

**A Survey of Pullet Rearers and Egg Producers Managing White Laying Flocks in
the UK**

**by Paula Baker, BSc, MSc (Principal author with assistance from members of
the operational group)**

**Contact details: paula.baker@lhwf.co.uk
mark.williams@britisheggindustryCouncil.com**



Organisation: Laying Hen Welfare Forum

Date: [April 2026]

CONTENTS

Executive Summary	1
Introduction	2
What was the purpose of the survey?	6
Design, Methodology and Approach	6
Results	7
Understanding White Breeds: Egg Producers' Views and On-Farm Experiences	7
Baseline Management: Housing System, Flock Size and Beak Status	7
Welfare and Behaviour Outcomes	9
Feather Cover	9
Pecking, Flightiness and Smothering Behaviour	9
Ranging Behaviour and Enrichment Preference	10
Feed Conversion Ratio	10
Health and Mortality Levels	10
Discussion	11
Conclusion	14
Acknowledgements	14
References	15
Annex 1: A survey of Pullet Rearers and Egg Producers managing White Laying Flocks in the UK Questionnaire.....	17

Executive Summary

White chick placements reached 15% of the UK national flock by the end of June 2025. In response to this recent shift, this survey aimed to investigate farm management practices and experiences of some producers rearing and managing white laying hen flocks in the UK. Some producers report that white hybrids are easier to manage, with fewer incidences of feather pecking and lower mortality compared to brown hybrids. Results also indicated that some producers are gaining the benefits of high productivity, a slightly better feed conversion ratio, resilience to disease, longer laying cycles, and improved sustainability. In the survey, producers were asked about their preference for managing intact-beaked birds of either white or brown breeds, or neither. A significant majority (59%) did not feel confident in managing flocks with intact beaks, irrespective of feather colour/breed. Of the minority voicing a preference, 30% favoured white intact-beaked birds, and 11% favoured brown intact-beaked birds.

The survey captures a sample of 39 laying hen and rear producers. The findings and experience of egg producers, and those rearing, will provide the wider industry with guidance on management practices that are essential to optimising white flocks.

Introduction

Eggs are a globally significant nutritious food and are widely consumed, providing consumers with high-quality, affordable protein, rich in essential amino acids (Lesnierowski & Stangierski, 2018) and are a natural source of vitamins and minerals (BEIC, 2025). The UK produced 11.9 billion eggs in 2024, with a total UK consumption of 13.6 billion eggs, and achieved 88% self sufficiency. White shell eggs were widespread in the UK in the early 1970's, but by the end of the 1970's, brown shell eggs became popular as British consumers considered them a healthier option (www.egginfo.co.uk). Today, the UK predominantly remains a brown shell egg market, and the demand for ever higher egg production has driven selective breeding efforts, resulting in commercial brown laying hens now producing over 300 eggs per year (Fan and Wu, 2022). During the COVID pandemic, consumer demand for shell eggs grew rapidly during the lockdown when food service establishments had to close for many months. The high demand for brown eggs resulted in some shortages, so white eggs, which would normally have been produced for food service and liquid egg processors, were instead stocked on some supermarket shelves. Some large packers then started trialling white shell eggs with a UK retailer during the lockdown, which proved to be successful. Another UK retailer imported white eggs from the Netherlands temporarily to address shortages, although brown eggs were the first choice of consumers in-store. As a result, during the pandemic, the UK underwent a slight shift, with white eggs gaining acceptance and popularity.

The British Egg Industry Council (BEIC) market report shows a 10% average of white birds over the whole of 2024, and the number of white breed chick placements is slowly growing, at 15% at the end of 2025 (BEIC, 2025). World egg production is approximately 50% brown / 50% white. The white shell egg market is predominant in the USA, Mexico, Canada, several Scandinavian countries and other countries (WEO, 2025). The Netherlands, Denmark and Germany have shown an increase in white eggs, with the Netherlands and Germany now at 65-70% of production from white flocks (Van de Braak, 2024).

Several Scandinavian countries have adopted white hybrid breeds due to multiple contributing factors: higher productivity, lower mortality, better feather cover, longer laying cycles and improved sustainability. European research has shown that white birds are achieving 500 eggs

in caged systems and over 590 eggs from cage-free systems by 117 weeks of age (Van de Braak, 2024).

