmet

NL: Jansen PE, Vencomatic

Figure 3.9: Cross section of Aviaries with integrated nestboxes



3.3.3 Portal systems

The youngest type of aviaries have stacks of elevated floors with units of nestboxes integrated in the same stack. On top of two of those stacks, connecting the two stacks, a single level system is placed. Between the different stacks of floors, under the single level part, an aisle covered with litter is positioned to enable carers to walk through the system and to provide litter to the hens. On the outside of the two stacks there is also an aisle covered with litter. Litter actually runs underneath all stacks and is covering the complete floor area of the henhouse.
The elevated floors often have a slight slope to allow eggs to roll towards the side of the floors. Often there is a perch positioned along the side of the perforated floors with enough space underneath to cover mislaid eggs and thus protect them from claws or pecks of birds. Under each perforated floor a manure belt is positioned to prevent manure from falling on the lower levels and to transport manure out of the henhouse. The nestboxes (group nests) are lined in 1 row in each stack of floors and also in 2 rows connected with the back of the nests on top of the system (as part of the single level part).

Between the elevated floors there is a space of at least 45 cm heigh as this is the minimum height required by law. On the elevated floors water and feed is provided. Water is usually provided through nipple drinkers, but cups are also possible. Feed can be provided by means of chain feeders or feeding pans.

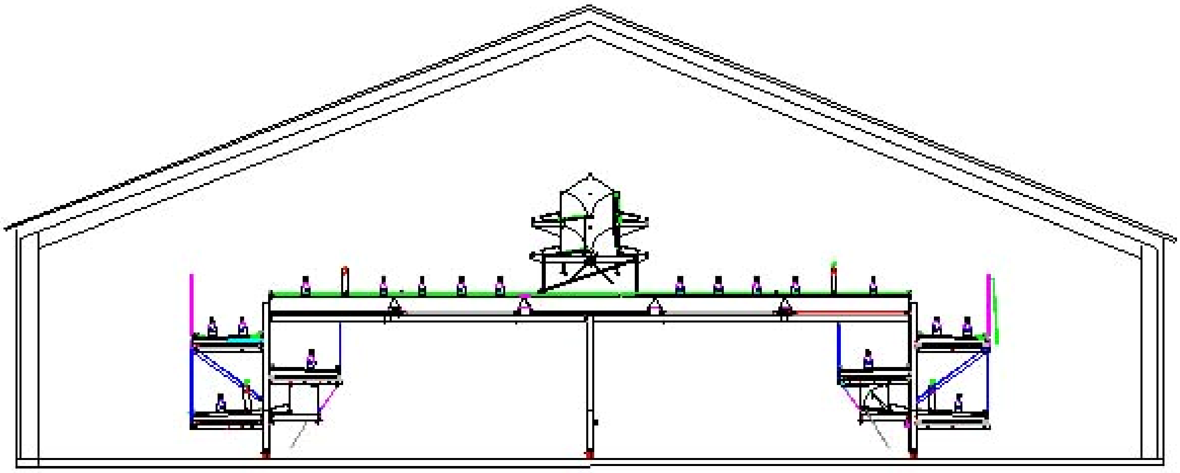
Perches are located over the elevated floors.

Litter is provided on the entire floor of the henhouse and birds can walk underneath the elevated floors.

MANUFACTURERS PORTAL SYSTEMS:

D: Farmer Automatic, Fienhage, Meller
NL: Jansen PE, Vencomatic

Figure 3.10: Cross section of Portal systems



3.4 Outdoor/free range systems

3.4.1 Wintergarten / Covered verandas

Covered verandas can be build as additional element to the henhouse or as part of the total construction. For the latter the roof and floor are extended. The wall between the inside area and the covered veranda is then build more to the inside of the house. The outside wall often is a curtain that can be lifted to provide hens access to the free range area. If there is no free range the ouside wall is fenced off with wire mesh preventing hens from going out, but letting the fresh air blow freely through the area. Only some protecting devices can be made to prevent rain entering the area.

The floor of the covered veranda is usually covered with litter. This can be only a thin layer of sand, but especially in organic farming the area is used to provide hens with additional feeding materials (e.g. straw, vegetables).

3.4.2 Free range

Free range can be covered with grass, but to encourage hens to use the area, more should be provided. Hens use the area if there is sufficient shelter. This may be trees or bushes, but it can also be artificial shelter (elevated nets, tents) and also a fence is used as cover to walk along. Providing water, feed or a sandbath is another way to attract hens. However, the more elements, the more difficult is is to work in the free range are.

3.4.3 Other

Other housing systems, like tents or mobile housing, are not much used. These options have the special issue of how to provide them with feed, water and electric and how to remove manure and eggs. They are therefore only a reasonable option when flock size is not too large.

