Broiler welfare environmental sustainability review 27 Nov 2022

This document aims to summarise the intersection of higher welfare broiler production and other aspects of sustainability, namely GHG emissions and land use change. Higher broiler welfare is taken to mean standards equivalent to the Better Chicken Commitment (BCC, which can be certified to G.A.P. step 1 on farm). As mentioned below, the Dutch Retail Broiler Standard (or DRB), is a commercially functioning standard close to the BCC standard except for some difference in stocking density, and the Beter Level one star is also similar, but slightly lower stocking density (12 birds / m^2).

The main aspects of higher welfare broilers (and BCC) that impact on environmental sustainability are;
1) feed and feeding – feed intake and feed conversion efficiency
2) feed composition (particularly soy/soybean meal levels) that can be used with these moderately slower growing breeds (see box below)
3) slaughter age; most are intermediate growing to 2.5 kg in 46/47 days, and
4) maximum stocking density (BCC: 30kg/m^2 i.e., 6lb/ft^2).

No cages are permitted and raising must be on some form of litter, with suitable enrichment and minimum of 50lux light and 6-hour dark periods (plus controlled atmospheric stunning for slaughter). More about BCC can be read here. We will consider below aspects of 1-4 as the key determinants of environmental sustainability and discuss the slaughter age and stocking density briefly across different markets.

The questions and summaries of interest pertaining to science available:

1. **How does this higher broiler welfare impact GHG emissions?**

Mostert et al., 2022 reviewed the potentially competing sustainability elements of higher welfare Dutch Retail Broiler (DRB) and Better Life one Star (BLS) production systems against retailer targets for GHG emission reduction using a LCA (Life Cycle Analysis) approach. This study was a farm to gate analysis, including the breeder and hatchery stages, and used lower proportion of soybean meal (SBM) in the feed for slower growing genetics. Key findings show that soy production for feed constitutes the greatest proportion of GHG emissions (from Land Use Change, LUC). Diet inclusion and thus total emissions are lower for BLS overall, then DRB, which is lower emissions again than conventional raising. However, if slaughter age or feed intake was varied, as in the sensitivity analysis, then there was overlap with conventional production GHG emissions. For example, if soy sourcing was from a country with low LUC emissions (i.e., didn't involve deforestation, peat areas etc.) then the conventional system incurs lower GHG emissions. However, current soy supply in the Netherlands, is predominantly from Brazil with high GHG footprint (as it can involve deforestation and other LUC risks).

In conclusion the study shows that GHG efficiency was better for conventional, DRB or BLS at different stages of production. It also concluded that it is essential to include the SBM origin and LUC emissions, reflecting any associated deforestation-linked soy sourcing. The authors showed the system comparisons across the production stages, with feed intake and LUC. If we isolate the broiler production stage, to compare with some other studies (e.g., in section 2), the proportion of SBM was highest (and thus emissions highest if high GHG soy sourced) in the finisher stage of conventional compared to DRB and BLS systems. This is because the dietary protein requirements differ between the broiler chicken genotypes used in each system. This study assumes assumption d below. The study was funded by the Dutch private-public-partnership of 'Greenwell'.

Other possible studies: Avendaño et al and FAO (summarised in section 3) are more generic and do not explicitly consider the origin of soy / SBM.

2. How does varied broiler welfare impact land use?

A 2022 study by Chan et al., assessed the potential land use increase if the (entire) US broiler industry, converted to the BCC higher welfare standard, employing a range of moderately slow growing breeds. They conclude that an extra 19.9-30.6% additional CAFOs (concentrated animal feeding operations, essentially indoor barns currently used for conventional broiler raising), would be needed if there were no 'drastic reduction in consumption'. The relevant assumptions in this study are a.b.c.d.e. (below) plus, most importantly, another factor and another key assumption. The factor of extended raising time for the US market and the assumption of the same percentage of soybean use in the feed for conventional and slower growing breed use are highly relevant. The US raises broilers to a higher weight and time of 2.93 kg at 47days. The additional 5 days difference, usually irrelevant beyond the US market, increases the land area needed for both feed and broiler production, making the conclusion poorly extrapolatable beyond the United States. The assumption of the same percentage of soybean needed for slower growing chickens differs to Mostert et al, 2022. The latter study builds on earlier work by Wageningen University and the commercial industry that slower growing breeds can rely on a lower feed quality, specifically lower proportion of soybean in their feed. This false assumption in the Chan et al. study augments the additional land area change concluded. Study funded by the Centre for Environmental and Animal Welfare at New York Uni.