White laying hens are often described by some producers as having lower incidences of injurious pecking (IP) and aggressive pecking behaviour (AP) compared with brown hens. European studies have found that although white hens feather peck (FP) less, they may be prone to other problems, such as toe pecking (TP) (Sabine et al. 2023). This has been reported as a welfare concern in white hybrids on many farms in Switzerland. A recent survey by Sabine et al. (2023) reported that, out of 96 producers, 50% had witnessed TP on their farms. Producers observed hens initially peck at conspecifics' toes, then they would peck their own, and this was associated with decreased egg production, an increase in cannibalistic behaviour and significant mortality. The findings demonstrated that TP is a multifactorial problem similar to IP, and that TP was associated with housing and management, including metal slats, direct sunlight and high intensity of bright light in the house (Sabine et al. 2023). This same study showed TP to be more prevalent if the farm had previously had *E. coli* in the last 5 years. On a study tour in 2025, members of the Laying Hen Welfare Forum (LHWF) heard first-hand from European producers that TP may be linked to the provision of hens with only intermittent access to water, occasionally used as a management tool to protect litter quality. TP is less common in brown hybrid breeds; nevertheless, the study of both TP and head pecking (HP) has been relatively overlooked in all laying hen hybrids and is not widely documented in peer-reviewed publications.

White hybrid breeds are generally regarded by some producers as easier to manage in terms of injurious feather pecking, even without the use of infrared beak treatment (IRBT). This has been observed in several Scandinavian countries where beak trimming is prohibited (Van de Braak, 2024). Scientific studies directly comparing mortality between white and brown-feathered laying hens remain limited, as most research has focused primarily on housing systems rather than genotype differences. Leenstra et al. (2012) evaluated commercial laying hen genotypes on free-range and organic farms and reported that white-feathered layers generally exhibited equal or slightly lower mortality compared with brown strains under these production conditions. However, flock sizes on commercial free-range and organic farms ranged from 500 to 3,000 hens per genotype, with some farms housing multiple genotypes in

separate flocks, whereas white layers in the UK are generally kept in much larger flocks of around 16,000 birds, with only organic flocks maintained at smaller sizes of about 3,000 birds. Lower mortality levels have been observed in intact-beaked birds of Lohmann LSL and Dekalb white breeds at 70-76 weeks, with mortality at 3% (range: 0.5–9%) (Kittelsen et al. 2022). Both white and brown (and mixed) hybrid breeds can exhibit smothering and piling (Winter et al. 2023). These adverse behaviours have been reported to be displayed more prevalently in brown flocks (Van de Braak, 2024).

There is a common consensus within the egg industry that white laying flocks are flightier than brown layers, and that brown hybrid breeds are more passive. In the scientific literature, white layer hen breeds have been reported to be generally more active, agile and prefer their personal space (Van de Braak, 2024). A meta-analysis of 23 studies compared fear responses in brown vs. white laying hens using novel object and tonic immobility (TI) tests. This found white hens to be generally less fearful in novel object tests; they were more likely to approach a novel object, and to approach it more frequently, compared to brown hens (Rentsch et al. 2023). This same study revealed that, over the last 5 decades, there has been a decrease in fearfulness in white layers, as indicated by decreased tonic immobility durations, likely due to genetic selection for increased productivity (Rentsch et al. 2023).

Allowing hens to range outdoors has many welfare benefits, including providing them with the opportunity to engage in natural behaviours such as foraging and dust bathing (Weeks and Nicol, 2006). Mahboub et al. (2004) investigated differences in outdoor area use between white and brown hybrids. Brown hybrids spent more time in the outside area, whereas white hybrids moved between the indoor and outdoor areas more frequently. However, the sample size was small (50 hens) and may not be comparable with larger commercial flocks. A study comparing Bovan's Brown and Dekalb White hens under organic free-range conditions found that the brown hens made greater use of the outdoor area, venturing further from the chicken house than the white hens. The brown hens also displayed lower fearfulness when ranging, had better plumage condition, and experienced fewer trauma-related keel bone injuries, suggesting that they are more robust and better adapted to the conditions of organic production systems than white breeds (Larsen et al. 2018; Tahamtani et al. 2024). These findings are consistent with broader research indicating that genotype influences range use

and welfare outcomes. White breeds often range less and show higher vulnerability to injuries and feather damage compared with brown breeds under similar environmental conditions (Larsen et al. 2018; Tahamtani et al. 2024). In general, overall ranging behaviour has mostly been studied in brown hybrid breeds, and little attention has been paid to white layers.

It is well documented that enriching the birds' environment can be an effective means of reducing injurious pecking, both during rearing and the laying period (Jones et al. 2002; Lambton et al, 2013). Tahamtani et al. (2022) studied enrichment use in 45 indoor multi-tiered aviary systems stocked with either Lohmann LSL (n = 30) or Dekalb White (n = 15) intact beak hybrid birds, aged 16-20 weeks. For both breeds, the provision of environmental enrichment resulted in significant benefits to feather condition. However, few studies have compared differences in the use, and preference of enrichment devices between white and brown hybrid breeds.

