DELIVERABLE

DL. 3.3.1 LIST OF THE IDENTIFIED POTENTIAL DEMONSTRATORS OF EXAMPLES OF SUCCESS THAT IS SELECTED FOR VISITS.

Contents

Introduction

Concrete examples of best practices in relation to animal welfare may inspire poultry producers in the European Union to take up similar practices or implement related initiatives. During 2021, the European Reference Centre for the Welfare of poultry and other small farmed animals have searched for and identified farms and slaughterhouses showing best practices related to poultry welfare. This includes examples of full systems, housing elements, enrichment, management initiatives, welfare assessment protocols, procedures and equipment used in connection with slaughter and other examples of best practices. The intention is that one or two members of the consortium will visit a selection of these best practices in 2022. The knowledge gained during the visits will be used for the final decision on which demonstrators can be approved as examples of best practices. The end-product will be factsheets on four examples of best practices (one per priority area; due ultimo 2022).

Description of the identified examples of best practices

The present deliverable contains a short description of each of the 28 identified examples of best practices. For each example, one or more countries where the best practice can be found are indicated.

1. Hatching on-farm of organic, medium-growing and fast-growing broilers - DK/NL

The full system described here is considered a best practice for animal welfare due to the use of the hatching on-farm method, where the eggs are hatched in the house where the broilers grow up. The idea behind on-farm hatching comes from a few broiler farmers who had problems with hatchery chicks: a lot of variation in chick quality and start-up problems. This concept is developing in several European countries and can improve performance and welfare, provided that time can be devoted to monitoring this key stage.

On-farm hatching addresses three basic needs of chick life from the outset: food, water and fresh air when hatcheries are dark, noisy and offer little space for the chicks. This may be beneficial for broiler welfare, as it reduced total mortality and resulted in dryer litter, which is known to be beneficial for reducing footpad dermatitis (De Jong et al. 2020). Moreover, immediate access to food and water after hatching provides energy for organ growth and for the development of key physiological systems, such as the immune system and thermoregulation; stimulates intestinal development and digestive capacity during the growing season; and on-farm hatching greatly reduces the risk of cross-contamination. Conditions are better for embryos and chicks due to improved air quality due to large air volume per egg, quiet environment with light and bedding imitating natural conditions for hatching, and optimal accessibility of feed and water for freshly hatched chicks. The chicks are more robust, they have better health and better digestion (e.g. less problems with foot pad lesions), which results in better litter quality and therefore higher yields. Better animal health leads to lower antibiotic use, which is becoming increasingly important to reduce antibiotic resistance.

Practically, the hatching eggs are supplied on standard setter trays, where the eggs can be either candled or directly transferred to the broiler house without candling. When the chicks hatch, the conditions must be ideal: the temperature must be as homogeneous as possible in the house and the concrete floor needs to be warm enough to prevent the young chicks from cooling down too much. Food and water are immediately available for the chicks and there is no need to transport them;

instead, the 18-day incubated eggs are transported. Thus, hatching on the farm avoids the stress of transport. In a hatchery, after birth, the chicks are sorted on a conveyer belt, crated, and then transported by truck. All these steps can be stressful for a chick.

On the other hand, on-farm hatching requires a lot of labour and time. In particular, the farmer will have to remove unhatched eggs and dispose of them with a grinder, as is done at the hatchery. The shells can be left on site, as their membranes contain an immunity booster. However, many farmers remove them, which is labour-intensive, as it is done by hand, unlike at the hatchery. Furthermore, controlling the micro-climate around the eggs is delicate. If not done appropriately, the risk of chicks hatching with unhealed navels increases.

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Ingrid C. de Jong, Theo van Hattum, Johan W. van Riel, Kris De Baere, Ine Kempen, Sofie Cardinaels, Henk Gunnink, 2020. Effects of on-farm and traditional hatching on welfare, health, and performance of broiler chickens, Poultry Science, Volume 99, Issue 10, Pages 4662-4671, ISSN 0032-5791, https://doi.org/10.1016/j.psj.2020.06.052.

2. Replacement of fast-growing broilers with medium growing broilers, combined with lower stocking density (38 kg/m2) and hatching on-farm - DK(/NL)

One of Scandinavia's leading poultry producers is to move to a slower growing broiler breed. The full system described here is considered as a best practice for animal welfare due to the use of slower growth rate, lower stocking density and hatching on-farm method.

Hatching on-farm method: cf. #1

Growth rate: Selection of animals for high growth performance has been associated with animal welfare problems (low activity, locomotor disorders). Their bodies are not necessarily adapted to this overload and broilers are therefore less mobile, with more health problems (pododermatitis, hock burns, cardiac mortality). Fast-growing chickens spend most of their time lying down and they rarely perch due to their heavy weight which reduces their mobility.

