NATIONAL FARMERS UNION

Impacts of the Better Chicken Commitment on the UK Broiler Sector

October 2019

ADAS

ADAS GENERAL NOTES

Project No.: 1010453

Title: Impacts of the Better Chicken Commitment on the UK broiler sector

Client: National Farmers Union

Date: October 2019

Status: Final

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Date:	17 October 2019	Date:	18 October 2019

EXECUTIVE SUMMARY

The Better Chicken Commitment (BCC) urges the adoption by 2026 of additional standards for chicken production which exceed the requirements of current legislation in the UK and the voluntary standards set out in the Red Tractor (RT) quality assurance scheme. At present, the likely level of adoption of BCC by 2026 is unknown.

The key differences in on farm requirements for BCC are i) a lower maximum stocking density of 30 kg of liveweight per square metre rather than 38 kg in RT; ii) the use of breeds that demonstrate higher welfare outcomes, often referred to as 'slow-growing' strains and iii) light intensity of at least 50 lux in houses including natural light. In addition, the use of thinning is discouraged and if practiced, it must be limited to one thin per flock.

It is clear that the adoption of BCC standards will add to the cost of chicken production, mainly due to poorer feed conversion ratio (FCR) and an extended cycle length due to slower growth rates. Since fewer birds can be stocked in a house, the output (i.e. total liveweight) will be lower and the costs per square metre of growing space will be higher.

This report compares the typical on-farm costs of producing chickens to BCC and RT standards. It also calculates the additional growing space that would be required to meet current *per capita* chicken consumption levels in the UK and the cost of providing it. This is based on four different scenarios which assume levels of adoption of BCC for UK consumption ranging from 25% to 100%. Account is also taken of changes resulting from expected human population growth in the UK between 2019 and 2026.

Cost comparisons are based on BCC and RT flocks both reaching an average liveweight of 2.26kg. This is based on 30% thinning at an average of 1.85kg and a final depopulation weight of 2.45kg. For equivalence, the same 10 day turnaround time is assumed in both cases, though it is accepted that in some cases, a shorter turnaround time (around seven days) may be used.

Comparative costs for BCC and RT production systems were gathered from a number of different sources, including growers and breeding companies. Production using BCC standards is limited to date in the UK and some variation in experiences was noted. Overall, the key performance assumptions in this report for BCC compared to RT are i) an increase in FCR from 1.58 to 1.92 (and thus higher feed intake); ii) a 1% reduction in mortality (from 4% to 3%) and iii) growing cycle length increasing by a total of 10 days (from 39 days to 49 days).

The total cost of production was calculated in this report to be £1.81 per bird to RT standards and £2.14 per bird for BCC standards. These figures are equivalent to 80 pence and 95 pence per kilogram (liveweight) respectively, a difference of over 18%. In addition to higher feed intake, a range of other cost items were also assumed to be higher on a 'per bird' basis. These include housing costs, heating and clean-out. It was assumed that day-old chick price is currently the same for standard and slow-growing birds but it was noted that the parent flocks of slow-growing strains produce more eggs and consume less feed. In future, this may mean lower day-old prices but the current lack of grandparent, slow-growing stock in the UK raises some practical concerns for the sector.

Lower stocking densities and longer growing cycles result in reduced annual throughput - both in terms of birds and liveweight - for houses operating to BCC standards. The findings in this report show an annual reduction from 333kg to 221kg of liveweight produced per square metre per year, this representing a difference of around 50%.

Reduced output per square metre means that additional housing will need to be brought into production in order to maintain supplies, assuming *per capita* consumption remains at current levels. If chicken consumption levels are maintained, the scenarios selected in this report show that 3.5% more housing will be needed by 2026 due to UK human population growth alone. If BCC accounts for 25% of the chicken market by 2026, approximately 14% more growing space will be needed than at present. Using current UK housing costs (assumed to be £248 per square metre), this additional space would cost around £164 million to build, excluding planning and permitting costs. However, higher costs may have a negative effect on *per capita* chicken consumption. This could reduce the need for additional housing and – at worst – mean that some current growing facilities would become redundant.

Based on differences in FCR, total feed use is calculated to be around 770 grams per bird higher in BCC production. Feed use and FCR have a major bearing on the sustainability of chicken production. It is estimated that greenhouse gas emissions per kg of liveweight are 23% higher for BCC systems compared to RT systems. In addition, more land will be needed to grow the extra wheat and soya that will be consumed by BCC chickens. Based on typical crop yields, the increase in land area amounts to around 22%. Water consumption is also calculated to be around 22% higher per bird BCC.

Available evidence suggests that overall meat yield may be around 1% lower in slow-growing birds (71% eviscerated weight) compared to standard birds (72%). For a chicken of 2.26kg liveweight, this represents a difference of around 22 grams and this could be worth 8-9 pence at retail level. In addition, there is less breast meat and more leg meat in slow-growing birds. Whilst this cannot be quantified at present, some reports have suggested a difference of 7%. This study suggests that each 1% change in the proportions of breast and leg meat could result in a difference of 5 pence at retail prices. Since the UK is a net importer of breast meat and a net exporter of leg meat, these differences are likely to have measurable trading effects and implications for pricing. Consumer willingness to pay higher prices for BCC production and possible differences in meat taste and texture are outside the scope of this report, but could be considered separately.

If new growing facilities are required as a result of the adoption of BCC standards, growers and poultry breeders must have confidence to make this investment. This will require long term and secure commitments from buyers. Finally, growers must also be able to secure the necessary finance and obtain the relevant consents for planning and environmental permitting in respect of new developments.

CONTENTS

1 INTRODUCTION

This report has been prepared by ADAS to consider the effects of the Better Chicken Commitment[1] on costs of production and to describe other possible implications, including the need for additional growing space. The focus is on the UK broiler sector, covering a 7-year period from 2019 to 2026.

A range of published and other data available to ADAS has been gathered in order to prepare this report. Discussions have been held with growers and others who have relevant, direct experience of the issues under consideration here. Inevitably, differences in experiences and findings have been reported and so average values have been used in this report as necessary. A number of different scenarios have been considered, depending on the extent to which buyers adopt Better Chicken Commitment standards by 2026.

1.1 Background

Chicken is now the most-consumed meat in the UK and both production and consumption has increased in recent years. Between 2012 and 2016, annual *per capita* consumption of chicken increased by around 5%, from 22.0kg to 23.2kg. Between 2012 and 2017, the total annual chicken output produced in the UK increased by nearly 20%, rising from 1,322 thousand tonnes to 1,586 thousand tonnes. This reflects an increase in UK self-sufficiency in chicken over this period, as well as increases in *per capita* consumption and human population.

The welfare of broiler chickens is protected in the UK by legislation which implements EU Council Directive 2007/43[2] on the welfare of poultry meat. This sets minimum farm standards for broiler chickens and it is implemented in England by the Welfare of Farmed Animals (England) (Amendment) Regulations 2010 (SI 2010 No3033). Similar legislation is in place in other parts of the UK.

Under this legislation, the maximum stocking density for broilers is specified in terms of a maximum liveweight per square metre of floor area. Under certain prescribed conditions, the EU Directive allows up to 42kg of liveweight per square metre of floor space and this is used elsewhere in the EU. In the UK though, a maximum of 39kg of liveweight per square metre has been set in legislation.

Over 90% of the chicken currently produced in the UK is understood to be grown in accordance with voluntary standards set out in the Red Tractor Scheme[3]. These exceed the requirements in UK legislation in a number of ways. Three key aspects which are either already in place or planned are set out below.

- **Stocking density** is currently limited to a maximum of 38kg of liveweight per square metre i.e. 1kg per square metre below the UK legal requirement and 4kg per square metre below the EU legal maximum;
- **Environmental enrichment** must now be provided in all houses from day seven at the latest. This typically consists of bales of shavings (at least one per 1,000 birds over the cycle),

[1] https://betterchicken.org.uk/

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32007L0043&from=EN

[3] https://assurance.redtractor.org.uk/contentfiles/Farmers-6803.pdf?_=636359681046417894

perches or platforms (at least two linear metres of perching per 1,000 birds) and pecking objects (at least one object per 1,000 birds).

- **Windows** must be fitted in all houses from October 2020 and the translucent area must equate to at least 3% of the floor area. Houses which already have 1% windows have until October 2023 to increase the area to 3%. Windows must be evenly distributed to ensure an even spread of light throughout the house. Windows are already fitted to the majority of broiler houses due to retailer requirements.

1.2 The Better Chicken Commitment

Recently there has been increasing pressure on retailers and the food service sector throughout Europe to adopt the standards set out in the 'European Chicken Commitment' also known in the UK as the 'Better Chicken Commitment'. At present, some buyers have already made this commitment in respect of UK procurement. Others may follow, but the likely future uptake is unknown at present.

The Better Chicken Commitment (BCC) urges the adoption of additional standards for chicken production by the year 2026. Farm requirements include the following, all of which exceed current UK legal requirements:-

- A maximum stocking density of 30kg liveweight per square metre;
- The use of breeds that demonstrate higher welfare outcomes, based on the criteria set out in the RSPCA Broiler Breed Welfare Assessment Protocol[4]. In effect, this requires the use of slower-growing strains and for guidance, the Protocol includes a threshold of 60g growth rate per day;
- Lighting levels in houses of at least 50 lux, including natural;
- At least two metres of useable perch space and two pecking substrates per 1,000 birds.