The egg industry is becoming more sustainable due to a mix of environmental, economic, regulatory, and consumer-driven pressures. Direct comparative research which specifically shows that white layers have a better feed conversion ratio (FCR) than brown layers when fed lower-carbon, alternative protein diets, is limited. Most studies focus on general nutritional responses across breeds rather than explicitly linking FCR differences to carbon footprint or alternative protein sources. White hens tend to have a better FCR overall, and this advantage is likely to extend to lower-carbon diets, but direct sustainability-focused studies comparing breeds remain scarce. However, white hybrid breeds may be kept for longer production cycles, and typically consume 5–6 grams less feed per day, compared to brown layers when housed within UK free-range systems (Van de Braak, 2024). With this in mind, a lower carbon footprint, between 4% (Ryan, 2024), 5.33% up to 90 weeks, and 6.31% up to 100 weeks (Van de Braak, 2024), has been estimated for some white breeds.

While studies on the health and welfare of white hybrid breeds have generally been conducted on commercial farms in Scandinavian countries and elsewhere in Europe, comparable research for white layers kept within the UK is lacking. Nevertheless, the UK egg industry can still gain valuable insights into white hybrid breeds (including genetics, health and welfare)

from progress made elsewhere, and this will be used to provide a solid foundation for optimising management practices and to support further uptake.

What was the purpose of the survey?

This survey was designed to explore the views and experiences of pullet rearers and egg producers with relevance to rearing and managing white laying flocks in the UK. The data gathered aimed to highlight the benefits and challenges of managing white breeds. The study sought to enhance our understanding of the way in which the management of white flocks in the UK could be further optimised to improve bird health, welfare and management within this growing sector.

Design methodology and approach

An online questionnaire (Annexe 1) was designed using software available at Hubspot (<https://share.hsforms.com/>) and was distributed by the BEIC to all Lion-registered pullet rearers and laying farms via email. Additionally, it was shared via poultry veterinary practices. The survey was further promoted through the LHWF website and social media platforms, including Twitter and LinkedIn, and was retweeted by key industry organisations such as the British Free Range Egg Producers Association (BFREPA) and the National Farmers Union (NFU). Articles and links to the survey were also published by industry magazines: Poultry Business, The Ranger and NFU Poultry. A snowball sampling method was employed, encouraging participants to forward the invitation to other poultry producers who met the selection criteria of having experience in the management of white breeds during rearing and/or laying. A mixed-methods approach was employed, targeting stakeholders including pullet rearers and egg producers. The survey comprised 24 questions that were based on a combination of key observations reported via the scientific literature and the respondents' own experiences, and included closed and open questions that were designed to collect a mixture of quantitative and qualitative information.

The survey aimed to evaluate the combined experience of UK pullet rearers and egg producers in rearing and managing white layer breeds. The survey was conducted between 4th February 2025 and 31st March 2025, and the study generated a total of 39 responses that met the

criteria—and completed all 24 questions. This included information on years of experience managing white flocks, housing systems, flock sizes, general management, behaviour, health and welfare (Annexe 1). The data were analysed using frequency counts and percentages. Open questions were analysed following manual coding and categorisation of each response using recurring themes.

Results

Understanding White Breeds: Egg Producers' Views and On-Farm Experiences

The majority of respondents were solely egg producers, 75% (n=29), 15% were solely pullet rearers (n=6), and 10% (n=4) combined both sectors. Ninety five percent (n=37) of respondents had experience in managing brown and white flocks, and 5% (n=2) had experience managing white flocks only. Of those respondents managing white flocks, 41% (n=16) had 3+ years of experience, 38% (n=15) had 1-2 years, and 20% (n=8) had less than one year.

When asked what prompted their decision to manage white breeds, 41% (n=16) of respondents expressed that they were asked to by their contracted egg packer/processor, 30% (n=12) emphasised ease of management, and 28% (n=11) mentioned the potential for longer laying cycles. More respondents found white breeds easier to manage than brown breeds, 67% (n=26), while 18% (n=7) found the opposite, and 10% (n=4) were unsure.

When asked about their preference for managing white breeds with intact beaks, brown breeds with intact beaks, or neither, 59% (n=23) of respondents said they would prefer neither (i.e., not to manage intact-beaked birds, regardless of feather colour). Of those 16 respondents who were comfortable managing intact beaked birds (n=12) would prefer to manage intact beaked white birds, and (n=4) brown.

Baseline Management: Housing System, Average Flock Size, and Beak Status

Fifty four percent (n=21) of respondents housed white breeds in [free-range] multi-tier/aviary, which was the most common system in use. Fifteen percent (n=6) of respondents housed white breeds solely in [free-range] flat deck systems, while 7% (n=3) utilised a combination of both [free-range] multi-tier/aviary and flat deck systems. Twenty percent

(n=8) of respondents housed white breeds in indoor barn systems, and only one (n=1) housed birds within an enriched colony cage. Four respondents manage organic flocks.

