SP-01

Health and production benefits in veal calves born from NCD and BRD vaccinated cows

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Objectives: Neonatal calf diarrhea (NCD) and bovine respiratory disease (BRD) are the most important health problems in veal calves. Given the increased pressure to reduce intensive antimicrobial use, vaccination may be an efficient measure to reduce the use of antibiotics in the treatment and prevention of BRD and NCD in young animals. Passive immunity transfer from vaccinated dams may be applied for the prevention of NCD whereas BRD protection can be provided by vaccinating the calves but also by passive immunity transfer.

The objective of this study was to measure the benefit of vaccinating pregnant cows against NCD and BRD (Rotavec® Corona and Bovilis® Bovipast RSP) on the health and production in veal calves.

Materials and methods: 211 calves that received adequate colostrum from cows vaccinated with inactivated multivalent vaccines against NCD (Rotavec Corona) and BRD (Bovilis Bovipast RSP) (V2+) and 220 calves without known history (V-) were equally divided over 10 veal farms at an age of at least 14 days and compared for clinical NCD, BRD, weight and general condition at 3 (d3) and 45 (d45) days post arrival, antibiotic treatments, mortality and carcass weight.

Results: At d3, V2+ (11.4%) had less clinical BRD compared to V- (19.1%) (P=0.028). The weight at d3 was higher (P=0.026) in V2+ compared to V- and the calves in V2+ were in better condition. The mortality in V2+ (2.8%) was significantly (P=0.01) lower than V- (11.8%). The odds of mortality in V2+ was 4.57 times lower than in V- (P=0.01). V2+ received about one antibiotic treatment less compared to V- (P=0.02) (3.5 versus 2.9). All other measured parameters were not statistically significant different, which is not surprising for NCD at d3 and d45 post arrival as NCD occurs mainly before arrival at the veal unit.

Conclusions: This study clearly describes several health and production benefits in veal calves receiving adequate colostrum from mother cows that were vaccinated against NCD and BRD (respectively with Rotavec Corona and Bovilis Bovipast RSP). It reinforces the interest to strengthen the relationship between the dairy and veal sector, in order for health investments in dairy calves (e.g. vaccination) to be appreciated by the benefiting veal producers.

Keywords: Veal, mother vaccination, BRD, scours, benefits.

SP-02

Age at First Calving in UK Jerseys; Impact on First Lactation 305-day Milk Yield, Lifetime Daily Milk Yield, Calving Interval and Survival to Second Lactation

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Objectives: To determine the association between Age at Fist Calving (AFC) and production, fertility and survivability in Jersey heifers, and to compare this with published literature on Holstein heifers

Material and methods: Lactation records from 7255 pedigree Jersey heifers from 471 UK milk recorded herds, calving for the first time from 1st January 2009 to 31st December 2010, were examined. Heifers were grouped by AFC into 4 groups comprised of AFC 18-24 months, 25-26 months, 27-29 months, and 30-36 months. Mixed effects multivariable regression modelling and binary logistic regression modelling was used for data analysis.

Results: Increased Lifetime daily yield (LDY) was significantly associated with a reduced AFC; heifers calving at 18-24-month-old produce 9.87 kg milk/day (mean) (CI: 9.64-10.11) (P=<0.000001), nearly 1 litre more than those calving at 30-36 months (mean 8.94kg; CI: 8.72-9.16). Calving UK Jersey heifers at 24 months or below is optimal. There was some evidence that lower AFC may be associated with enhanced fertility; heifers calving at 25-26 months had a significantly lower mean calving interval (391 days; CI 386-397) than those calving over 30 months (399; CI 394-405) (P=0.03). Heifers with an AFC over 30 months were less likely to survive to second lactation than those with an AFC 18-24 months; odds ratio 1.75 (CI 1.38-2.23) (P=<0.0001) more likely to fail to reach second lactation than heifers calving at younger ages.

Season of first calving had a significant impact. Spring calving heifers produced significantly less milk per day (9.87kg; CI: 9.64-10.1) than Autumn (10.18; CI: 9.94-10.41) or Winter calvers (10.07; CI: 9.84-10.3) (P=<0.01). Heifers that calved in the winter had a significantly shorter calving interval (389 days; CI: 394-383) (P=<0.01) than heifers calved in any other season.

Conclusion: The results of this study show the importance of achieving a low AFC which was associated with increased lifetime daily milk yield, improved reproductive performance and increased odds of calving for the second time. Calving heifers over 30 months is associated with significantly poorer survivability, fertility and lifetime production parameters. The impact of AFC on Jersey production, fertility and longevity traits shows a similar to trend to that seen in the Holstein, though potentially on a lesser scale.