In addition, the use of thinning (i.e. the removal of a proportion of a flock prior to final depopulation) is 'discouraged' in BCC and if practiced, it must be limited to one thin per flock.

It is clear that a lower stocking density and the use different (slower growing) breeds are required for BCC compared to RT. The specified light intensity is higher i.e. 50 lux as opposed to at least 20 lux over 80% of the useable area. Requirements for enrichment (perches and pecking substrates) are similar for RT and BCC although there are minor differences. For example RT requires one bale and one pecking object per 1,000 birds whereas BCC only specifies two pecking substrates and no bales.

Whilst the UK poultry sector operates on the basis of responding to – and meeting - the requirements of its customers and consumers (growers receive no direct public funding), it is clear that the adoption of these standards could have significant impacts on the future of UK chicken production. In particular:

- The capacity of an existing broiler house currently operating to RT standards would be reduced by around 20% due to differences in stocking density requirements in BCC;
- A longer growing cycle would be required in BCC, since the daily liveweight gain would be lower. As a result, a house would complete fewer growing cycles or crops each year and so the annual output per house would be lower.

[4] https://science.rspca.org.uk/sciencegroup/farmanimals/standards/chickens

These impacts would mean that additional growing space would be required if the current annual output of UK chickens is to be maintained. Additional production costs would be incurred as a result.

1.3 Report scope and format

This report provides a comparison of the cost of production of an individual chicken produced to i) Red Tractor (RT) and ii) Better Chicken Commitment (BCC) standards. This comparison is based on the expected physical performance of chickens produced to each standard and typical current costs and prices.

The impacts on broiler house capacities (due to differences in stocking density) are assessed, together with differences in annual throughput. The latter also takes account of differences in growing cycle length. A number of scenarios are then used to forecast the impact of varying degrees of uptake of BCC by UK buyers. On this basis, the need for additional growing space on farms and the likely current costs of this are estimated. Finally, other possible impacts of the adoption of BCC standards are considered.

The report aims to provide factual information and practical guidance. It may be used as part of discussions between growers, processors and customers in the retail, food service and related sectors, helping to improve understanding of unit costs and other implications.

The possible poultry health and veterinary implications associated with the move towards BCC standards are not covered here but they have been addressed in a separate report.

1.4 Overview of previous studies

Whilst no attempt has been made to undertake a thorough literature review on the subject, a number of documents and scientific papers have been identified which provide comparison and useful context. These have been used for guidance purposes only, during the preparation of this report. A brief summary of key documents and conclusions, particularly in relation to costs is set out below.

- A European Commission document prepared by the Scientific Committee on Animal Health and Animal Welfare (2000)[5] concluded that the direct effect of a reduction in stocking density from 38.4 to 30kg per m² would be a production cost increase of 5.3%. The report considered that the gap could be reduced if the change resulted in a reduction in mortality. In relation to a reduction in broiler growth rate and based on data from France, the report suggested a 10 day difference in slaughter age, an increase in feed conversion ratio from 1.89 to 2.10 and a reduction in weekly mortality from 1% to 0.35%.
- A review paper by Estevez in Poultry Science (2007)[6] reported on previous studies showing that the economic return per bird decreased at higher stocking densities but that the total liveweight per unit of space increased. However this was said to be valid only up to a certain point, because individual bird performance declined at very high stocking densities (see separate veterinary report prepared for the National Farmers Union).

[5] https://ec.europa.eu/food/sites/food/files/safety/docs/sci-com_scah_out39_en.pdf

[6] Estevez I, Density Allowances for Broilers; Where to Set the Limits. Poultry Science 2007; 86:1265

- A recently-published paper, 'Global Prospects of the Cost-Efficiency of Broiler Welfare in Middle Segment Production Systems' (2019)[7] compared technical inputs, prices and production costs for a range of different broiler production systems and three different country scenarios. The most relevant comparisons for this study are i) the 'conventional' system in the Netherlands which follows minimum EU legislation, albeit using a stocking density of 42kg per square metre (i.e. higher than that allowed in UK legislation) and ii) the Global Welfare Standard. Key attributes of these are set out in Table 1 below.

Table 1 Comparison of conventional and global welfare standards in the Netherlands

System	Conventional (Netherlands)	Global Welfare Standard
Broiler strain	Standard	Slower-growing
Stocking density (kg/m²)	42	30
Natural light	No	Yes
Light intensity	20	20[8]
Enrichment	No	Yes (bales and perches)

Technical inputs and prices for the Netherlands from this study are summarised in Table 2 below. Prices which were quoted in the paper in euros have been converted to UK pounds sterling based on a current currency conversion rate of €1 being equal to £0.90.

Table 2 Summary of performance and key cost assumptions

	Conventional (Netherlands)	Global Welfare Standard
Liveweight (kg)	2.3	2.4
Feed conversion ratio	1.61	1.88
Mortality (%)	3.5	2.5
Feed price (£ per tonne)	294	294
Day-old chick (pence per bird)	30	28
Labour (£ per hour)	21.60	21.60

Production costs calculated from this study are summarised in Table 3 below. As above, costs which were expressed in eurocents have been converted to UK pence, using a currency conversion rate of 0.9.

[7] Luuk SM, de Jong IC, van Horne P and Saatkamp HW, Global Prospects of the Cost-Efficiency of Broiler Welfare in Middle-Segment Production Systems. Animals 2019; 9

[8] Lower than Better Chicken Commitment standards in which 50 lux is specified

Table 3 Production costs for two systems

	Conventional (Netherlands) (pence per kg liveweight)	Global Welfare Standard (pence per kg liveweight)
Day-old chick	12.3	12.6
Feed	47.4	55.4
Animal health	1.8	1.4
Litter	0.4	0.5
Grain and straw	0	1.3
Housing and equipment	5.1	9.6
Labour	2.4	5.4
Catching	1.9	1.8
General and other costs	4.6	5.9
Total (pence per kg liveweight)	**75.9**	**93.9**

On this basis, the adoption of Global Welfare Standards was found to add approximately 23% to the cost of production on a 'per kg liveweight' basis.

Whilst these figures provide useful background information for this study, it is clear that some of the price assumptions are not applicable to UK circumstances. In addition, the two standards are not identical to those being considered here.

2 APPROACH

2.1 Data gathering

ADAS has used existing knowledge of standard commercial broiler performance as a basis for this study but information has been reviewed and updated as necessary to ensure that it remains representative of current UK chicken production. Data and views have also been gathered from a range of different sources on the current performance of slow-growing broiler strains. Where reported performance varied, an average or typical value has been used in this report.

To ensure that the costs are comparable, the same 'typical' final liveweight, thinning regime and turnaround time has been assumed. The details are set out in Table 4.

It is recognised that differences exist in terms of turnaround times. In some cases, the turnaround period may be reduced to around seven days or lower. The 10 day period included in Table 4 could therefore be considered to be a maximum. If a shorter turnaround period was assumed for both standards, it is unlikely that the conclusions would differ substantially.

Table 4 Key assumptions for Red Tractor and BCC standards

	Red Tractor	Better Chicken Commitment
Birds removed at thin (%)	30	30
Average liveweight at thin (kg)	1.85	1.85
Average liveweight at final depopulation (kg)	2.45	2.45
Average liveweight for flock, thin & final (kg)	2.26	2.26
Turnaround time (days)	10	10

Clearly, the age at thinning and the length of the growing cycle required to produce final-liveweight birds varies for standard and slow-growing flocks. Within the data-gathering stages, information was gathered on typical growth rates for both. This included reference to published 'performance objective' guides produced by breeding companies and commercial experiences.

The Better Chicken Commitment suggests a number of slower-growing strains which meet the criteria of the RSPCA Broiler Breed Welfare Assessment Protocol. The physical performance of these strains varies and this variation could impact upon overall production costs. However, the Protocol uses one particular bird – the Hubbard JA757 – as the control for all trials intended to demonstrate the acceptability of others. This bird (as well as the Hubbard JA787 and others) is currently used in the UK in systems where a slow-growing bird is required.

To provide context on current market arrangements for chicken in the UK, the NFU has provided a range of data available to them through Kantar[9]. This includes information on total chicken sales

[9] www.kantarworldpanel.com

through major retailers, sales of whole carcasses and portions and sales by system of production e.g. standard and free range. This information has been used to inform the scenarios selected for the future (see section 2.3).

2.2 Consultations

Meetings, telephone calls and email exchanges have been undertaken with poultry companies and breeding companies. These have helped to define typical commercial performance levels and production costs. Emerging findings have also been discussed informally with these same contacts, to ensure that they are considered representative at present.

We are grateful to individuals who provided time, data and expertise.

2.3 Selected scenarios

The agreed scope for the study is to consider the following scenarios:

2.3.1 Absence of BCC or 'business as usual'

In this scenario, we have considered the conventional chicken market (i.e. excluding organic systems) at present and within this, the percentages of standard production (which includes some 'high welfare' production) and free range. No allowance has been made for any production to BCC standards.