Regarding flock size, 33% (n = 13) of respondents managed 16,000 birds. A further 13% (n = 5) managed between 10,000 and 15,999 birds. The remaining respondents 54%, (n = 21) selected “other” when reporting total birds overall, with numbers ranging from 9,000 to 410000.

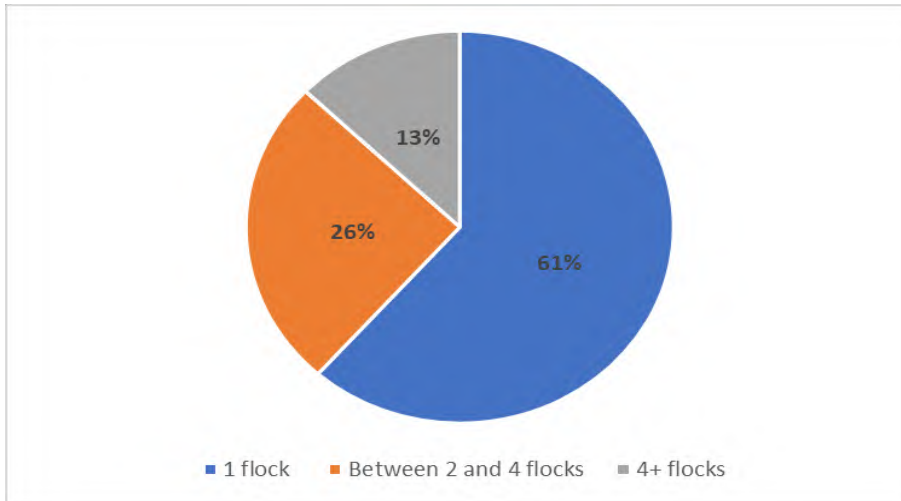


Figure 1: The percentage of white-breed flocks currently managed per respondent

Most white-breed flocks (67%) were Infra-red beak treated (IRBT), 20% had intact beaks, and 13% of respondents were managing a combination of flocks with and without beak treatment (Figure 2).

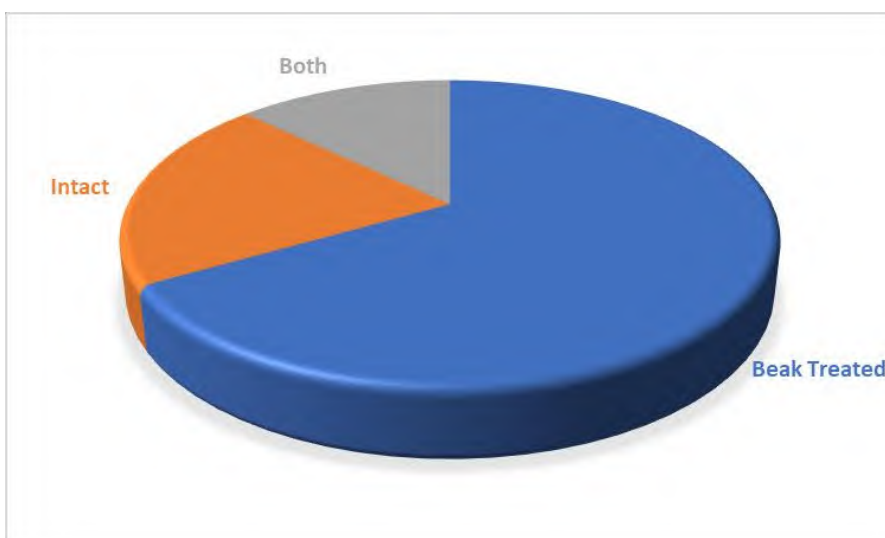


Figure 2: The beak status of white-breed flocks managed by the survey respondents: infrared beak treated (IRBT); Intact; Both (a combination of IRBT and intact-beaked flocks)

Welfare and Behaviour Outcomes

Feather Cover

Most respondents (77%, n=30), reported better feather cover in white breeds, compared with brown, while a small number (7%, n=3) reported no difference. The remaining 15% (n=6) of respondents were unsure.

Pecking (Other than feathers), Flightiness and Smothering Behaviour

Sixteen of the respondents reported having experienced (non-feather) pecking behaviour in white birds. Among these respondents (n=11) reported managing beak-treated flocks and (n=3) reported managing intact flocks. Two respondents managing both beak-treated and intact flocks reported that these flocks were housed in barn systems. Ten respondents reported head pecking at the early onset of lay, and two respondents had witnessed toe pecking in a beak-treated and intact flock. Head pecking was reported in both intact flocks, with one flock also exhibiting toe pecking. One respondent noted that head pecking was observed during the rearing period and attributed it to the number of cockerels present in the house. They identified mistakes linked to sexing at hatch as an ongoing management challenge.