Slower growing birds are one of the key issues highlighted in the European Chicken Commitment. The largest Danish broiler producer will phase out its use of the fast-growing Ross 308 breed in favour of a slower growing breed due to animal welfare issues. Within a year, Denmark has gone from 0% to 33% of all DK broilers being medium growing.

Stocking density: According to many studies, the activity of chickens kept at high density decreases compared to those kept at low density (e.g., Cenzig et al., 2015: 23.8 and 56.3 kg/m²; Arruda et al., 2016 : 25.5, 28.5 and 31.5 kg/m²; Weimer et al. 2020: 29 and 37 kg/m²; Yanai et al., 2018: 20, 25 and 32 kg/m²). Chickens kept at high density move less than those kept at low density, i.e. they sit more and are more inactive. This is explained by a difficulty in movement due to the occupation of space by conspecifics. Stocking density is also associated with poorer bedding quality and more frequent health problems, especially in the legs (Hongchao et al., 2013; de Jong and Gunnink, 2019; Weimer et al., 2020).

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3. Broiler farm using brooders with feed and water, natural ventilation, daylight, platforms, straw bales, spread wheat on floor, reduced stocking density, slower growth rate – NL

The full system described here is considered as a best practice for animal welfare as it combines many needs for broilers chickens. It has also been invented to answer environmental questions raised by animal production.

Natural light is provided by a window occupying the entire surface of the North-side of the house (11m high). The size of the window equates to 50% of the provided floor space. It provides broilers with a source of enrichment via its variation in levels throughout and between days, and provides a gradient of light across the barn, allowing the birds a choice of their preferred environment. Natural light also includes a wider light spectrum, including UV light, than artificial light.

Brooders (or motherhoods): brooding is the period from hatching until chicks no longer require a supplemental heat source. Under natural conditions, the broody hen is a source of warmth and protection from predators, a function partly replaced by artificial brooders. Provision of dark brooders has been found to reduce fearfulness in layers (Riber & Guzman, 2016). Motherhoods used in this system are covered areas that provide refuge and warmth for the chicks, like dark brooders, but which also remain in the broiler house throughout production. They contain infra-red heaters, LED lighting, a water line and perch, i.e. unlike dark brooders they are not intended to be only resting areas. The motherhoods are the only part of the house that is artificially heated – contributing significantly to the 80% reduction in energy use when compared to a conventional broiler house. The motherhoods, by virtue of being a relatively small space, also capture the body warmth of the birds, further lessening the requirement for artificial heating. Initially simulating the safety and warmth of being under a mother hen, the broiler chickens continue to make use of the motherhoods up until the end of the production cycle. The temperature and ventilation under the motherhoods is automatically controlled in response to sensors installed inside.

Stocking density: the maximum stocking density is 25kg/m². The lower stocking density allows the birds to choose their preferred environment and has the welfare benefits described in example #2.

Enrichment: The house contains multiple raised platforms, straw bales and perches, so that the birds can explore and perch at different levels within the barn. Straw is provided on the raised platforms once the birds start to explore them, typically when the birds reach four weeks of age. This encourages the birds to use the platforms and allows them the opportunity to display scratching and dustbathing behaviour. To further encourage the birds to explore their surroundings and display natural foraging behaviour, wheat is scattered from spreaders suspended from the roof once a day, at a rate of 2g per bird.

Breed: The system uses a slower growing breed: birds are kept until 8 weeks of age, with a finished liveweight of 2.4kg, which has the welfare benefits described in example #2.

References

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4. Housing system for laying hens focusing on sustainability, including animal welfare – NL

This poultry farm has good practices considering animal welfare and environmental respect, for the purposes of sustainability. Male chicks are not killed but reared for meat (roosters) in a modular rearing system during 17 weeks before slaughter. The breed, Dekalb White, has been chosen in terms of egg production, liveability, and feed efficiency. The hens are not beak-trimmed and are reared in an enriched environment with a low stocking density of 6.7 birds per m^2 (excludes outdoor areas). Within the barn of 3,600 m^2, 24,000 laying hens are reared and, next to multitier structures, several enrichments are provided in the "internal garden", such as natural light, wood chips litter, small trees in pots, tree trunks, dust bath area, etc. The hens also have external access to an enriched area of 1800 m^2 (180 m x 10 m on both sides of the barn) of gravel and sand with some small trees in pots and tree trunks. The animals are fed with residual flows from bakeries and other food producers (food waste) providing them with variation in their diet and additional foraging material. The farm also boasts many environmental benefits such as using sustainable feed, solar power, environmentally friendly egg cartons, and reducing fine particle emissions.