2.3.2 Growth in demand for BCC chicken

We have considered four different scenarios in respect of future demand for BCC. These are based on the market share for BCC reaching 25%, 50%, 75% and 100% of UK production by 2026. Since a 'straight-line' annual increase in demand for BCC chicken over this period is not expected, no attempt has been made to forecast changes on an annual basis. The likelihood is that there would be an acceleration effect over time i.e. more conversion to BCC in later years than at first.

Since a seven year period from 2019 to 2026 is considered (2026 being the proposed implementation date for the Better Chicken Commitment standards), current government forecasts have been used to set out expected UK human population changes over this period. These provide a basis for predicting future chicken consumption requirements. No change in *per capita* chicken consumption has been included in the data although it is accepted that this could either increase or decrease for a number of different reasons. This approach allows a clear comparison to be made between BCC and 'business as usual' scenarios although we appreciate that any price changes could have an effect upon consumption levels.

2.4 Analysis and reporting

At present, there is limited UK experience of producing chickens to meet BCC standards. Growers who currently use slow-growing strains may adopt different approaches and they may also have different requirements for average liveweight. Comparative analysis is therefore not straight-forward. In addition to comparing costs using 'typical' figures, a number of sensitivity calculations have therefore been included to show the likely effect of changed assumptions.

Three key variables are considered within the sensitivity analyses, namely the effects of changes in feed use, mortality and labour requirements.

3 COMPARISON OF PERFORMANCE AND COSTS

3.1 Growing cycle length and cycles per year

Table 5 below sets out key performance assumptions intended to meet the requirements set out in Table 4 (i.e. an average liveweight of 2.26kg, based on 1.85kg at thinning and 2.45kg at final depopulation).

Chickens grown to Red Tractor (RT) standards typically reach an average as-hatched liveweight of 2.45kg by 39 days. For Better Chicken Commitment (BCC) production, it is assumed that the growing period needed to reach the same final as-hatched liveweight is increased to 49 days. This is based on industry views and is due to the use of slower-growing birds. Thinning at 1.85kg average as-hatched liveweight is also assumed to take place sooner for RT flocks (32 days) than for BCC (38 days).

Table 5 Key performance parameters for RT and BCC chicken

	Red Tractor	Better Chicken Commitment
Maximum stocking rate (kg per square metre)	38	30
Age to achieve 1.85kg at thin (days)	32	38
Age to achieve 2.45kg at final depopulation (days)	39	49
Turnaround time assumed (days)	10	10
Total cycle length (days)	49	59
Cycles per 365 days	7.45	6.19

3.2 Feed performance

Expected feed performance of chickens grown to RT and BCC standards is set out in Table 6. The feed conversion ratio (FCR) of RT chicken is likely to be substantially better than for BCC chicken since the latter are slower-growing and so body maintenance requirements are higher over a longer growing period.

It is assumed that chickens grown to RT standards have an average FCR of 1.58 when grown to an average liveweight of 2.26kg. This means an average feed consumption of 3.58kg per bird (i.e. 1.58 x 2.26). In comparison, an average FCR of 1.92 has been assumed for BCC, which means an average of 4.35kg of feed per bird (i.e. 1.92 x 2.26). On this basis, a chicken grown to BCC standards typically consumes around 770g more feed to produce the same liveweight than a RT chicken.

Table 6 Comparison of feed performance for RT and BCC chickens grown to 2.26kg liveweight

	Red Tractor	Better Chicken Commitment
FCR	1.58	1.92
Feed consumption (kg)	3.58	4.35

3.3 Mortality

On the basis of current views from industry, average mortality is expected to be lower for flocks grown to BCC standards than for RT (Table 7). However, variation in mortality rates exists between farms and flocks and low levels of mortality can be achieved in both systems. Importantly, it has been assumed that average flock mortality is 1% higher for RT (4%) than for BCC (3%) at final depopulation and that the daily mortality for each system is the same throughout each growing cycle i.e. 0.1% per day for RT and 0.06% per day for BCC.

Table 7 Comparison of mortality levels in RT and BCC flocks at final depopulation

	Red Tractor	Better Chicken Commitment
Total mortality per crop (%)	4.0	3.0
Daily mortality (%)	0.10	0.06

3.4 Chick placements

The maximum stocking density permitted for RT standard chicken (38 kg per square metre) must not be exceeded at the time of thinning or final depopulation. For BCC standards (30 kg per square metre), the same principle applies. As a result, a house operating to RT standards could be stocked with more birds at day-old than a house of the same-size operating to BCC standards.

Based on the expected average liveweight at thinning and final depopulation (1.85kg and 2.45kg respectively) and the percentages of birds remaining at each stage (100% and 70%, with no allowance made for mortality), the highest stocking density is calculated to occur at the time of thinning. On that basis, Table 8 below shows the maximum stocking for day-olds for each system.

Table 8 Day-old placements for RT and BCC houses

	Red Tractor	Better Chicken Commitment
Maximum stocking density (kg per square metre)	38	30
Maximum day-old placements based on 1.85 kg liveweight at thinning (birds per square metre)	20.54	16.22[10]

3.5 Output 'per cycle' and 'per year'

Table 9 shows the stocking capacity for a 2,400 square metre growing house, based on RT and BCC standards and the implications of the difference for output on a 'per cycle' and an annual basis. These numbers and the subsequent values in this Table have been calculated precisely in Microsoft Excel. Any apparent minor discrepancies in the calculations here are due to rounding up of figures for ease of reference.

Table 9 Comparison of output in a standard house (2400m²) operating to RT and BCC standards

	Red Tractor	Better Chicken Commitment
Day-old placements, birds per square metre (see Table 8)	20.54	16.22
Numbers placed at day-old (based on 2400m²)[11]	49,297	38,919
Total liveweight in kg per m² after flock mortality	44.74	35.71
Total liveweight per cycle (tonnes) based on 2400m² growing space	107.39	85.703
Production cycles per year (see Table 5)	7.45	6.19
Total liveweight per year based on 2400m² growing space (tonnes)	799.93	530.19
Liveweight (kg) per square metre per year based on average of 2.26 kg	333.30	220.91

[10] Note that this figure has been rounded to two decimal places in this Table for ease of reference.

[11] These numbers and the subsequent values in this Table have been calculated precisely in Microsoft Excel. Any apparent minor discrepancies are due to rounding up of figures only.

From Table 9, it can be seen that nearly 27% more birds are stocked per growing cycle for RT compared to BCC standards and that the total liveweight per square metre per year is around 50% higher.

3.6 Production costs

Table 10 below sets out the calculated total production costs on a 'per bird' and a 'per kilogram of liveweight' basis for RT and BCC standards. The basis for these calculations is set out in the narrative that follows the table.

The individual cost items shown in Table 10 are rounded to the nearest penny. The sum of the individual values may therefore not match the total as shown in this table. The individual costs and the total are set out more precisely in Appendix 1.

3.6.1 Differences in production costs

Based on the assumptions made (see below), it costs £1.81 to produce a 2.26kg liveweight chicken to RT standards and £2.14 to BCC standards. This represents a difference of 33 pence per bird. On a 'per kilogram' basis, RT chicken costs 80 pence per kilogram to produce whereas BCC chicken costs 95 pence per kilogram. This means on average it costs around 18% more to produce chicken grown to BCC standards than to RT standards. This difference is lower than the outcome of the study reported in section 1.4 (see Table 3) but it should be noted that the 'standard' system in the Netherlands was based on 42kg per m^2 rather than 38kg per m^2.

The stated production costs take account of expected differences in mortality (Table 7) but no assessment is made of the relative market values of chicken from each system.

The basis for the individual cost items in Table 10 is set out below.

Chick

Chick price is assumed to be 35 pence per bird for both standard chicks for RT and slow growing chicks for BCC. When expected mortality is taken into account, the chick cost is equivalent to around 36 pence per bird at slaughter weight, for both RT and BCC chicken.

Based on breeder's performance objectives and discussions with industry, it is understood that slow growing breeder birds produce more eggs per laying cycle than standard growing breeder birds (up to 50 eggs per bird more). Slow growing parent stock also consume less feed (a difference of up to 8kg per cycle). At present though, the resultant savings are offset by higher 'overhead' costs resulting from the very small size of the market and higher day-old breeder costs. On this basis, it could be expected that the cost of slow growing chicks could be reduced in future, if the size of the slow growing market increases.