Most respondents, 72% (n=28), considered white hybrid breeds to be much more flighty than brown hybrids, in both beak-treated and intact-beaked flocks, and observed within all systems. Nearly 8% (n=3) of respondents who have managed brown and white flocks were unsure as to whether white breeds were more flighty, and 5% (n=2) could not answer because they had only ever managed white flocks (Figure 3).

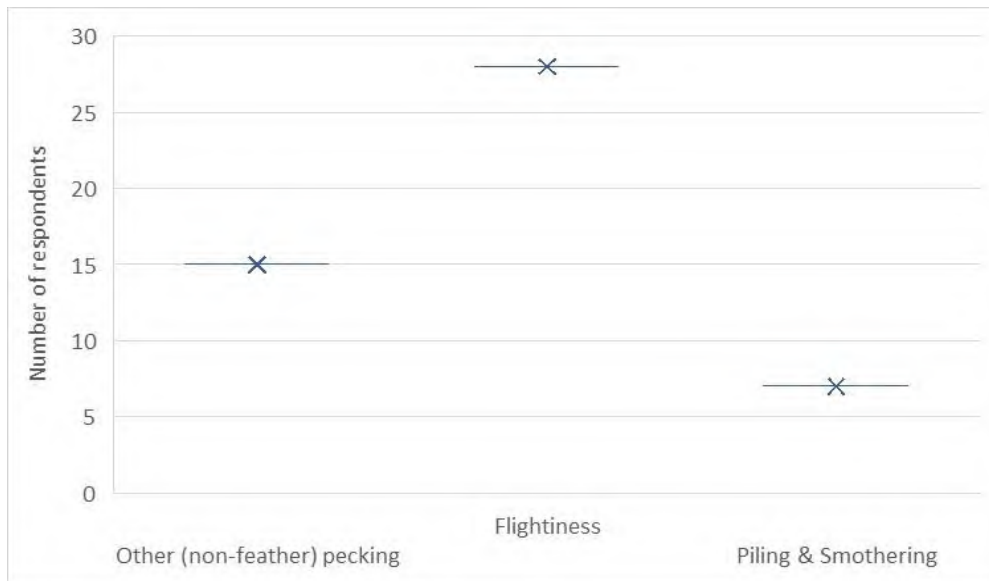


Figure 3: The number of respondents who reported problem behaviours to be prevalent in white breed flocks

Ranging Behaviour and Enrichment Preference

Only 21% (n=8) of respondents believed that white hybrid breeds range better than brown hybrid breeds, whereas 51% (n=20) said the opposite. The remaining respondents 28%, (n=11) were pullet rearers or managed barn systems without access to an outdoor range. Only 10% (n=4) of respondents said that white birds used more enrichments than brown birds, while 25% (n=10) of respondents said they were unsure. The respondents noted that white birds generally used enrichments such as Lucerne, pecking blocks, rope/string and plastic objects (including plastic bottles, drums). Other enrichments, such as cardboard, coloured balls, CDs, and straw, were also provided and utilised. However, no evidence was provided to indicate that white birds displayed a preference for one enrichment over another. A small number (5%, n=2) of respondents specified that some white flocks rarely used any enrichment throughout the laying cycle.

Feed Conversion Ratio

Fifty four percent (n=21) of respondents agreed that white hybrid breeds outperform brown breeds in terms of feed conversion ratio (FCR), while 26% (n=10) reported no difference. With 15% (n=6) were unsure, and 5% (n=2) were not applicable as they were pullet rearers.

Health and Mortality Levels

When asked about their experiences with health problems, respondents shared the following insights: most, 79% (n=31), indicated that white hybrids did not pose any health problems and seemed more resilient and robust than brown hybrids. This was reflected by much greater reports of lower mortality levels in white breeds compared to brown. Sixty one percent (n=24) of respondents reported lower mortality, 8% (n=3) said higher and 31% (n=12) reported no difference.

Discussion

Understanding White Breeds: UK Egg Producers' Views and On-Farm Experiences

The survey indicates that those producers currently housing white breeds were satisfied with their performance, liveability, and manageability. This finding is in line with the recent increase in the number of UK white chick placements, which reached 15% by June 2025 (BEIC, 2025). The UK is gaining experience in managing white flocks, as evidenced by more than a third of producers responding to the survey having managed them for over 3 years.

The increasing popularity of white layers could be, at least, partially explained by two-thirds of the producers responding to the survey reporting that their white flocks were easier to manage than brown flocks; a finding consistent with previous European studies and compliant with further growth in the future. However, when questioned about managing intact-beaked flocks, regardless of feather colour, more than half of the respondents claimed that this was something that they did not feel comfortable with. Of those respondents who were prepared to manage an intact-beaked flock, two-thirds of this cohort favoured managing intact-beaked white flocks over brown, while one-third of the cohort favoured managing intact-beaked brown birds over white. This split appears to reflect what is happening in other countries, e.g. Germany, which currently has around 70% of white intact-beaked flocks (Van de Braak, 2024). We hypothesize by the survey responses, that UK producers feel uncomfortable about managing larger flocks of intact birds. This is likely to be due to the absence of any compensation scheme and the financial, welfare and reputational risks associated with a significant outbreak of injurious pecking.