5. Mobile houses for broilers/laying hens – DE

Commercial mobile systems house flocks of 200-4,000 laying hens in either a single-tier or a multi-tier setup. Smaller mobile systems may exist. The system is always combined with access to a free range. Mobile houses are fitted with wheels or skids which allow them to be pulled to another part of the range by a tractor. This reduces build-up of manure and parasites as well as degradation of range quality in the direct vicinity of the poultry house. Whilst some mobile houses have fully solid floors, in single-tier mobile houses the litter area is often floorless and the elevated nest area is slatted with bare ground underneath. Although systems with mechanical ventilation exist, most systems depend on natural ventilation through horizontal vents spanning the full length of each side of the house. Roofs and walls are insulated to maintain an appropriate temperature in the house. Houses are equipped with automatic feeding and watering systems and egg collection belts, and some single-tier mobile houses also have manure drying belts. Some mobile houses also include a covered winter garden, but a setup in which the birds move directly from the house onto the range is more common. Benefits to birds include improved foot health as manure build up and muddy conditions can be avoided by moving the mobile house regularly. This also can reduce birds' exposure to parasites and pathogens. Birds housed in smaller flock sizes show lower levels of feather pecking (Nicol et al., 1999; Bilčik and Keeling, 2000) and lower levels of fear (Bilčik et al., 1998). Smaller flocks are also at a reduced risk of spreading disease and have a lower risk of smothering (Lay Jr et al., 2011).

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6. Broiler farm with an increased level of automatic surveillance and a high level of management – GR

This poultry farm has best practices mainly in relation to broiler management. Different management issues are improved such as:

- At arrival: day-old chicks are placed in one compartment upon arrival as the farmer believes they learn to feed and drink faster when being at a high stocking density during the first days. The hatchery providing the day-old broilers is in the close vicinity of the farm, so transport is limited.
- During rearing: Greece being a hot climate country in summer, the farmer was capable of keeping the barn temperature approximately 10 degrees lower than the outdoor temperature. This was possible due to the cooling system equipped in the farm. Multiple devices in the barn survey the indoor climate and the birds themselves, such as video cameras, temperature and humidity sensors and weighing scales are installed. Furthermore, feed and water consumption is automatically registered. The farmer closely surveys the automatic recordings obtained from the different devices, both separately and in combination, in order to optimise broiler welfare and productivity.
- Departure: Catching is done manually by trained personnel. The abattoir is located approximatively 5 km from the barn. Feedback is received from the abattoir if severe welfare problems are detected.

7. Turkey farm with lower stocking density, natural light, enrichments and a winter garden – FR

Male turkeys are reared in flocks of 4,500 birds in barns of 1,250 m² with natural light in contrast to the artificial low lighting in the conventional farms normally used to make turkeys less active, but it may cause eye abnormalities and blindness. There are winter gardens of 280 m² which allow turkeys to have access to fresh air. This differs from the conventional farms where turkeys never have access to outdoor air and may suffer from gas concentrations, especially ammonia. The stocking density is lower than usual: 3.6 turkeys per m² versus between 7.8 and 8.2 turkeys/m² in conventional farms. In addition, when the winter gardens are opened, the stocking density decrease to 2.5 turkeys per m². Turkeys are reared in an enriched environment with perches/ platforms, empty plastic bottles full of different colours (syrup), grit, and pecking blocks. These enrichments, never available in conventional farms, allow the expression of natural behaviours of turkeys like perching, exploration, or foraging. This expression of positive behaviours may diminish damaging behaviours (feather-pecking, cannibalism, aggression), known as reasons for turkeys' mutilations (beak and toe trimming) in conventional rearing systems.

8. Broiler farm with continuous atmospheric control - SE

The vision of the farmers is to “conduct poultry farming with focus on animal”.

This is a farm of fast growing broilers chickens (Ross 308), with partial slaughter at day 28 at 1,600g and at day 35 at 2,200g. The farm consists of 3 barns with 8 compartments (4/2/2) and 380,000 chickens/flock. That means 8 flocks/year and around 3 million chickens/year. The maximum stocking density is 36 kg/m².

The farm is very well managed and with a high level of biosecurity that makes it an example of best practices in this “standard” of production type:

- Very well designed and clean areas outside the barn with concrete floor surrounding the periphery of the barns to ensure a high level of biosecurity.
- Separation between barns to break spread of infection between units.
- Strict protocol for people to entry: Always wash and spray hands before entering the barn and change clothes before entering the units.
- No antibiotics used to promote growth.
- The floor heating is well managed with a very dry litter. The farmers reported very few problems with foot pad dermatitis (foot health program).
- High level of atmospheric control: CO_2 and NH_3 continuously monitored. The ventilation is adjusted according to the CO_2 level.
- Animals are inspected twice a day, dead animals removed and runts culled.
- Acidification of the water by the 3 first days of life. Flush of water with chlorine in between 2 batches.