Table 10. Summary of production costs for RT and BCC standard chicken

	Red Tractor		Better Chicken Commitment	
	Cost per bird (£)	Cost per kg (£)	Cost per bird (£)	Cost per kg (£)
Chick	0.36	0.16	0.36	0.16
Feed	0.98	0.44	1.20	0.53
Labour	0.04	0.02	0.06	0.03
Water	0.01	0.01	0.01	0.01
Electricity	0.02	0.01	0.03	0.01
Heat	0.04	0.02	0.06	0.03
Litter	0.04	0.02	0.04	0.02
Repairs and maintenance	0.03	0.01	0.04	0.02
Vaccines	0.02	0.01	0.02	0.01
Medication	0.02	0.01	0.01	0.01
Site preparation and clean out	0.04	0.02	0.06	0.02
Interest and capital	0.17	0.08	0.22	0.10
Overheads and miscellaneous items	0.04	0.02	0.05	0.02
Total	**1.81**	**0.80**	**2.14**	**0.95**

Feed

Feed is the largest single cost component and it represents the most important difference between RT and BCC production costs. This is not unsurprising as a chicken grown to BCC standards consumes 22% more feed than a RT chicken, in order to produce the same liveweight bird (Table 6). At present, growers typically use the same feeds for standard and slow growing broiler strains, rather than

varying the specifications. This may in part be a reflection of the current small scale of the 'slow growing' sector although it is also thought to be cost-effective. Using lower-specification (and therefore cheaper) feeds would reduce growth rates still further, leading to even longer cycle lengths and poorer FCR.

An average feed price of £275 per tonne has been assumed for each growing cycle for both standard and slow growing birds. The difference in feed use means that it costs an additional nine pence per kilogram to produce to BCC standards, equivalent to an additional 22 pence per bird.

Labour

Discussions with industry indicate that daily labour requirements may be less in BCC compared to RT, due to reduced mortality and fewer culls and because litter 'top-ups' are rarely needed. For an existing site, the difference may not be sufficient to reduce staff numbers but it may enable labour to be re-directed to achieve additional health, welfare and performance benefits. On this basis, it is assumed that labour costs per square metre of growing space are the same for both RT and BCC standards. This means that when adjusted for growing cycle and stocking density, labour costs 3 pence per kilogram for BCC compared to 2 pence per kilogram for RT. Changed assumptions for labour are explored in the sensitivity analysis in section 3.7.

It has also been suggested that the role of the stockperson is easier and more pleasant to undertake in lower stocking rate systems. Whilst it is not possible to quantify this, it may help to retain labour, reduce recruitment costs and address concerns over future labour availability.

Water

Water consumption per bird is assumed to be higher for BCC chicken compared to RT due to the longer growing cycle and the higher feed intake. However, this results in very little difference in cost between the two standards. Water costs around one penny per bird for RT and just over one penny for BCC.

Electricity

The main component of electricity cost is the operation of the ventilation system. Ventilation is required to remove excess heat from the house and to reduce levels of carbon dioxide and other harmful gases. Ventilation requirements will be different between houses due to factors such as insulation and local climate conditions etc. However, total bird heat output and levels of harmful gases in a house are related to stocking density and the length of the growing cycle. On the basis that the stocking rate for BCC is 21% lower whilst the cycle length is 25% longer, we have assumed that the cost of electricity is broadly the same for RT and BCC chicken (one penny per kilogram for both RT and BCC chicken). Discussions with growers also suggest no substantial differences in electricity costs.

Heat

Heating costs are based on the use of LPG, however it is acknowledged that biomass boilers used to generate renewable heat have become more common in the UK broiler industry and may reduce the heating cost.

Based on industry discussions, it is assumed that an annual average of 15% more heat is required for BCC chicken due to the lower stocking density. For winter flocks, the increase is likely to be higher

than this whilst it will be lower in summer. As a result, it costs around one penny per kilogram more in heating costs to produce to BCC standards.

Litter

Litter cost is calculated on the basis that the cost per square metre of growing space is the same for RT and BCC. This assumption is based on the same quantity of litter being provided at the start and makes no allowance for topping up throughout the cycle. Due to stocking density differences, the cost of litter per bird is higher for BCC chicken, but this difference has only a marginal effect.

It is understood that in general, houses stocking birds to RT standards are more likely to require additional litter (per square metre) throughout the growing cycle than houses stocked to BCC standards. Primarily this is because the higher stocking density means that more water is excreted per unit area. Therefore, if top-up litter is accounted for it is likely that the cost per bird or per kilogram will be very similar between the standards. The extent to which topping-up is required also has implications for labour requirements.

Repairs and maintenance

The cost of repairing and maintaining buildings and equipment is based on a fixed price per square metre regardless of stocking density. When adjusted on a 'per bird' basis according to differences in growing cycle length and bird stocking density, it costs around one penny per kilogram more for BCC chicken.

Vaccines and medication costs

It is assumed that chickens grown to RT and BCC standards will receive the same programme of vaccinations and therefore the cost per bird is the same (i.e. around two pence per bird) for both standards.

Industry experience to date suggests that birds grown to BCC-type standards require far fewer medical treatments than birds grown to RT standards. On this basis the medication cost for BCC chicken has been halved compared to RT. Based on a cost of two pence per bird for RT, this means that the medication cost for BCC is one penny per bird.

Site preparation and clean out

This includes the cost of removing the litter from the previous flock, cleaning and disinfecting the house and preparing it for the next batch of birds. For BCC, there may be more manure output per bird because of higher feed intake but for RT there may be additional weight of 'top-up' litter. Overall, these items are calculated on the basis of the same cost per square metre but differences in stocking density mean that the costs are just over 20% higher for BCC on a 'per bird' basis. However the actual costs are low and so this equates to just over two pence per kilogram for BCC and just under two pence per kilogram for RT.

Interest and capital

The capital cost for a new poultry house including equipment and ground works varies substantially but for these purposes, a figure of £248 per square metre has been assumed for both RT and BCC production. The values in Table 10 are based on capital costs and interest being re-paid over 10 years at a rate of 5% interest. When adjusted on a *pro rata* basis according to differences in stocking

density and growing cycle length, the cost of capital and interest is around 10 pence per kilogram for BCC and 8 pence for RT. This represents the third largest cost item, after feed and chick costs.

It is accepted that in practice, some existing housing and equipment costs have already been re-paid in full and therefore the inclusion of these costs may not be appropriate in all cases.

Overheads and miscellaneous items

Overheads include office running costs, vehicle and fuel costs, buildings insurance and other miscellaneous items. These costs are likely to be the same on a 'per farm' basis irrespective of whether BCC or RT standards are followed but they will be higher for BCC on a 'per bird' basis because of the reduced bird numbers.

Bird disposal costs are also included under this item and are calculated according to expected mortality and the weight of birds for disposal. Disposal costs represent a marginal cost for both standards and they are slightly higher for RT standards due to the expected higher mortality (Table 7). On the basis of all these costs combined, the overall cost is around two pence per kilogram for both standards.

It is assumed that the cost of providing environmental enrichment is similar on a 'per bird' basis for both production systems and that windowed houses are able to achieve the required (higher) light intensity of 50 lux as required in the BCC standard.[12] Enrichment costs are minimal and are based for example on treated straw bales costing £7 each.

3.7 Sensitivity analysis

It is clear that there is variation in the physical performance of broilers and differences in labour requirements may also exist. The sensitivity analysis predicts the impacts of changes to FCR, mortality and labour on production costs and the differences in costs between RT and BCC. The results of this analysis are presented in Table 11.

Table 11 Summary of BCC production costs based on sensitivity changes

Sensitivity change	Effect on costs (pence per bird)	Total costs (£ per bird)	Increase (%) compared to RT at £1.81 per bird
FCR for BCC increases from 1.92 to 1.97	+ 3.1	2.17	20%
FCR for BCC decreases from 1.92 to 1.87	– 3.1	2.11	16%
Mortality for BCC reduces from 3% to 2%	- 1.0	2.13	18%
Labour requirements for BCC reduced by 50% compared to RT	- 2.8	2.12	16%

[12] This is also addressed in section 5.2.

If the FCR for BCC is increased from 1.92 to 1.97 for a 2.26kg bird, feed use increases by an average of 113g per bird. This costs an extra 3.1 pence, based on a feed price of £275 per tonne. Under this scenario, BCC chicken would cost 20% more to produce than chicken grown to RT standards (with an FCR of 1.58). Alternatively if FCR is reduced from 1.92 to 1.87, feed use and feed costs decrease by the same amount and under this scenario BCC would cost 16% more to produce than RT chicken.

Table 11 also shows that if the average flock mortality rate for chickens grown to BCC standards is reduced from 3% to 2% the cost of production is reduced by one penny per bird from £2.14 to £2.13. The relatively small impact of reducing mortality means that the cost differential between RT and BCC remains at around 18%.

Based on discussions with industry and producer experiences, it has been suggested that daily labour requirements may be lower in BCC than in RT, due to reduced mortality, fewer culls and reduced need for litter maintenance. Table 11 shows that the effect of reducing labour cost on a 'per square metre' basis by 50% means that the total production cost for BCC is reduced by 2.8 pence per bird. Under this scenario, BCC would cost 16% more to produce than RT.

4 FUTURE PROJECTIONS AND SCENARIO MODELS

Since the extent to which Better Chicken Commitment (BCC) standards will be adopted in the UK by 2026 is unknown at present, the likely impacts upon the UK poultry sector are difficult to assess.

Broadly, it is expected that multiple retailer and food service buyers operating in less price-sensitive and more 'quality-conscious' parts of the market are more likely to adopt BCC standards. Conversely, those for whom price is the primary issue are less likely to switch. Future prospects are also subject to a range of other factors, including consumer willingness to pay extra, which in turn may be affected by the state of the UK economy.