Housing System, Flock Size and Management

The survey suggests that most white flocks are kept in multi-tier systems, which are similar to those aviary systems commonly used in the European Union (EU). Of the flocks reported, eight were housed in barns and only one in an enriched colony cage system.

While white birds are still found in enriched colony cage systems across Eastern and Southern member states in the EU, they are generally better suited and easier to manage, in terms of behaviour and welfare, in barn or aviary/multi-tier systems (Heijmans, 2021). However, the use of enriched colony cage systems is declining across some EU member states due to market pressures, with some retailers already committing to the “Cage-free” initiative by transitioning to barn or other non-cage systems. In the UK, free-range production, which includes both brown and white layer breeds, represents around 68% of the market and continues to grow (BEIC, 2025).

Most respondents reported housing only one white flock, which may reflect producers still being in the early stages of transition, limited availability of white chicks, or a continued preference for brown eggs by retailers and egg packers. Overall, respondents felt that white breeds generally used the housing system well, had good feather cover, displayed few issues with both floor-eggs and piling/smothering, and had lower mortality.

Feather Condition and Adverse Pecking Behaviour

Seventy seven percent of respondents reported better feather cover and less adverse or injurious pecking (IP), in white than brown breeds. This result is comparable to the scientific evidence and industry’s findings (Van de Braak, 2024). Only two cases of toe pecking (TP) were reported in the survey, which does not reflect the scale of this significant welfare concern elsewhere in Europe. The recent study by Sabine et al. (2023) suggests that risk factors for TP include metal slats in the house, high intensity and frequency of bright light in the house (including direct sunlight), and whether the farm had been previously exposed to an *E. coli* challenge. In the UK, five hundred thousand hens per annum are reared in multi-tiered/aviary systems (Industry source, 2025), with the rest of the birds floor-reared on jumpstarts/slatted tables, and the majority offer no windows or natural daylight. This is similar to the laying house where there may be pop holes at or near floor level, but no side or roof windows to allow

extreme levels of bright, direct sunlight to enter the house. In contrast to IP, TP appears to affect almost exclusively white hybrid breeds, which could be the reason why TP has become particularly prevalent in Switzerland, where a large proportion of the country's egg industry comprises white hens kept in aviary systems with side and roof windows.

Head pecking (HP) was observed by a quarter of all respondents. Due to a lack of scientific literature related to this behaviour, there are no relevant research findings with which to compare this finding. Anecdotally, UK respondents hypothesised that HP could be due to the white hybrids' large combs being caught and damaged on the system, in turn leading to other birds pecking and damaging the top of the head. One participant reported observing head pecking during the rearing period, which they attributed to the number of cockerels present in the house. This appears to be a common and ongoing management challenge, as sexing errors are more frequent in white breeds; feather-sexing used for white breeds is less reliable than colour-sexing, which is typically employed with brown breeds. However, many respondents emphasised that HP was observed generally during the onset of lay, affected a small number of birds, and was only observed for a few weeks.

Flightiness and Smothering Behaviour

Responses to the survey suggest that white flocks tend to show stronger behavioural and physiological fear responses to potentially threatening stimuli, as flightiness among white birds was frequently reported. While smothering has been observed in both white and brown hybrids, research indicates that brown layers are more prone to piling behaviour, which increases the risk and frequency of smothering incidents (Winter et al. 2023). However, our survey found that respondents reported minimal cases of smothering. In white flocks, such low incidences may be due to a combination of several factors, including the birds' tendency to maintain personal space, effective shed design, absence of direct bright sunlight inside the sheds, and general good management of both the indoor and outdoor environments.

Ranging Behaviour and Enrichment Preference

Many studies have demonstrated that, even when provided with the opportunity, large numbers of laying hens within any flock will seldom venture outside to range (Pettersen et al. 2016). In line with our survey findings, white birds were observed to range less far from the house, a pattern also reported by Tahamtani et al. (2024). This behaviour may be due to white

breeds being more flighty and exhibiting higher levels of fearfulness, or due to white laying hen breeds historically having been bred for use primarily in caged systems. Europe has a less developed free range market than the UK, and white breeds have only begun to be managed within free range systems relatively recently.

It is well documented that the provision of enrichment is beneficial in helping to reduce IP and boredom in laying hens (Lambton et al. 2013). Both brown and white hybrid breeds utilise enrichments such as Lucerne, pecking blocks, rope/string and plastic objects (plastic bottles, drums), as highlighted by the survey, and white layer breeds appear to demonstrate no preference for one enrichment over the other.