9. Standard layer farm that is very well managed with a high level of biosecurity - SE

The farm housed 22,000 brown layers. Layers arrive at 16 weeks and are killed at 75 weeks (4 barns of 5,500). The farm consists of 4 barns with Bovans Brown layers of 16, 35, 50 and 68 weeks of age. Birds are not beak trimmed but beaks appear quite blunt. A multitier system is used and the stocking density is 9 hens/m². Hens have access to the litter under the tiers (with lights) and a scraping device is present on the floor. The manure in the system is removed twice a week with a manure belt. Wood shavings are added when needed. The barns are provided with enrichment that consists of six nets filled with alfalfa/barn, and pecking blocks. The light program consists of 15 hours of light/day at 50 weeks with 30 min dusk and 1h dawn.

This is a “standard” multi-tier layer farm that has been identified as a best practice because is very well managed and has a high level of biosecurity:

- High level of biosecurity: well maintained outdoor surroundings, separation between barns and strict protocol for entry.
- Presence of windows (but closed to reduce risk of feather pecking developing in brown hens)
- NH_3 and CO_2 monitored regularly, manually with a device. The threshold is 10 ppm NH_3 and 3000 ppm CO_2.
- The total mortality is around 4-5%.

10. Dark brooders used in rearing of layer chicks – (*UK*)

Photo: Riber, A. B. (2007). *Ontogeny of Behaviour in Domestic Fowl: With Emphasis on Feather Pecking: Ph D Thesis*. Section of Ethology, Department of Large Animal Sciences, University of Copenhagen.

Chicks cannot thermally regulate on their own during the first few weeks of life and often require supplemental heat for survival in commercial settings. Commonly, this is done by heating the entire barn to the required temperature, which can be energetically demanding. Dark brooders are an alternative solution that consist of hot plates placed at bird level, providing shelter, warmth, and a dark area for rest. In addition to reducing energy consumption, dark brooders more closely emulate maternal care and may contribute to improved welfare at rearing and later in life. Chicks reared with brooders have been shown to be less fearful (Riber & Guzman, 2016). Many dark brooders contain flaps, creating an enclosed, dark area for chicks to retreat to for rest, as light is often provided for the full 24-hour period (Edgar et al., 2016). Dark brooders do not appear to be stressful to chicks (Nordquist et al., 2020) and may prevent the development of damaging behaviours. Less severe feather pecking, better plumage condition, less wounds, and lower mortality have been observed in flocks reared with dark brooders (Jensen et al., 2006, Riber and Guzman, 2016; 2017; Johnsen and Kristensen, 2001; Gilani et al., 2012). These effects appear to be long lasting, with effects remaining apparent well into the laying period (Jensen et al., 2006; Gilani et al., 2012). It is believed that dark brooders contribute to increased synchronization of behaviour, which is one possible explanation for the reduction in feather pecking, as feather pecking is often directed by active birds towards those that are inactive (Riber et al., 2007). The combined improved welfare and environmental benefits make dark brooders a promising practice to be considered for the rearing of commercial pullets, and examples of their use can be found in the United Kingdom.

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11. Heat exchangers in broiler (/laying hen) barns – DK

Heat exchangers in poultry houses can substantially improve the barn environment in an environmentally efficient manner. Heat exchangers, in the process of heating a barn, condense moisture in the air and draw it outside. Reducing atmospheric moisture in the barn helps maintain dry bedding conditions, thus keeping ammonia levels down. In addition, these systems can contribute to improved air distribution in the barn, providing more fresh air and eliminating drafts. A company based in Denmark is producing heat exchangers for use in layer and broiler facilities that are marketing a documented energy reduction of 80%, and ammonia reductions of 30-60%. Producers that have installed these heat exchange systems on their facilities have reported better growth rates and improved foot pad health. Well maintained, dry litter further contributes to improved welfare by allowing birds to perform dustbathing and foraging behaviours. Overall, these systems require minimal maintenance, however thorough cleaning and disinfecting should be prioritized to prevent the accumulation of potential pathogens. Ease of cleaning and maintenance should be taken into consideration when deciding on a system to install, as persistent problems with salmonella bacteria on farms have been linked with heat exchange systems.

12. Automatic litter scrapers on the floor under multitier systems for laying hens – DK

Managing litter under multitier systems can be challenging. Manual removal of litter is time consuming and costly and can have negative impacts on worker health. Failure to properly maintain litter can result in damp litter conditions which can have negative health and welfare impacts on the hens. Automatic litter scrapers are an alternative to manual litter maintenance that can help ensure consistent litter management, keeping the litter at a level that can be worked by the birds – preventing microbial build-up and litter collapse. Automatic litter scrapers are relatively low tech involving a motor (chain or belt drive) that pulls a scraper across the barn floor using ropes or chains. The scraper removes contaminated litter and collects it at the end of the barn, often in a separate covered manure storage area, where it remains until the end of the flock. This equipment requires an initial investment but can save in labour costs and can produce a product (fertilizer) that can be sold for additional revenue. Dry, friable litter contributes to good welfare by providing a medium for birds to forage, dustbathe, and rest comfortably in. Further, dry litter conditions help ensure good foot health, good air quality, and can reduce the risk of exposure to parasites and pathogens. An additional benefit of frequent scraping of the litter area is the prevention of hens laying floor eggs under the multitier system.