Figure 3.11: Covered veranda

Figure 3.12: Tents for laying hens

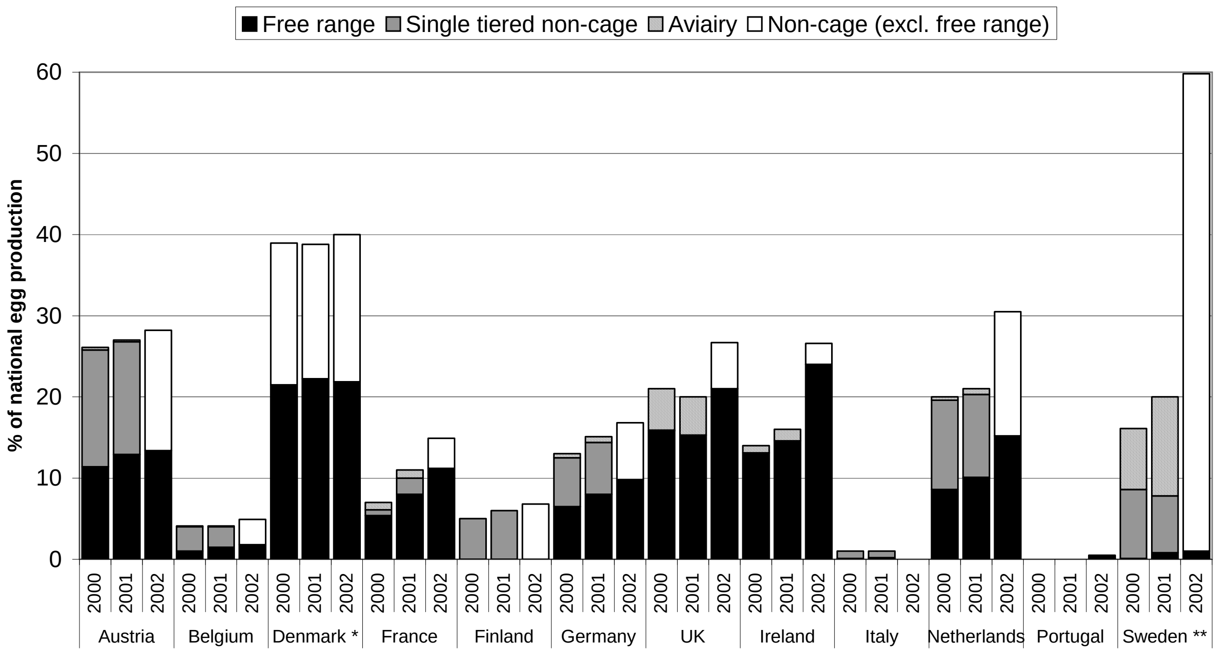
4 HOUSING SYSTEMS IN EUROPEAN COUNTRIES

4.1 Prevalence of systems in different European countries

In recent years housing of laying hens has changed a lot. More and more hens are housed in non-cage systems. Seen as a percentage of the total national production Sweden is ahead of the rest of Europe (figure 4.1). This has of course a lot to do with the ban on cage housing that has been into force for a longer period than in other countries. Other countries with high percentages non-cage systems are Austria, Denmark, Great Britain, Ireland and the Netherlands. This is however seen as percentage of the national production. European wide seen not all of the mentioned countries play a role of importance in the European production.

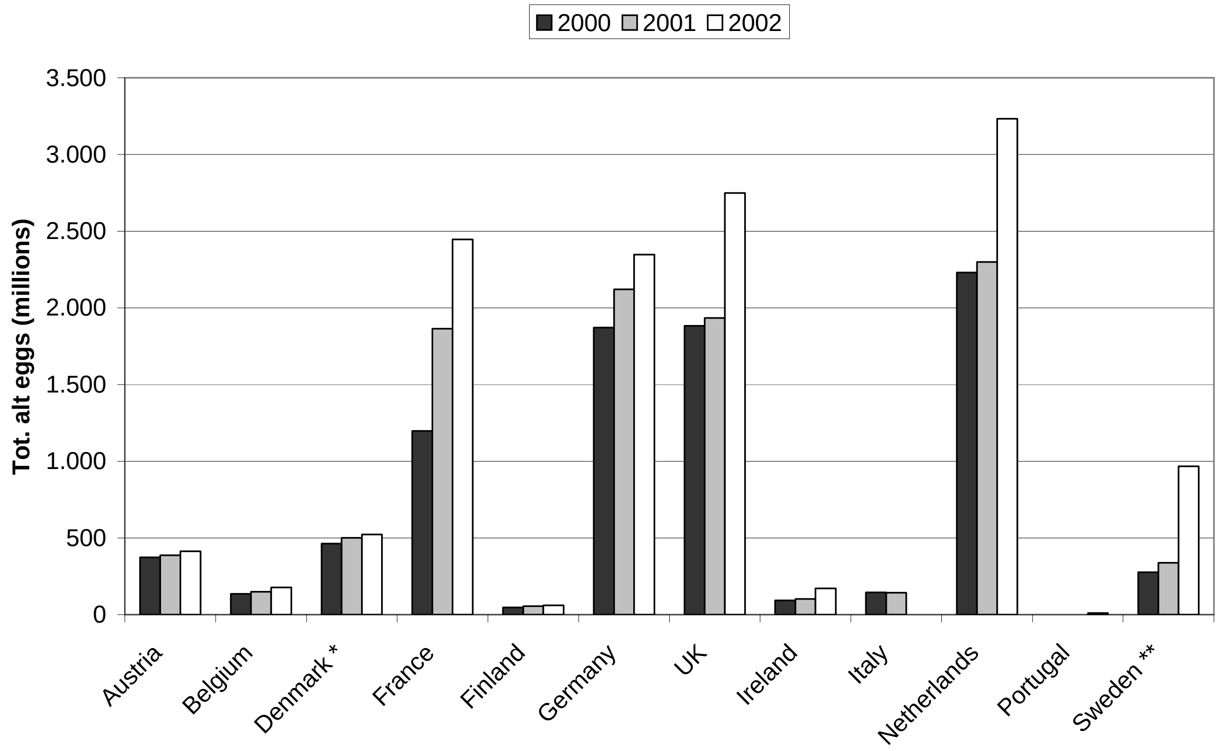
If the figures are transformed into total number of eggs produced in non-cage systems the situation is different (figure 4.2). The Netherlands is the greatest producer of non-cage eggs, directly followed by Germany and Great Britain. Also France is playing an important role. Egg production in Sweden is moderate, leading to a much less important contribution to European non-cage production than was suggested in figure 4.1.