Health & Welfare – Mortality

The results from the survey indicated that, in the experience of the respondents, white flocks have a lower mortality rate than brown flocks, which is in agreement with scientific studies (Kittelsen et al. 2022). Some respondents raised concerns regarding gut health, fatty liver, and *E.coli*, due to longer laying cycles, as well as soiling of birds in aviary systems. There was no evidence for any difference in susceptibility to red mite infection.

Conclusion

Overall, the survey has provided some useful indications of the understanding and experiences of respondents currently managing flocks of white laying hens within the UK. White breeds seem to be growing in popularity in both the UK and mainland Europe due to many factors, including: high productivity, lower feed conversion ratios, longer laying cycles, lower mortality, and ease of management (in terms of behaviour and welfare). First-hand farm experience in managing white layers will continue to offer valuable insights that can be shared across the UK industry to support optimal management practices during both the rearing and laying phases. Currently, the UK is primarily a brown shell-egg market, and ultimately, consumer demand will determine the balance between brown and white shell egg production.

Acknowledgements

The LHWF would like to acknowledge the respondents who shared their experiences and gave their time to participate in the survey. An appreciation is made to the industry for sharing the survey with their stakeholders-

References

- Abrahamsson, P., Fossum, O., & Tauson, R. (1998). Health of laying hens in an aviary system over five batches of birds. *Acta Veterinaria Scandinavica*, 39(3), 367–379. [hKps://doi.org/10.1186/BF03547785](https://doi.org/10.1186/BF03547785)
- BEIC, Egginfo, [hKps://www.egginfo.co.uk/www.egginfo.co.uk](https://www.egginfo.co.uk/www.egginfo.co.uk) [Accessed June 2025]
- Fan, H., & Wu, J. (2022). Conventional use and sustainable valorisation of spent egg-laying hens as functional foods and biomaterials: A review. *Bioresources and Bioprocessing*, 9(1), 43. [hKps://doi.org/10.1186/s40643-022-00529-z](https://doi.org/10.1186/s40643-022-00529-z)
- Fulton, R., (2017) Causes of Normal Mortality in Commercial Egg-Laying Chickens. *Avian Diseases* 61(3):289-295 DOI: 10.1637/11556-120816-RegR
- Gebhardt-Henrich, S.G., Toscano, M.J., & Fröhlich, E.K.F. (2023). Fearfulness in commercial laying hens: a meta-analysis comparing brown and white egg layers. *Poultry Science*, 102(3), 102664. [hKps://doi.org/10.1016/j.psj.2023.102664](https://doi.org/10.1016/j.psj.2023.102664)
- Heijmans, M. (2021, November 11). Welfare doesn't come automatically with a switch to aviary systems. *Poultry World*. [hKps://www.poultryworld.net/poultry/layers/welfare-doesnt-come-automatically-with-a-switch-to-aviary-systems](https://www.poultryworld.net/poultry/layers/welfare-doesnt-come-automatically-with-a-switch-to-aviary-systems) [Accessed 02/08/2025] Industry Source [Accessed June 2025]
- Industry Source (2025)
- Jones, R. B., McAdie, T. M., McCorquodale, C., and Keeling, L. J. (2002). Pecking at other birds and at string enrichment devices by adult laying hens. *British Poultry Science*, 43, 337-343 cited in Perry welfare of Hens, 2004 Oxfordshire: CABI Publishing
- Kittlesen, K. E., Tahamtani, F., Moe, R. O., Gretarsson, P., & Vasdal, G. (2022). Flock factors correlated with elevated mortality in non-beak-trimmed aviary-housed laying hens. *Animals*, 12(24), 3577. [hKps://doi.org/10.3390/ani12243577](https://doi.org/10.3390/ani12243577)
- Lambton, S.L., Nicol, C.J., Friel, M., Main, D.C.J., McKinstry, J.L., Sherwin, C.M., Walton, J. and Weeks, C.A. (2013) A bespoke management package can reduce the levels of injurious pecking in loose housed laying hen flocks. *Veterinary Record* 172, 423-430
- Larsen, H., Hemsworth, P.H., Cronin, G.M., Gebhardt-Henrich, S.G., Smith, C.L. & Rault, J.-L., 2018. Relationship between welfare and individual ranging behaviour in commercial free-range laying hens. *Animal*. Available at: [hKps://pubmed.ncbi.nlm.nih.gov/29362002/](https://pubmed.ncbi.nlm.nih.gov/29362002/)
- Lesnierowski & Stangierski, (2018) What's new in chicken egg research and technology for human health promotion? - a review *Trends in Food Science & Technology* (2018)

Leenstra, F., Maurer, V., Bestman, M., van Sambeek, F., Zeltner, E., Reuvekamp, B., Galea, F., & van Niekerk, T. (2012). Performance of commercial laying hen genotypes on free range and organic farms in Switzerland, France and The Netherlands. *British Poultry Science*, 53(3), 282–290. DOI: 10.1080/00071668.2012.703774

Mahboub, H.D.H., Muller, J. and Von Borell, E. (2004). Outdoor use, tonic immobility, heterophil/lymphocyte ratio and feather condition in free-range laying hens of different genotype. *British Poultry Science* 45: 738-744.