Because of this uncertainty, the implications of a number of different scenarios have been considered in this report. These are based on market shares for BCC of between 25% and 100% by 2026. To provide some context for the scenarios selected here, we have used current data from Kantar Worldpanel (provided via the National Farmers Union) to summarise current market segmentation for chicken.

4.1 UK chicken consumption and future trends

According to the 2019 annual report by AVEC[13], UK chicken consumption for 2016 (the most recent year for which data are available) stood at an annual average of 23.2 kg per person. On this basis, Table 12 below uses UK human population data and forecasts from the Office for National Statistics[14] to calculate total UK chicken consumption for each year up to 2026. For the period from 2019 to 2026, overall human population growth is expected to be 3.5%. The same *per capita* chicken consumption is assumed throughout these years although it is accepted that it may change for a range of different reasons.

Table 12 Changes in UK chicken consumption as a result of human population change, 2019-2026 (based on annual *per capita* consumption of 23.2 kg per person)

Year	UK human population (millions)	Total UK chicken consumption (thousand tonnes)
2019	66.867	1,551.3
2020	67.255	1,560.3
2021	67.616	1,568.7
2022	67.961	1,576.7
2023	68.290	1,584.3
2024	68.612	1,591.8
2025	68.928	1,599.1
2026	69.235	1,606.2

[13] https://www.avec-poultry.eu/resources/annual-reports/

[14] https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/timeseries/ukpop/pop

4.2 Market share summary for chicken

Recent sales for free range chicken meat provide an indication of consumers' current willingness to pay higher prices for a premium product. In Table 13 below, Kantar Worldpanel data for the retail sector shows total sales of chicken (by volume) and the percentage of this which is free range (not including organic). For each year, the data are for a 52 week period up to mid-June.

Table 13 Free range as a percentage of UK chicken sales in the retail sector (2015-2019)

Year	Total chicken volume (thousand tonnes)	Free range volume (thousand tonnes)	Free range as a % of retail total
2015	432.7	56.6	13.1
2016	457.9	60.1	13.1
2017	488.6	63.9	13.1
2018	503.3	63.3	12.6
2019	516.9	65.5	12.7

For 2019, volume sales of chicken through the retail sector (516.9 thousand tonnes) represent approximately one-third (33%) of total UK consumption for the year. This is based on the data in Table 12 which suggests a total consumption of around 1,551 thousand tonnes. Free range sales to non-retail sectors are expected to be minimal and so on that basis, we estimate the market share for free range chicken to be only around 3-4% of the total at present. This falls far short of the percentages assumed in the BCC scenarios that follow.

In Table 14 below, Kantar Worldpanel data for the 12 months to mid-June 2019 have been used to show chicken sales levels by volume through named UK retailers.

Table 14 Chicken sales volume and calculated market shares of UK multiple retailers

	Volume (thousand tonnes)	Percentage of all retail sales
Marks & Spencer	16.6	3.2
Waitrose	14.2	2.7
Tesco	112.9	21.8
Sainsbury's	56.8	11.0
ASDA	62.6	12.1
Morrison's	45.1	8.7
Iceland	14.0	2.7
Aldi	70.0	13.5
Lidl	50.5	9.8
Total	**442.7**	**85.5**

The total volume from these named outlets above represents between 85 and 86% of the retail total of 516,884 for 2019 (see Table 13). This is consistent with data set out in the AHDB Poultry

Pocketbook (2018)[15] which stated that 85.5% of all retail sales were through the multiples. The remainder of the retail total was sold through specialist freezer centres (4.3%), butchers (3.2%) and others (7.0%).

4.3 Future scenarios for chicken produced to BCC standards

Of the retailers listed in Table 14, at present only Marks and Spencer and Waitrose have committed to the future adoption of BCC standards. These two combined represent around 6% of all retail sales at present. However, the major restaurant chain KFC and CDG (which has a number of restaurant brands in the UK including Bella Italia, Café Rouge and Las Iguanas) are also committed. So too are the food service companies Compass, Sodexo and Elior and the food manufacturers Nestle and Unilever. Tesco have also committed to extend their range to include indoor chicken grown to BCC standards. The extent to which other retailers and food businesses will also sign the same commitment before 2026 is difficult to estimate and outside the scope of this study.

The scenarios considered in this report are set out in Table 15, together with an informal assessment of the type of businesses which may adopt BCC in each case.

Table 15 Outline of BCC scenarios and possible rationale

Market share (all sales)	Likely nature of uptake
5	Scenario based on the current free range, organic and 'high welfare' indoor market share considered to be a 'baseline' position for the purposes of this report.
25	Additional uptake by certain retailers but the majority remaining with 'standard' RT production. Adoption of BCC by more restaurant and food service buyers than are currently committed, but these still in the minority.
50	Additional uptake by more of the higher-volume retailers and by more restaurant and food service buyers.
75	All multiple retailers likely to be committed except perhaps for 'discounters'. The majority of restaurant and other buyers also specifying BCC rather than RT production standards.
100	A theoretical end-point or an agreement for universal uptake of BCC whether by agreement, by voluntary standards or by legislation.

4.4 Number of BCC chickens needed for different scenarios

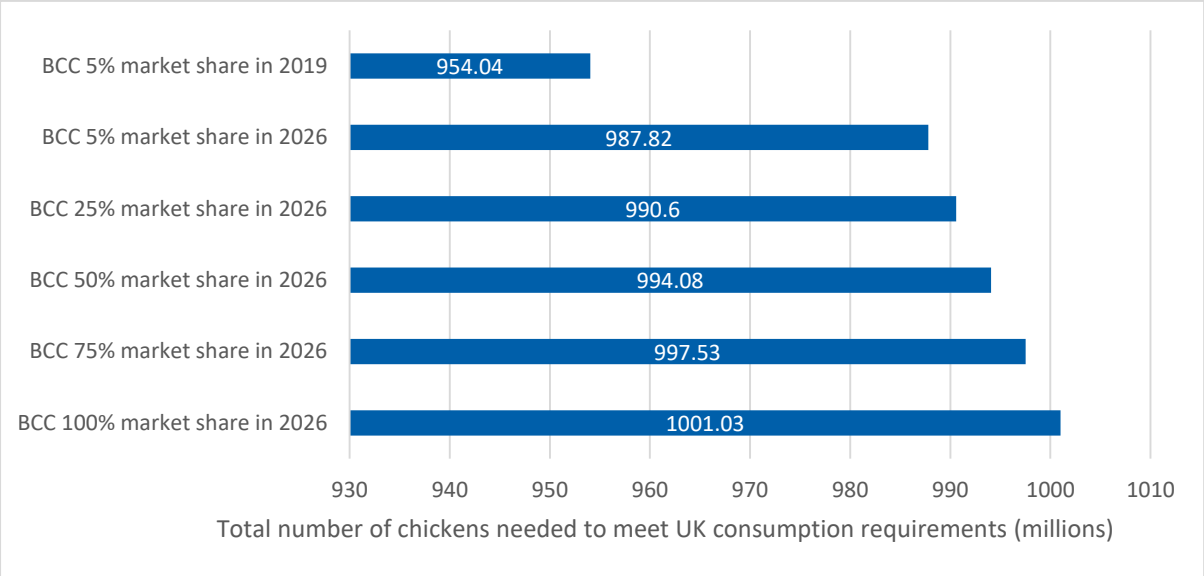
The expected growth in human population and longer growing cycles point to the need for additional chickens to be grown in future. *However, these trends are based on the important proviso that 'per capita' chicken consumption is unchanged over this period.*

Chart 1 below shows the number of chickens required annually to meet UK consumption requirements under different scenarios of BCC uptake. The consumption requirements for 2026 are

[15] https://pork.ahdb.org.uk/media/275384/poultry-pocketbook-2018.pdf

based on the forecast growth in the UK human population (see Table 12). For 2019, the 5% market share is effectively the free range and organic chicken sector. It should be noted that not all of these chickens will necessarily be grown within the UK. The data also include a small allowance for a reduction in carcass yield for BCC (see section 5.4) although it is accepted that this may not be applicable to whole carcass sales for example. Further details are given in Appendix 2.