13. Freshly cut grass as roughage for laying hens – DK

Organic production of laying hens in the EU requires that "Roughage, fresh or dried fodder, or silage shall be added to the daily ration..." Provision of freshly cut grass as roughage for laying hens can contribute to improved health, fulfil behavioural needs, and can be an economical and sustainable option for producers, especially when harvested from their own property. Roughages, when fed as a supplement to concentrated poultry feed, contribute to satiety, additional nutrients and novelty in the hens' diet, and can improve gut flora health. Arguably one of the greatest benefits to providing freshly cut grass is that it encourages foraging behaviour, both in consuming the grasses and in searching for insects within the grass. Studies have shown that provision of roughage can reduce damaging behaviours such as feather pecking (Wechsler and Huber-Eicher, 1998), likely stemming from the increased time that birds spend engaged in foraging behaviours (van Krimpen et al., 2007). Grasses can be harvested daily from the property during the summer months providing a convenient, low-cost solution to providing roughages to organic hens.

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14. Rapeseed straw pellets as bedding material (broilers/laying hens) – DK

Rapeseed straw is a by-product of rapeseed oil production, which when processed and pressed into pellets can make an excellent litter material for poultry production. Heat treatment during the production process effectively removes the risk of pathogens. Rapeseed straw pellets consist of approximately 50% cellulose making them much more absorbent than more traditional wood shavings or straw. The fibres of rapeseed straw are also much longer than wheat straw making it a naturally less dusty material. Producers experienced with the use of this bedding material report that it is easier to keep dry than other types of bedding and that it performs well even in humid barn conditions. When exposed to moisture, rapeseed straw pellets draw the moisture into the bottom layer, keeping the top surface layer dry. Dry bedding in poultry facilities is critical for air quality, footpad health, comfortable rest and for promoting the expression of natural behaviours such as foraging and dustbathing. Overall, rapeseed straw pellets are a highly effective litter material that help reduce waste, making them an attractive option as poultry bedding material.

15. Alfalfa bales in the barn: Foraging material that keeps the birds occupied – DK

Placing alfalfa bales in the barn provides environmental complexity and encourages foraging behaviour. Enrichment materials that are manipulatable and consumable have been shown to be the most desirable and lead to the greatest reduction in undesirable behaviours such as feather pecking (Mason et al., 2010; Huber and Wechsler, 1997). For biosecurity purposes, alfalfa can be heat treated prior to being chopped and pressed into a bale. Pressed alfalfa bales provide a suitable, long-lasting outlet for foraging behaviour, which could contribute to directing pecking behaviours away from other individuals within the group, leading to an overall reduction in observed feather pecking. Alfalfa can be consumed by the birds, adding additional nutrients and fibre to their diet which could further lead to a reduction in feather pecking (Van Krimpen, 2005). Another benefit to placing alfalfa bales in the barn is that they provide dimensionality to the environment and can be used as a resting place. Vertical structures within the litter may contribute to hen comfort, encouraging dustbathing and preening behaviours (Cornetto and Estevez, 2001; Daigle et al., 2014). In summary, alfalfa bales offer a practical solution for producers to provide dynamic and rewarding enrichment which may be beneficial in encouraging natural behaviours and preventing feather pecking.

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16. Outdoor areas with high coverage of bushes and trees, including corridors with grass and herbs (broilers/laying hens) – DK

Chickens are prey animals that benefit from being able to see far in order to look out for predators, but also prefer to remain near objects that provide shelter in case they need to take cover and protect themselves from an attack. When designing outdoor areas for poultry, placement of trees and tall vegetation should be done strategically to ensure birds feel comfortable enough to utilize the range area (Dawkins et al., 2003). While the number of birds using the range area has been shown to be positively correlated with the amount of tree cover, too much coverage may conceal predators (Newberry and Shackleton, 1997). Arranging bushes and trees in rows can provide an ideal mix of visibility and cover, while corridors can be planted with grass and herbs to provide additional foraging materials. Herbs add variety to a bird's diet and increase biodiversity on the farm, attracting insects, which provide further foraging opportunities for the birds. Taking care to design outdoor areas with a mix of visibility and natural shelter encourage range use and exercise, which is especially important for the health of broilers.