Figure 4.1: Growth in production of non-cage eggs per country, seen as percentage of the National production



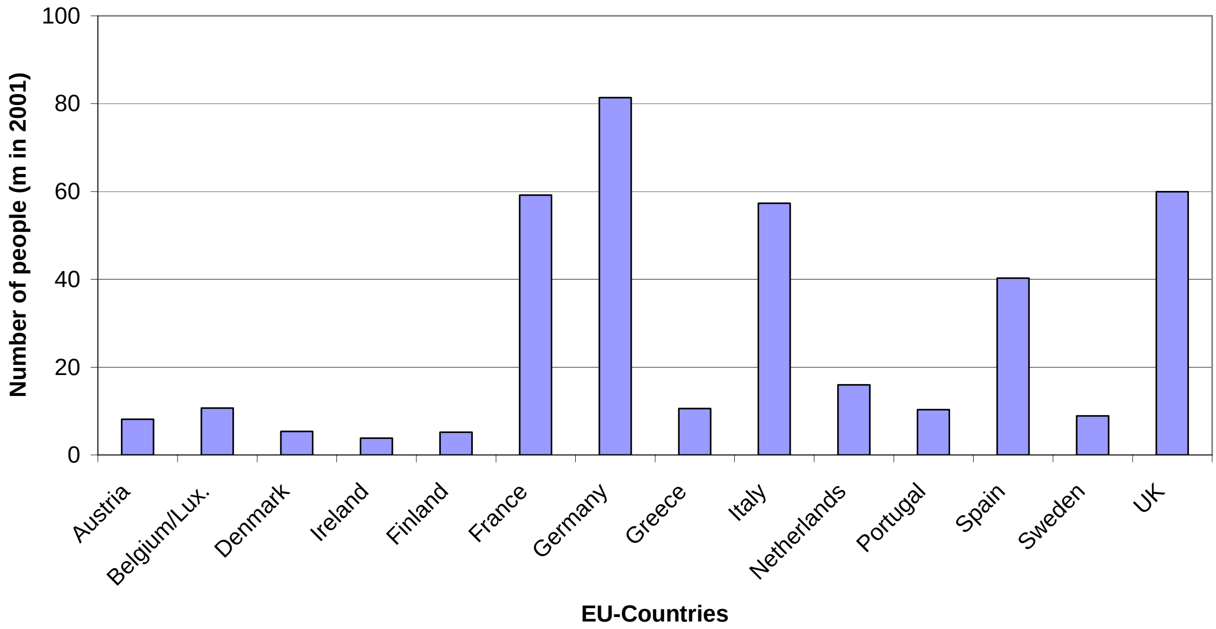
**   from free range 60% is organic*
*** 2/3 of cage eggs are produced in furnished cages, which are not included in this table*

Figure 4.2: Total non-cage eggs produced (in millions) per country



*   *from free range 60% is organic*
** *2/3 of cage eggs are produced in furnished cages, which are not included in this table*

Figure 4.3: Human population (in millions) per country in 2001



4.2 Sources of information

Description of housing systems based on scientific report “Welfare aspects of various systems for keeping laying hens” EFSA-Q-2003-92, Annex to The EFSA Journal (2005) 197, 1-23; The welfare aspects of various systems of keeping laying hens.

Photographs various systems provided by:
- ADAS - Gleadthorpe Research Centre (UK)
- Swedish University of Agricultural Science (S)
- Wageningen University and Researchcenter (NL)

Figures European situation:
- EU facts & forecasts; Setback for EU egg sector. Poultry World, sept. 2004: 13-20
- EU facts & forecasts; EU struggles in aftermath of Dutch flu outbreak. Poultry World, september 2005: 14-19
- European Commission (Eurostat)
- Various commercial scources, IEC, ZMP, KATT

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