Chart 1 Total number of chickens required to meet expected UK consumption requirements under different scenarios

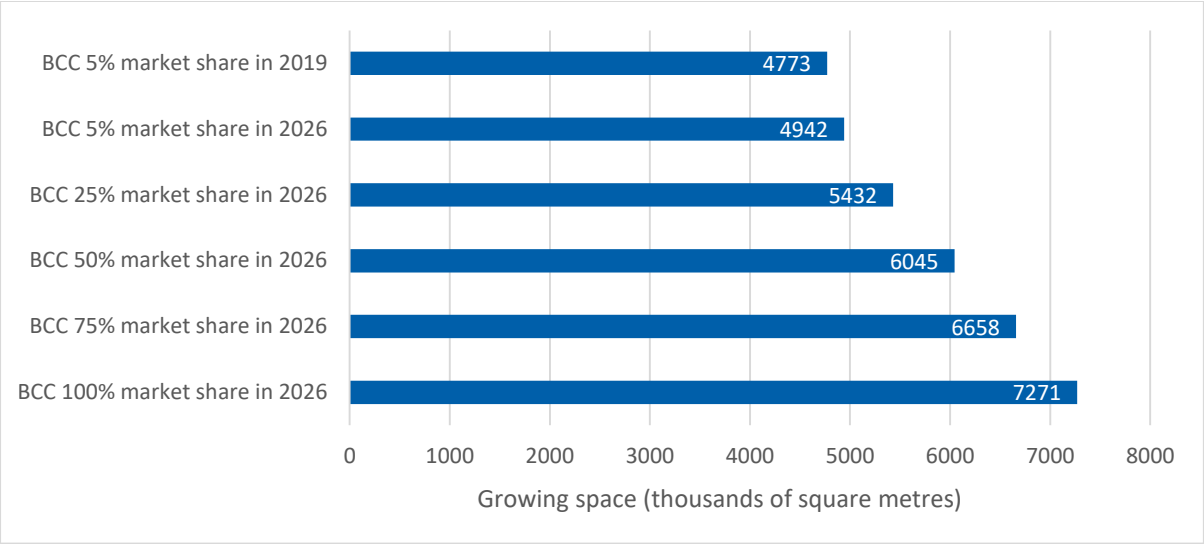


4.5 Effects on the amount of growing space needed

The expected growth in human population, together with the reduced stocking density, longer growing cycles and a small reduction in carcass yield for BCC production also point to the need for additional growing space in future. *Again, the same important proviso applies i.e. that per capita chicken consumption is unchanged between 2019 and 2026.*

On this basis, Chart 2 below sets out the amount of growing space required to meet consumption demand at present (2019) and in 2026. Further details are contained in Appendix 3. In some cases, values have been rounded for ease of reference and so calculated figures may differ slightly.

Chart 2 Total amount of growing space needed to meet 2026 scenarios



4.6 Capital requirements for additional growing capacity

On the basis of Chart 2 in section 4.5, additional growing space is required for the move to BCC standards. The amount required varies according to the scenario selected. In Table 16 below, the approximate cost of this additional growing space is calculated on the basis of a current cost of £248 per square metre of growing space (see section 3.6). This includes an allowance for infrastructure work as well as house construction and supply and fitting of equipment. The basis for these calculated growing space costs is set out in Appendix 3 and again, some rounding of individual values has been undertaken.

In practice, it is likely that much of the additional growing space required will be built close to 2026 rather than at present and therefore prices at the time may differ from those used here.

These calculations assume that current growing space – whether located in the UK or elsewhere – is fully utilised at present. If any surplus capacity of appropriate standard could be used, this would offset the need for new-build facilities.

Table 16 Calculated costs of supplying additional growing space required for each scenario

Current situation and scenarios for 2026	Additional growing space required (thousands of square metres)	Cost of additional growing space based on £248 per square metre (million £)
Growing requirements in 2019	0	Not applicable
Requirements in 2026 with 5% BCC	169.0	41.9
Requirements in 2026 with 25% BCC	659.3	163.5
Requirements in 2026 with 50% BCC	1272.3	315.5
Requirements in 2026 with 75% BCC	1885.2	467.5
Requirements in 2026 with 100% BCC	2498.1	619.5

4.7 Implications for use of compound feeds and major raw materials

Section 3.2 sets out key assumptions for feed conversion ratio and for feed use. To produce a 2.26kg liveweight bird, average FCRs of 1.58 and 1.92 are assumed for RT and BCC production respectively. This means feed consumption of 3.58kg per bird for RT and 4.35kg for BCC. The effects of the higher feed consumption for chickens produced to BCC standards are set out in Table 17 below. These cover compound feed in total and the two main raw materials used, wheat and soya. For these calculations, we have assumed that the average wheat content of broiler feeds is 64% and the average soya content is 23%.

Table 17 Additional feed required for each scenario

Current situation and scenarios for 2026	Additional compound feed required (thousand tonnes)	Additional wheat as a raw material of compound feed (thousand tonnes)	Additional soya as a raw material of compound feed (thousand tonnes)
Feed requirements in 2019	0	0	0
Feed requirements in 2026 with 5% BCC	122.2	78.2	28.1
Feed requirements in 2026 with 25% BCC	286.4	183.3	65.9
Feed requirements in 2026 with 50% BCC	491.5	314.6	113
Feed requirements in 2026 with 75% BCC	696.6	445.9	160.2
Feed requirements in 2026 with 100% BCC	901.8	577.1	207.4

4.8 Implications for sector sustainability

Table 18 compares greenhouse gas (GHG) emissions for RT and BCC production, the main sources of emissions being associated with energy (heat and electricity), feed and manures.

It can be seen that calculated emissions from the BCC system are 21% lower on a 'per square metre per year' basis (i.e. 296kg versus 363kg per year) because of the lower stocking density. However, emissions per kg of chicken liveweight are some 23% higher for BCC i.e. 1.34kg versus 1.09kg. This is mainly due to the increased feed use in the BCC system. The differences are also shown in Charts 3 and 4. On this basis, an increase in the uptake of BCC (at the expense of RT) will result in an increase in the amount of GHG emissions associated with chicken production.

Table 18 Comparison of GHG emissions between Red Tractor and Better Chicken Commitment production systems, per square metre and per kg of liveweight

	Red Tractor Standard		Better Chicken Commitment	
	Kg CO_2/m^2 per year	Kg CO_2 /kg liveweight	Kg CO_2/m^2 per year	Kg CO_2 /kg liveweight
Energy	50	0.15	46	0.21
Manures	31	0.09	25	0.11
Feed	282	0.85	225	1.02
Total	363	1.09	296	1.34

Chart 3 GHG emissions per square metre for Red Tractor and Better Chicken Commitment systems

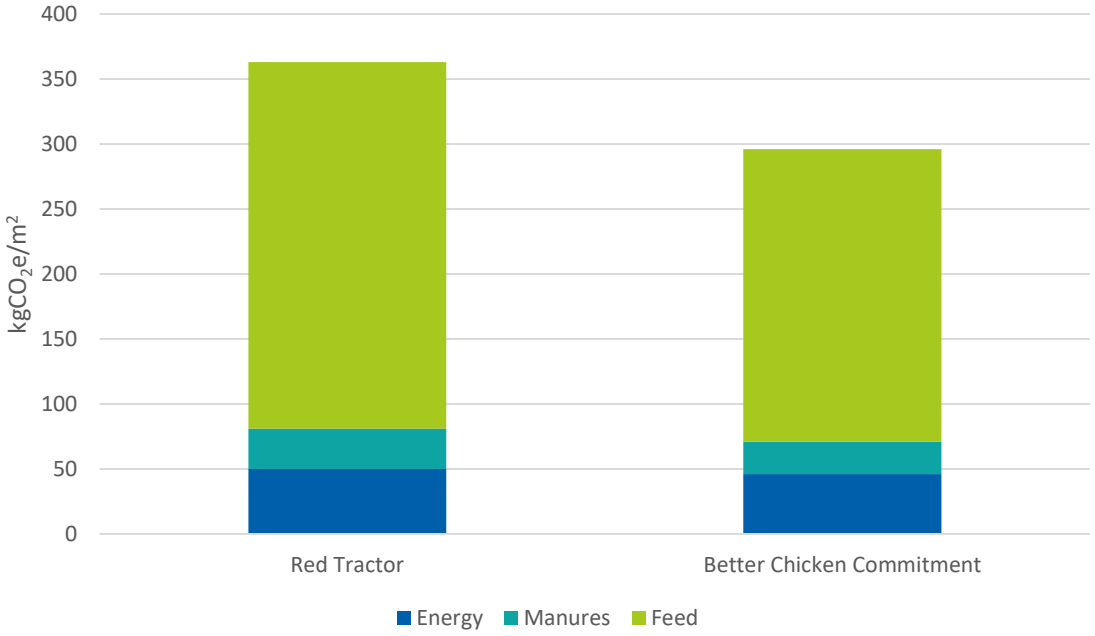
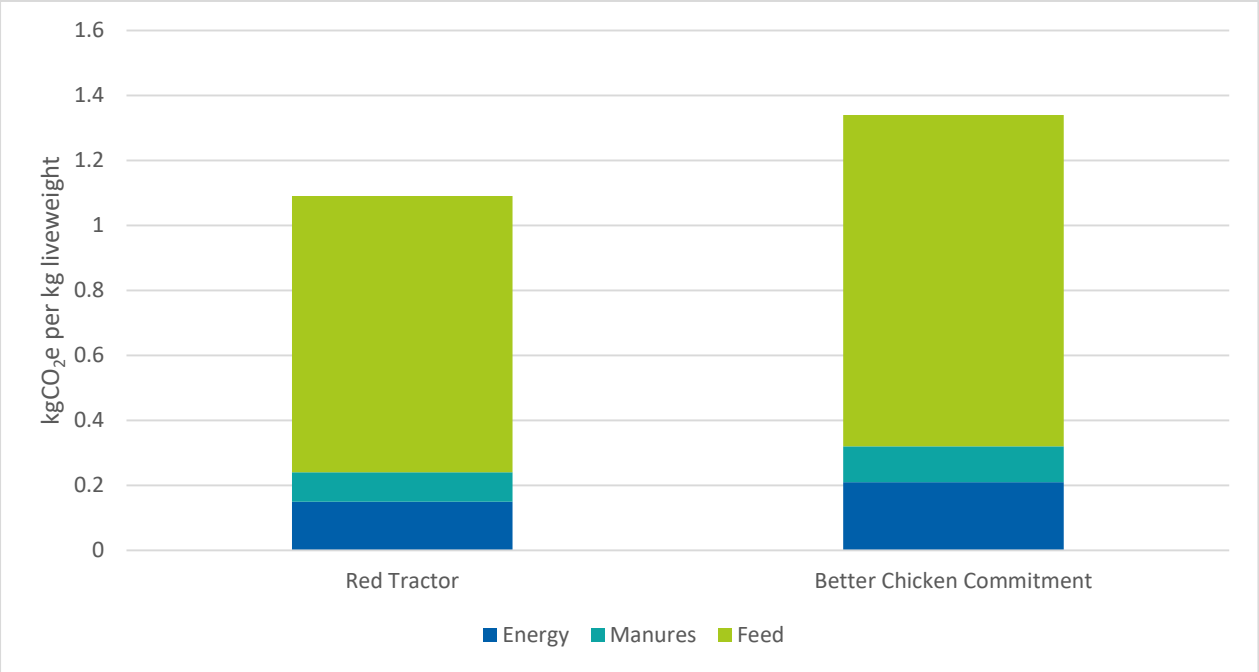