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17. Early access during rearing of pullets to outdoor areas – DK

Enrichment provided during the rearing period can enhance adaptation later in life by reducing fearfulness and sensitivity to stressors (Janczak and Riber, 2015; Campbell et al., 2017; Bari et al., 2020). The rearing environment should match the laying environment as closely as possible to allow birds to habituate and to develop necessary skills to navigate their environment later in life. Laying facilities with an outdoor range can provide many benefits to hens, but can be perceived as stressful (predators, weather extremes, etc.), especially at initial exposure. Allowing birds early exposure to these complex environments can have long-lasting impacts on bird ranging behaviour. Depending on the season and the weather conditions, pullets can be granted access to the outdoors once they have enough feather cover to thermally regulate. It is believed that this early exposure leads to a greater number of birds using the pasture, and a more even distribution of birds across the whole range area throughout life. Better range utilization helps prevent concentrated manure build up and promotes natural behaviours such as foraging and dustbathing, which can have significant positive impacts on health and welfare including a reduced risk of developing feather pecking.

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18. Fruit trees in the outdoor area (broilers/laying hens) - DK

Fruit trees planted in the outdoor area can be multifunctional, contributing to poultry welfare and also additional income revenue for the producer. Trees, when strategically planted, can provide shade and protection from predators, while still allowing for good visibility. This can help birds feel comfortable leaving the house and encourage them to venture further out into the range area. In addition, fruit that falls from the trees can provide additional foraging material and additional nutrients in the diet. Manure from the birds can serve as fertilizer for the planted trees. One study found that birds raised under olive trees ingested more herbage and had lower frequencies of foot and breast lesions (Dal Bosco et al., 2014). Orchards or other trees planted throughout the range have been shown to help distribute birds more evenly throughout the pasture (Moussier, 2015).

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19. Water in the outdoor range (broilers/laying hens) - DK

Providing water lines in the outdoor range can help encourage birds to spend more time outdoors. If birds do not have to travel back and forth to the house for water, they may be more likely to spend more of their day on the range. Placing water further out on the range can provide incentive, and often more cover, to help draw birds further out from the house, helping to distribute manure. Easy availability to fresh water ensures good welfare by encouraging feed intake and aiding in thermal regulation. Outdoor water lines should be covered in warm climates to ensure the drinking water remains at an appropriate temperature (i.e., less than 20℃) (Thiele and Pottgüter, 2008). These covered lines double as additional shade and protection from predators, further encouraging range use by hens.

References:

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20. Automatic scales in the barn for monitoring of growth (broilers/laying hens) - DK

Body weight can be monitored automatically with the use of hanging scales in the barn. Scales provide accurate data on bird growth without the time and labour costs required to weigh birds manually (Doyle and Leeson, 1989). Birds will naturally jump onto the scale throughout the day and software records the weights, providing the producer with data on bird weight and growth. This eliminates the need for handling which could be perceived as stressful to the birds. Monitoring growth rate allows producers to monitor flock health. Continuous monitoring of body weight can provide producers with early warning of disease or other issues within the environment such as poor feed quality or issues with the ventilation system (Lee et al., 2019). Birds experiencing stress or fear may reduce feed intake, therefore leading to a reduction in growth rate which can be detected with automatic scales. Prompt action is critical to ensure bird health and welfare and to minimize losses.

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21. A welfare assessment protocol for broilers/laying hens adapted for use in relation to inspection of compliance with EU regulations – IT

The Italian Directorate General of Animal Health and Veterinary Medicines of the Ministry of Health has implemented an information system, which allows the categorizing of farms according to the disease risk, using a scientifically validated approach, when carrying out official control activities.

The system is available to official veterinarians, farm veterinarians and farmers whose task is to monitor and analyse data and address actions on farm in order to ensure compliance with the recent community legislation on Animal Health Law and Official Controls.

In this way, the system improves and facilitates cooperation and dialogue between farmers and the competent authority with the aim of raising the safety and quality level of the agri-food products, strengthening the prevention of animal diseases and the fight against antimicrobial resistance and making the official controls carried out by the competent authorities more effective. At the same time, it provides farmers with the ideal conditions to improve and strive for excellence.

The system, included in the national veterinary website (www.vetinfo.it), has been developed for data collection acquisition, recording and analysing of indicators relative to the following areas; animal welfare on farm (resource based and animal based measures), lesion scores collected at slaughter, antimicrobial use and biosecurity.

Data acquisition for the risk categorization come from two different sources: a self-audit by the farmer and an official-audit by a vet officer. A final score is delivered for each of the above-mentioned areas, allowing a comparison of the farms' results with average results at national, regional and local levels.

At present, official data are being inserted into the system for layers whereas self-auditing checklists are under scrutiny of the poultry producers and will hopefully be agreed upon shortly. The developed checklists at present will support the assessment of compliance with legislation but will in the future be developed to provide a final score for the different topics following expert knowledge elicitation process.