Pettersson, I. C., Freire, R., & Nicol, C. J. (2016). Factors affecting ranging behaviour in commercial free-range hens. *World's Poultry Science Journal*, 72(1), 137–150. [hKps://doi.org/10.1017/S0043933915002664](https://doi.org/10.1017/S0043933915002664)

Ryan, C (2024) White Turn [hKps://www.poultrynews.co.uk/production/white-turn.html](https://www.poultrynews.co.uk/production/white-turn.html) [Accessed 02/06/2025]

Sabine G. Gebhardt-Henrich, Sabine Mueller, Lisa Zanini, Michael J. Toscano (2023). A survey about the welfare problem "toe pecking" in Swiss laying hens. *Applied Animal Behaviour Science*. 259; 2023, 105854 doi.org/10.1016/j.applanim.2023.105854

Tahamtani, F. M., Kittlesen, K., & Vasdal, G. (2022). Environmental enrichment in commercial flocks of aviary-housed laying hens: Relationship with plumage condition and fearfulness. *Poultry Science*, 101(4), 101754. [hKps://doi.org/10.1016/j.psj.2022.101754](https://doi.org/10.1016/j.psj.2022.101754)

Tahamtani, F., Uller-Kristensen, H. and CORE Organic Cofund, 2024. Commercial layer hybrids kept under organic conditions: a comparison of range use, welfare, and egg production in two layer strains. Aarhus University / CORE Organic Cofund. Available at: [hKps://projects.au.dk/coreorganiccofund/news-and-events/show/ar8kel/finding-the-bestlaying-hens-for-organic-farms](https://projects.au.dk/coreorganiccofund/news-and-events/show/ar8kel/finding-the-bestlaying-hens-for-organic-farms) [Accessed 19 Jan. 2026]

Van De Braak, T. (2024). Cracking myths, cracking eggs. The truth about white egg layers in the United Kingdom. [Accessed 02/06/2025]

Weeks, C.A. and Nicol, C.J. (2006) Behavioural needs, priorities and preferences of laying hens. *World's Poultry Science Journal* 62: 296-307.

World Egg Organisation (2025) Global Egg Industry Outlook. September 2025. Available at: [hKps://www.worldeggorganisation.com/app/uploads/2025/09/Global-Egg-IndustryOutlook_Sep2025.pdf](https://www.worldeggorganisation.com/app/uploads/2025/09/Global-Egg-IndustryOutlook_Sep2025.pdf) (Accessed: 6 February 2026)

Winter J, Toscano MJ and Stratmann A, 2021. Piling behaviour in Swiss layer flocks: description and related factors. *Applied Animal Behaviour Science*, 236, 105272. [hKps://di.org/10.1016/j.applanim.2021.105272](https://doi.org/10.1016/j.applanim.2021.105272)

Annex 1

A survey of Pullet Rearers and Egg Producers managing White Laying Flocks in the

Q1	Are you an egg producer or pullet rearer?
Q2	Do you have an Organic system?
Q3	I have experience with: White birds and brown birds, or just white birds
Q4	What is the flock size of the white layer / pullet flocks you currently manage?
Q5	How many white flocks do you house currently?
Q6	How long have you been managing white birds?
Q7	What prompted your switch to managing white birds?
Q8	Do your white birds have intact beaks or are they beak treated?
Q9	Which housing systems do you use for your white birds?
Q10	Do you find white birds easier to manage than brown birds?
Q11	Do you consider feather cover is better in white birds?
Q12	Have you experienced any other pecking issues (e.g. toe pecking or heads)?
Q13	From your observations, are white birds more flighty than brown birds?
Q14	Do white birds range better than brown birds?
Q15	Do white birds use more enrichments than brown birds?
Q16	What enrichment material works best for white layers? (tick all that apply)
Q17	Do you observe more smothering and piling in white birds compared to brown birds?
Q18	Do white breeds have a better feed conversion ratio than brown laying hens?
Q19	Have you experienced specific health problems with white layers compared to brown layers?
Q20	Have you witnessed disease issues or problems with red mites and internal parasites?
Q21	Is the mortality rate of white birds higher, lower, or the same as that of brown laying hens?
Q22	Do you prefer to manage/rear white or brown birds?
Q23	In terms of managing birds with intact beaks, would you be more comfortable in managing white birds with intact beaks, or brown, or neither?
Q24	Do you have any other comments which you would like to submit as part of this survey?