Chart 4 GHG emissions per kg live weight for Red Tractor and Better Chicken Commitment systems



4.9 Land Use

The BCC system produces a lower amount of liveweight per square metre on an annual basis. In addition, more feed is required because the FCR is inferior (i.e. higher).

For BCC, each square metre of housing produces 221 kg of liveweight per year, compared to 333 kg liveweight for RT (see Table 9). Therefore, in order to produce one tonne of liveweight per year, 4.52m^2 of growing space would be required for BCC and 3.00m^2 for RT.

To calculate the land area needed to grow the additional wheat and soya, typical yields of 8 tonnes per hectare (wheat) and 3 tonnes per hectare (soya) have been assumed. On this basis, it is calculated that the BCC system requires some 3,008 m^2 of land for growing wheat and soya per tonne of chicken produced (liveweight). This is compared to 2,475m^2 for RT production. For BCC, it is therefore concluded that to produce the same weight of chicken, nearly 22% more land would be required for the production of wheat and soya.

4.10 Water use

Water consumption of broilers is approximately 1.8 times feed consumption[16]. Therefore it is estimated that a standard RT chicken grown to 2.26kg liveweight will consume 6.4kg of water (i.e. 3.58kg of feed x 1.8) and a BCC standard chicken will consume 7.8kg of water (i.e. 4.35 of feed x 1.8). On this basis, chickens grown to BCC standards will consume 22% more water than chickens grown to RT standards.

[16] Pesti G.M *et al.,* Water Consumption of Broiler Chickens under Commercial Conditions. Poultry Science 1985; 64(5):803-8.

5 ADDITIONAL CONSIDERATIONS

The adoption of Better Chicken Commitment standards raises a range of other issues. These are briefly reviewed below in order to provide a broader perspective for future discussions.

5.1 Consent for new buildings

If additional growing space is required then new developments will be conditional upon gaining planning consent. It is almost certain too that an environmental permit will have to be obtained or varied as a result. These requirements will still apply even if the number of birds placed is not increasing.

Both of these requirements can be major obstacles to development since new poultry facilities can have a range of environmental impacts and implications for neighbours and protected sites. In some cases, proposed developments may not be possible, either because of a failure to gain planning consent or a failure to obtain or vary an environmental permit.

In both cases, there may be differences in requirements between different countries within the UK (e.g. differences in Wales compared to England) and even between different parts of the same country. This could mean disproportionate numbers of new developments in some areas at the expense of others. The need for additional housing will increase the visible 'footprint' of poultry buildings and may give the impression of sector expansion, even if this is not actually the case.

If there are major difficulties in gaining the necessary consent in the UK, it is possible that more of the additional growing capacity will be filled by exports from countries where new developments are easier and cheaper to undertake.

Conversely, if chicken consumption levels decline as a result of higher purchase prices, then fewer new buildings will be required. If this decline is extreme, it could even result in some existing growing space becoming redundant.

5.2 Changes to existing buildings

The assumption is made that the requirements for windows in the BCC are the same as those in place or planned in the RT standards and therefore no additional costs have been included in respect of these.

It is unclear whether the stated requirement in BCC for at least 50 lux of light should be considered a minimum across all areas of each house or whether achieving 50 lux across parts of the house only is permissible. In this report, it is assumed that windowed houses would be able to achieve this 50 lux across most areas of the house and so no additional costs for changes have been included. If a minimum of 50 lux light intensity is required throughout each house, wide houses (in particular) may not be compliant and substantial costs could apply due to additional light fittings being required.

5.3 Possible removal of thinning

If thinning continued to be permitted in RT production but was prohibited in BCC, the cost of production differences between the two systems would increase.

Table 19 below shows the effect that a 'no-thinning' stipulation in BCC production would have upon stocking, throughput and costs. To provide comparable scenarios, it is assumed that the average liveweight of birds taken from 'no-thin' BCC systems is 2.26kg and that it takes 49 days to reach that

weight (i.e. the same as 'thinned' BCC systems). On that basis, as no birds are removed during the growing cycle, the number of day olds placed must be reduced. In practice, bird output and cost calculations are based on 13.27 birds per square metre (i.e. 30 / 2.26) compared to 16.22 for 'thinned' BCC systems and 20.5 for RT standard systems.

The difference in the number of birds placed per square metre means that the total output from 'no-thinning' BCC systems is substantially reduced i.e. 180.1kg compared to 220.9kg per square metre per year for BCC 'thinned' systems.

When calculating the costs it was assumed that the physical performance of the birds and production cost inputs are the same for 'no-thinning' as for 'thinned' BCC systems. The only exception was heating, which was assumed to be 18% more than 'thinned' BCC systems, due to 18% fewer birds being stocked per house. Other performance and cost differences may be expected however. For example, lower mortality may be expected in 'no-thinning' systems due to the absence of stress caused by the thinning process and the reduced stocking density. Similarly, labour requirements may also be reduced due to lower mortality, fewer culls and reduced pressure on the litter. However, for the purposes of this comparison these potential differences were not considered.

In total it costs £2.52 to produce a BCC bird without thinning compared to £2.14 with thinning. Accordingly on a 'per kilogram' basis, it costs £1.12 compared to £0.95 respectively. This means that on average it costs 18% more to produce BCC chicken without thinning than with thinning. Compared to chicken grown to RT standards, on average a 'no-thinning' BCC chicken would cost 39% more to produce.

Table 19. Differences in stocking rate, output and production costs between RT and BCC standards with and without thinning.

	Red Tractor	Thinning at 1.85 kg liveweight	No thinning
Maximum stocking density (kg per square metre)	38	30	30
Maximum day-old placements (birds per square metre) based on 2.26 kg average liveweight	20.54	16.22	13.27
Liveweight (kg) per square metre per year	333.3	220.9	180.1
Production cost per bird (£)	1.81	2.14	2.52
Production cost per kilogram liveweight (£)	0.80	0.95	1.12

5.4 Carcass yield and balance

Industry data indicates that the overall carcass yield is slightly lower from breeds used in BCC production than it is for the standard birds used in RT production. On the basis of data provided, the

eviscerated weight is likely to be about 1% lower, going from around 72% to 71%. For a bird at 2.26 kg liveweight, this means that the eviscerated weight would be around 22 grams lower.

This would have a marginal effect on the overall value of the carcass. Kantar data for 12 months to mid-June 2019 indicates that the volume of retail sales of chicken amounted to some 516.9 thousand tonnes (see Table 13) and that the value of this was £1,978.4 million. On this basis, the calculated average value of chicken at retail level is £3.83 per kg and so a 22g difference would be worth around 8-9 pence per bird.

In addition, there are likely to be differences in the carcass balance between standard and slow-growing birds. Current industry data suggests that the percentage of breast meat is substantially lower in slow-growing birds with some estimates putting these at around 25% and 18% respectively of the total weight i.e. a difference of 7%. Conversely, thigh and drumstick yield are both likely to be higher in slow-growing breeds. It is understood that on-going studies are attempting to clarify the extent of these differences.

Kantar data (as above) indicates the annual retail volume of chicken breast meat to be 177 million tonnes and the value to be £1,076 million. On this basis, the calculated average retail value of breast meat is £6.08 per kg. For leg meat only, comparable figures are 105 million tonnes (volume) and around £302 million (value) from which an average of £2.86 per kg is calculated.