Animal welfare Checklist's based on EU legal requirements have been developed for broilers and turkeys. These will be inserted into the system starting in 2022.

22. A monitoring tool for pre-slaughter broiler welfare - BE

This online tool, available in three languages (Dutch, French and English), has been developed for performing the welfare assessment of broiler flocks during the preslaughter stage. The monitoring tool is based on a protocol which includes 11 measures for nine welfare indicators that can be assessed at the slaughter plant by a trained assessor. The welfare measures included in the protocol are based on scientific literature and have been evaluated by poultry experts. The measures are animal-based, meaning that these measures focus on the birds' response to the pre-slaughter phase, rather than measuring the conditions the birds were exposed to.

The first part of the protocol consists of a welfare assessment at the slaughter plant, performed at the end of the waiting period (lairage) when birds are still in the crates. The assessor records the number of birds showing signs of thermal stress, birds with stuck body parts (wings, toes, heads), birds with splayed legs, crowding (one bird on top of another) and birds lying supine (on their back without being able to turn). The goal is to assess 60 crates per flock.

The second part of the assessment is done at the slaughter line, the assessor counts the prevalence of wing and leg fractures, dislocations and bruises. Birds are assessed after they have been defeathered, but before they are further processed. The goal is to observe 10 minutes per slaughter-line indicator. In addition, number of dead on arrivals and rejected birds are recorded.

Performing the welfare assessment may take about 50 - 60 minutes per transported flock. The prevalence of each indicator can be transformed into an indicator score, which is integrated in an overall welfare score. Both calculations can be done using the tool developed for this purpose. The protocol is user-friendly and allows for detailed welfare evaluations at slaughter. The protocol with welfare score calculation can be used for welfare-oriented quality assurance schemes. In addition, it can be used for benchmarking and can help to identify potential preventive actions as well as the risk factors for broiler welfare issues during the pre-slaughter period.

23. Self-assessment tool for farmers, focusing on prevention of injurious pecking – IR

This tool allows for comparing feather loss scores between farmers adhering to the same voluntary based assessment scheme in non-caged flocks of laying hens and to provide guidance on addressing risk factors and improving performance on feather cover. Suppliers of this Benchmarking Tool also provide welfare guides on good practice and improving feather cover, support and training for producer groups, field staff, vets and companies. The aim is also to encourage producers who are achieving good feather cover to share best practices to help guide continuous improvement within the wider industry. Each farmer can enter their own feather loss scores and see how they compare to other producers. They will receive immediate feedback and a copy of their feather loss results, plotted on a graph showing how their scores compare to those of other peers. The graphs focus on two areas of feather loss: the head/neck and the back/vent. For each of the areas, there is a graph showing the percentage of birds with any feather loss (score 1&2), and another showing moderate /severe feather loss (score 2). All graphs are updated annually. Each graph is split into 3 sections: RED (bottom 25% of flocks), AMBER (middle 50% of flocks) and GREEN (best 25% of flocks). The thresholds for the different colours are based on pooled data from laying hen farms sharing the same assessment scheme. What colour the score falls into can help determine what actions should be taken - if RED then immediate actions may be required to find the cause of the problem.

24. A mobile application for farmers to self-assess and benchmark the welfare status of their livestock – BE

This tool allows producers to monitor animal welfare on their farms through an application on their smartphone. The application is free to download and contains a series of assessments for different livestock species, including broilers and laying hens. Producers answer questions on the application related to farm management, housing, production parameters and key animal-based measures. The assessment has been thoughtfully designed to allow for collection of data on the smallest number of individual animals to be representative of the entire flock – saving the producer time and effort. By making the application simple to use, it is hoped that producers will be more likely to perform regular welfare assessments. If used on a regular basis, producers can track the welfare of the birds on their farm over the course of time and can view how changes in management or environmental factors impact welfare. This allows for early detection, and thus early intervention, of problems when they arise, leading to improved bird welfare. Over time, producers may become blinded to welfare issues on their own farms and this application can help prevent this phenomenon. Additionally, this tool allows for benchmarking of scores, allowing producers to see how their farm compares to similar farms within the industry. After completing the survey on their phones, the answers can be sent online where a report is automatically generated and emailed to the farmer. This pdf report contains a table summary of collected data with benchmarking, as well as a visual representation of scores based on key welfare indicators (“welfare radar”). The associated webpage contains information on risk factors associated with each score, allowing producers to create an action plan to address any areas of concern. In summary, this application encourages farmers to perform regular welfare checks of their flock and provides easy to understand visuals and scientifically validated action items for intervention.

25. Management tool for self-assessment of the welfare of pullets and laying hens – DE

This management tool was developed to support farmers in improving animal welfare in their daily work. The tool collects animal-based welfare indicators and provides practical assistance in capturing and evaluating animal health.