Note: Most other conventional broiler markets raise the birds until maximum 2.5kg at 40-42 days, and may thin the flock at around 30 days (~1.5kg birds for a different market, particularly used in Thailand and Brazil Latam as 'griller' birds). These markets however, currently risk importing deforestation-linked soy supply (for feed) from Latam as can be shown by TRASE.

Note: While US derived soybeans do not apparently involve recent deforestation, the expansion of soy crops at the assumed rates would certainly increase the land use change area and may involve some LUC/deforestation or even deforestation-linked imports, although the two latter elements are not mentioned in the study. Authors used for US land use for soy (and maize): FAO. 2020*FAOSTAT_data_crops-USA-yield*. See http://www.fao.org/faostat/en/#data.

Note: As the BCC does not require raising birds on pasture or even occasional/daily outdoor access, only the outcomes related to indoor litter-based raising are considered (cf. Chan et al., other comparisons).

Other studies: Mostert et al, 2022 is relevant to the above paper and findings, with regard to lower percentage of soy/SBM in real slower growing broiler diets, and the relationship of LUC and soy sourcing.

3. What are the underlying assumptions to the above study models/findings?

a. Maintenance (or growth) of chicken consumption (volume) by the relevant market (ignoring IPCC and WHO recommendations for meat consumption reduction or at least limited to WHO recommendations of annual maximum meat consumption).
b. Maintenance of the consumption habits and volume of chicken meat
c. Maintenance of the preference for breast meat predominantly (vs the Dutch retail situation where consumers have reverted partially to a wider acceptance of a range of broiler meat parts)
d. Studies compare the higher welfare breeds used in the same conventional housing
e. Study does not involve the hatchery and breeder stages of the production chain (which can be more efficient for slower growing breeds as found in Mostert et al., 2022).

4. How did the Dutch retail system manage their transition and this sustainability balance?

The drivers, success and process of transition to the new Dutch Retail System, is well known by Wageningen University, and a case study is detailed on page 12 Valuing Higher Welfare Chicken. The pre-competitive agreement of the major retailers to this transition, including guaranteed demand and the removal of conventional lower welfare chicken, plus the higher value and price placed on higher welfare by willing Dutch consumers enabled good acceptance and absorption of the change. Fast food retailers and restaurants were also well assimilated to assume the change. Re-socialising consumer expectations beyond breast meat optimised carcass use, also helping the domestic chicken consumption value (in Euro) to remain stable. This ensured that income to Dutch farmers/companies was maintained, and farm GHG footprints and LUC were not necessarily additional (studied since in Mostert et al.). This Dutch domestic retail case study provides precedent for a national or export market transition, particularly where retail commitments and willing to pay customers prevail, e.g., in Western Europe and other developed markets.

5. How are the above studies relevant and what is still not known, or evidence based?

While the better, more comprehensive methodologies (e.g., Mostert et al., 2022) could be applied to other markets, and the assumptions re-considered, neither of the above studies are directly extrapolatable in specific findings of GHG emissions or LUC area to Asia. They vary in the soy sourcing and GHG associated with LUC, and whether the full production (hatchery to finisher stages) are included, as well as slaughter age/weight.

GHG emissions and LUC in Asian markets vary. Considering China, a major importer of Latam soy, and Thailand, Vietnam and Indonesia also import some Latam soy. Thailand already has litter systems and near BBC stocking density. Other Asian countries may vary somewhat in specific broiler genetics (and thus FCE and intake), stocking density, flooring system and origin of imported soy also.

6. Other sustainability or related studies:

- As part of the Greenwell sustainability assessment model, van Horne (2020) reported economic aspects of Dutch retail broilers from conventional to higher welfare systems. While all costs increased when moving from conventional to DRB or BSL, and to organic broiler systems, the respective revenue prices for the alternative systems were higher and enabled a similar income to farmers (in 2017) as for the original conventional production systems.