It follows therefore that if sold as pieces rather than whole, there would be less retail value in a carcass with less breast meat and more leg meat. Table 20 below shows the nominal value implications of each 1% change in both breast and drumstick meat. In this Table, no allowance has been made for possible differences in overall carcass yield. From this, it can be seen that each 1% change could result in a 5 pence difference in value, in favour of RT production. On this basis, a 5% reduction in breast meat yield could result in a difference of 25 pence if the carcass was sold in pieces.

Table 20 Effect on carcass value of each 1% change in the yield of breast and leg meat in RT and BCC production

	Red Tractor	Better Chicken Commitment
Breast yield (%) for a 2.26kg liveweight bird with assumed 72% eviscerated weight	25	24
Weight of breast meat (kg)	0.407	0.391
Breast meat value (based on £6.08 per kg)	2.47	2.37
Drumstick yield (%) for a 2.26kg liveweight bird with assumed 72% eviscerated weight	12.5	13.5
Weight of drumstick (kg)	0.203	0.220
Drumstick value (based on £2.86 per kg)	0.58	0.63
Total breast meat + drumstick value	£3.05	£3.00

It has also been reported that the shape of the breast fillet from slow-growing birds is different to that from standard birds. For slow-growing birds, the shape is described as being longer but thinner. At present, this can lead to difficulties with packaging and in some cases, breast fillets from slow-

growing birds may need to be trimmed so that they fit within currently-used packs. Whilst packaging difficulties could be overcome in future, it may mean that additional packaging lines are needed.

This study has not considered potential differences in meat texture and taste which could also affect the value of the carcass.

5.5 UK trading implications

Kantar data for the 12 month period to mid-June 2019 shows that at retail level, volume sales of whole chicken represent around 43% of the total whilst chicken pieces comprise around 56%. In terms of value over the same period, whole chicken accounted for 28% and pieces for 70%. This illustrates the importance of pieces over whole carcass sales and the additional value achieved. The UK is traditionally a net importer of 'white' (breast) meat and a net exporter of 'dark' meat.

Further analysis of the same Kantar data shows that the total retail value of breast meat in Great Britain was around £1,076 million whilst the combined value of leg meat and wings was much lower at around £320 million. Whilst there is a slight difference between the proportions of breast (around 25% of the total) and leg plus wing pieces (around 22%) in the carcass of standard birds, this difference is small compared to the difference in value. The value of breast meat is seen to be over three times higher.

Whilst the retail sector represents only around one-third of all chicken sales, these trends alone indicate that the reported lower breast meat yield of slow-growing birds could have at least some effect on future trade and on the balance between imports and exports.

It is understood that in the Netherlands – where there is more use of slow-growing birds – efforts have been made to encourage sales of dark meat. A similar programme in the UK may help to ensure a more balanced demand for different parts of the carcass.

5.6 Business confidence to invest

If the slow-growing market is to expand, breeding companies must have the confidence to invest in the future development of their slower-growing strains on the basis of long-term market requirements. The number of parent breeding stock in the UK would need to be rapidly increased. For a while, this may mean fewer commercial birds being available as more birds are directed to meet breeding requirements. At present, our understanding is that there are no grandparent breeder flocks of the Hubbard slow-growing strains in the UK. This means that parent breeder stock is currently imported which creates some uncertainty and less control over future supplies.

If additional growing space is required, then businesses and individuals must have the confidence to invest and it must be possible to secure the necessary finance. Based on the example used in this report of a single house with 2,400m² of growing space, a cost at £248 per square metre means a capital cost in excess of £0.5 million.

In order to make an appropriate investment decision, there must be confidence in the long-term viability of the proposition and security that the necessary market demand is there. At present, uncertainties surrounding the UK's future relationship with the European Union may raise questions about the country's future economic prospects. Specifically, concerns over a possible economic recession may raise questions both over whether current chicken consumption levels will be retained and whether buyers and consumers will remain committed to paying more for BCC production than they currently do for RT.

An indication of the likely effects of recession on consumption levels of chicken and consumers' willingness to pay for premium products could be gathered from an analysis based on data relating

to the most recent UK recession of 2008-9. The relationship between price and demand for chicken is likely to be a complex one and outside the scope of this report. However the data presented here could be used as a basis for a separate economic study of possible implications.

6 CONCLUSIONS

In this section, the key findings are drawn together in Table 21 below to provide a clear comparison between the two systems.

Table 21 Main features and differences between RT and BCC production

Feature (to produce a 2.26kg liveweight chicken)	Comparison between Red Tractor (RT) and Better Chicken Commitment (BCC) standards	Reference(s) in report
Cost of production	£1.81 for a chicken grown to RT standards and £2.14 for a chicken grown to BCC standards. This represents an increase of around 18% for BCC.	Table 10 and Appendix 1
Growing cycle length	39 days for RT and 49 days for BCC.	Table 5
Feed conversion ratio and feed use	FCR of 1.58 for RT and 1.92 for BCC, this difference representing 770 grams more feed being required for a BCC chicken.	Table 6 and section 3.2
Mortality	A 1% difference in favour of BCC has been used in this report based on industry experience and views.	Table 7 and section 3.3
Additional growing space required in 2026	Compared to a 'baseline' scenario for 2026, additional growing space is calculated as 490,000m² if BCC reaches 25%, rising to 2,329,000m² if BCC reaches 100%.	Chart 2 and section 4.5
Cost of additional growing space in 2026	Compared to a 'baseline' for 2026, the cost of the additional space is calculated as £164m if BCC reaches 25%, rising to £620m if BCC reaches 100%. These values are based on an average current capital cost of £248 per m².	Table 16
Greenhouse gas emissions	1.09kg of CO_2 per kg liveweight for RT and 1.34kg of CO_2 per kg liveweight for BCC. This represents an increase of around 23% for BCC.	Table 18
Land use	2,475m² of land is needed to grow wheat and soya to produce one tonne of RT chicken and 3,008m² is required for BCC. This represents an increase of around 22% for BCC.	Section 4.9
Water use	Water use is calculated to be 22% higher for BCC than RT	Section 4.10
Carcass yield	72% for standard chickens in RT and 71% for slow-growing chickens in BCC. This difference is equivalent to around 22 grams, which could be worth 8-9 pence per bird at retail level.	Section 5.4
Carcass balance	Slow-growing chickens have a lower yield of breast meat but more leg meat. Each 1% change between the two could result	Table 20

	in a 5 pence difference in value per bird at retail level.	

APPENDIX 1

Precise production costs differences for RT and BCC standards

	Red Tractor		Better Chicken Commitment	
	Cost per bird (£)	Cost per kg (£)	Cost per bird (£)	Cost per kg (£)
Chick	0.364	0.161	0.360	0.159
Feed	0.983	0.435	1.196	0.528
Labour	0.035	0.016	0.056	0.025
Water	0.010	0.005	0.013	0.006
Electricity	0.020	0.009	0.025	0.011
Heat	0.040	0.018	0.058	0.026
Litter	0.035	0.016	0.044	0.020
Repairs and maintenance	0.025	0.011	0.040	0.018
Vaccines	0.016	0.007	0.015	0.007
Medication	0.021	0.009	0.010	0.005
Site preparation and clean out	0.044	0.019	0.055	0.024
Interest and capital	0.174	0.077	0.217	0.096
Overheads and miscellaneous items	0.038	0.014	0.054	0.024
Total	**1.812**	**0.800**	**2.144**	**0.947**

APPENDIX 2

Calculation of the number of chickens required for each scenario

	2019 (current situation)	5% market share for BCC in 2026	25% market share for BCC in 2026	50% market share for BCC in 2026	75% market share for BCC in 2026	100% market share for BCC in 2026
Human population (UK, millions)	66.867	69.235	69.235	69.235	69.235	69.235
Total UK chicken consumption (thousand tonnes)	1,551.3	1,606.3	1,606.3	1,606.3	1,606.3	1,606.3
Number of RT chickens (millions)	905.7	937.8	740.3	493.6	246.8	0
Number of BCC chickens (millions)	48.3	50.1	250.3	500.5	750.8	1,001.0
Total number of chickens (millions)	954	987.9	990.6	994.1	997.6	1,001.0

APPENDIX 3

Calculation of the amount of growing space required for each scenario and additional capital costs

	2019 (current situation)	5% market share for BCC in 2026	25% market share for BCC in 2026	50% market share for BCC in 2026	75% market share for BCC in 2026	100% market share for BCC in 2026
Human population (UK, millions)	66.867	69.235	69.235	69.235	69.235	69.235
Total UK chicken consumption (thousand tonnes)	1,551.3	1,606.3	1,606.3	1,606.3	1,606.3	1,606.3
Approximate annual average output of chicken per square metre[17]	327.7	327.7	305.2	277.1	249.0	220.9
Approximate growing space requirement (thousand square metres)	4,773	4,942	5,432	6,045	6,658	7,271
Additional growing space compared to 2019 (calculated)	0	169.0	659.3	1272.3	1885.2	2498.1
Calculated cost of extra growing space based on £248 per m² (million pounds)	0	41.9	163.5	315.5	467.5	619.5

[17] This is based on 333.3kg per m² for Red Tractor and 220.91kg per m² for Better Chicken Commitment, see also Table 9.