The general concept of the tool is that in order to get an accurate picture of the state of health and well-being of livestock it is necessary to have a close look at (and assessment of) the animals and their behaviour.

The legal requirements for animal welfare usually only refer to criteria for stable/barn construction and herd or flock management. However, clear conclusions about animal welfare cannot be drawn only based on the available space, the floor design or the absence of beaks, i.e. resource-based measures.

The use of the tool is supported by a handbook which provides extensive background information on the procedure, possible causes of problems and concrete recommendations for action. For the animal assessment in the barn, farmers can use the provided reference images that allow for an easy evaluation of each indicator. A video tutorial provides helpful tips on the correct approach. The data are recorded in Excel templates that transfer the results to tables and graphics. The results can be used to better monitor animal health, i.e. potential risks and problems can be identified more quickly and improvement measures can be evaluated.

26. Captive bolt as a back-up stunning method during slaughter of turkeys

Figure. Using captive bolt as a back-up stunning for turkeys during slaughter.

COUNCIL REGULATION (EC) No 1099/2009 of 24 September 2009 on the protection of animals at the time of killing states that *"Business operators shall ensure that during stunning operations appropriate back-up equipment is immediately available on the spot and is used in the case of failure of the stunning equipment initially used. The back-up method may differ from that first used."* (Article 9, paragraph 2). However, re-stunning birds that show signs of consciousness after stunning procedure is a task that remains pending for most poultry slaughterhouses.

In a Spanish slaughterhouse that uses waterbath as method for stunning turkeys, when birds are not effectively stunned and signs of consciousness are detected, the business operator in charge applies a penetrative captive bolt adapted for turkeys. The captive bolt and a V-shaped 1-meter length fork are hanging in extension cords from the ceiling at the height of the business operator's shoulders. While the V-shaped fork is used to pull the head of the turkey with the aim of restraining it while it is shackled, the captive bolt is placed perpendicular to the bird's head and fired through the skull into the brain causing instant death to the bird (see Figure). Several captive bolts are placed along the slaughterline allowing the re-stunning of birds at any place of the slaughterline from waterbath to the scalding tank.

27. Gentle catching of broilers on farm and enforcement of legislation

COUNCIL REGULATION (EC) No 1/2005 of 22 December 2004 on the protection of animals during transport and related operations states that *"It shall be prohibited to: lift or drag the animals by head, ears, horns, legs, tail or fleece, or handle them in such a way as to cause them unnecessary pain or suffering".* Thus, it is not allowed to catch animals by their legs and no exception is made for broilers.

Birds lack a diaphragm and during inverted handling for either one or two legs, the pressure of the gastrointestinal tract over their heart and lungs is likely uncomfortable and causes stress, fear and aversion. In an attempt to regain posture, birds perform vigorous wing flapping and are more prone to injuries such as bruising, dislocations and fractures of legs and wings compromising their welfare. In contrast catching broilers in upright position, although it is more time consuming and requires more personnel, spare the animals to be inverted and is thus associated with less stress response and prevalence of injuries.

In the Netherlands, enforcement of legislation for catching broilers in an upright position are carried out at the slaughterhouse level by assessing broilers after plucking. A standardized approach exists for official veterinarians to perform a visual count of injuries on the slaughter line. It consists of assessing broilers in the dorsal position and calculating the prevalence of animals with at least one bruise of above 3 cm caused during catching (detected when bruises are dark red – purple colouring) either on the wings, legs or breast. When the prevalence is over 2%, a report of findings is declared to the farmer and catching team.

28. Sexing of eggs to avoid killing of day-old layer males - IT

In ovo sex determination through the use of hyperspectral imaging technology identifies the sex in brown layer lines by use of embryonic plumage colours, reducing the need to cull male chicks after hatching. Culling of male chicks typically occurs within 72 hours of hatching, and birds are either mechanically destroyed by maceration or are gassed using carbon dioxide, which has been shown to be aversive to poultry. The in ovo sexing technique can be applied in the second-third of the incubation period, and is typically performed at 14 days of incubation. Due to sex-specific plumage colours in brown layer lines, the sex can already be determined in the embryo based on its first feathers. Eggs are placed inside a measuring chamber, illuminated from below and a spectral image is taken from above and based on differences in the measured light spectra, an algorithm classifies the sex. In addition to sex determination, unfertilized eggs are also identified and sorted out at the same time. This technical solution appears to be suitable for the high volumes of a modern hatchery as it is able to check up to 20,000 eggs per hour, it is a non-invasive process, keeping the eggshell intact, with no risk of contamination and no risk of injuries to the embryo and high accuracy of in ovo sex determination (>95%). The system is proposed to be integrated with an electrical stunning system for the male embryos. The first machine has already been installed in the main layer hatchery in Italy. The machine is able to process 21% of the standard hatch that is around 240,000 female day-old chicks per hatch.