- Commissioned research by World Animal Protection to Wageningen University compared costs and broiler welfare benefits across conventional and BCC systems in Brazil, China, Netherlands, Thailand, and US. While the cost was more, it was not as much as previously estimated. There is also a case study summarising the Dutch Retail Transition, and chicken consumer polling. [Valuing higher welfare chicken.]

- The FAO chapter contributing to GLEAM data (2016), reports that 90% of global chicken production is industrial (using conventional breeds) with the majority of GHG emissions predominantly from feed cropping, especially soy, and manure production. FAO notes that backyard chicken systems, often of slower growing breeds with higher FCR (Feed Conversion Ratio, lower FCE) comprise approximately 8-9% of total global production and emissions. They have a lower GHG footprint, mostly as feed is often scavenged, food or crop waste. Even with additional rice in backyard feed (and the associated increased GHG emissions) these systems offset their lower FCR as they avoid soy in feed and the associated LUC emissions integral to industrial broiler systems. It also infers that caged layer (and presumably caged broiler) system emissions are higher partly from manure which is unprocessed compared to manure broken down in floor litter systems.

- Compared to conventional environmentally focused Life Cycle Assessments (LCA), Tallentire et al. (2019) developed an integrated framework for a Social – LCA using some initial basic welfare outcome indicators. Initially testing it with the European conventional broiler system, they found that new, larger, higher stocking density conventional farms demonstrated higher social or welfare impact scores (which conveys lower animal welfare), compared with smaller, lower density systems with lower scores and higher welfare. Authors claim the S-LCA framework could be scaled and used with more sophisticated welfare outcome indicators and other factors.

- Leinonen et al (2014) showed that in the UK, when combined with a heat exchanger (to enable more efficient barn heating) the lower density system of 16 birds/m^2 destocked at 35days at 1.9kg (compared to the 19 birds/m^2 destocked at 39 days at 1.95kg) reduced the Global Warming Potential (GWP) by 3% and reduced eutrophication and acidification potential by up to 8% and 10% respectively. Note: this 'higher welfare' system related to lower stocking density only, not breed change. This study used a cradle to farm gate LCA approach and GWP is related to GHG emissions, using CO2equivalent units (or kg GHGs) per 1000 kg chicken carcass weight. Barn heating in this climate is a key energy factor but it shows with efficient heating/ventilation system, lower stocking density (max at bird maturity equivalent to 30kg/m^2) can be environmentally better in many respects.

- A technical paper by Aviagen (Avendaño et al.) also compares the above-mentioned environmental factors generically across a range of its broiler genetics and the trade-off with animal welfare and other growing consumer preferences. As expected, depending on the FCE, growth rates, and expected slaughter age, overall the GWP, eutrophication and acidification potential increased from conventional to moderate and slower growing Aviagen breeds. However variation may occur at the various production stages, as the two main papers also concur. The paper also notes the antagonistic genetic correlation of some key factors have accelerated the environmental-welfare challenge, and that more balanced breeding is needed for a range of modern outcomes, albeit some trade-off with consumer preferences such as an animal welfare, and avoidance of excessive antibiotics may persist.

References:

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Annex 1: BCC Breeds approved as of 2019.

Additional ones have been approved since by RSPCA UK and University of Guelph project, but the following relate to some of the moderately slower growing breeds used in some of the above studies.

*Breeds that have been approved for use to meet the BCC: JA757, JACY57, JA787, JA957, JA987, JACY87, or Norfolk Black; Rowan Ranger, Rambler Ranger, Ranger Classic, Ranger Premium, or Ranger Gold; REDBRO, RedbroM; CS200, Cooks Venture Pioneer, or others that pass the breed welfare outcome assessments by either the Royal Society for the Prevention of Cruelty to Animals (RSPCA) or Global Animal Partnership (G.A.P.).

[1]Adapted with permission from Global Animal Partnership's 5-Step® Animal Welfare Rating Standards for Chickens Raised for Meat, Copyright 2018 Global Animal Partnership.