Keywords: AFC, Jersey, heifers, UK, dairy.

A randomised control trial to explore the effect of overall space allowance in adult dairy cow housing on reproductive performance, behaviour and milk yield

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Objectives:

- To support the evidence base on optimal methods to house dairy cows.
- To evaluate the impact of living space on dairy cow reproductive performance, behaviour and production.
- To evaluate the extent to which the impact depends on parity and days in milk.

Materials and Methods: A randomised [1:1], controlled, long term (364 day), parallel-group, cross-over study designed to evaluate the superiority/ inferiority of a spatial intervention was undertaken. This research was conducted in accordance with government regulations under a Home Office License, in a unique, purpose-built facility, which allowed precise measurement and configuration of the housed area. The study had a cross over design to account for differences between pen location.

Cows were matched based on parity and days in milk (±3days for cows ≤ 2nd parity, ±5days for cows ≥ 3rd parity) then randomly allocated into a control group (total: 9m^2 per cow, living space: 3m^2 per cow; based on GB median) and high space group (total: 14m^2 per cow, living space: 6.5m^2 per cow; based on GB upper 95%ile). The environment was controlled and matched for each group, excluding floor space allowance. A mirror image set-up was used to place the water trough area, electric brush and mineral access. Feed-face length, cubicle stocking density and design were identical. Both groups experienced the same management routines.

Data collection included insemination data and key reproductive events (e.g. conception), ultrasound scanning in early lactation, anti-Mullerian hormone (AMH) blood sample at week 5 for ELISA and milk sampling (3x per week at 14-84DIM) for progesterone ELISA. Production data was recorded via Lely Astronaut A4's, to provide daily yield per cow, alongside rumination time and weight. Cows were fitted with location sensors providing position and acceleration data for each cow using a novel wireless sensor system (Omnisense Series 500 Cluster Geolocation System) every 7s. Direct comparisons were made between time budgets for both groups. Key behavioural activities analysed were time spent in designated areas such as loafing areas, freestall and environmental enrichment use.

Data analyses were undertaken in R statistical software, including survival analysis, mixed-effects-modelling, non-linear regression and bootsampling methods.

Results: Compared to cows in the commercial average space (control group), cows in the high-space group produced more milk per 305-day lactation (first parity cows; 12,235L vs 11,592L, P<0.01, parity >1 cows 14,746L vs 14,644L, P<0.01).

There was a difference in median time to conception between groups; the control group median was 101 days (95%CI: 82-143 days) and high-space group 134 days (95%CI: 105-202 days), with a P-value of 0.02. A Cox-proportional hazards model revealed a reduced time to conception in the control compared to high-space group (hazard ratio 0.6, 95%CI: 0.35-0.94, p=0.03). Pregnancy rates (number of conceptions/inseminations) in the control vs high-space group were 40% and 25% respectively (p=0.049). Commencement of luteal activity (based on milk progesterone concentrations) showed no significant difference between groups; medians were 39 days for control and 38 days for high-space groups. No differences in time to first service, week 5 AMH concentrations, endometritis scores or antral follicle counts between groups were detected.

Cows with greater living space availability spent more time in lying (64 minutes/d) and feeding (10 minutes/d) areas, and less time in passageways (67 mins/d).

Conclusions: This is the first long term study in dairy cows to demonstrate that increased living space results in meaningful benefits in terms of productivity and behaviour. However, the cows with greater living space took significantly longer to conceive than cows in the control group, despite no detectable changes to underlying reproductive physiological parameters. Living space is a basic requirement for all housed dairy cows yet its fundamental impact on physiology, health, reproduction and welfare has been scarcely researched. It is likely that additional living space will be of benefit to adult dairy cows but further research is required into generalisability and cost-effectiveness of providing increased space to ensure it's sustainable.

Keywords: Dairy cow, housing, production, behaviour, reproduction.

Motivation of dairy farmers to engage in primary prevention: current situation, drivers, and perceived constraints

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Objective: While bovine veterinary medicine was traditionally focused on treatment of diseased animals, disease prevention is currently generally accepted as the preferred strategy, as this approach is favorable for animal welfare, highly appreciated by the general public, and also economically attractive for farmers. Instead of allowing diseases to occur and prevent it from getting worse (tertiary prevention), or to prevent it from re-occurring in the future (secondary prevention), primary prevention, is implemented before the occurrence of any clinical or subclinical disease. Despite the benefits of primary disease prevention, it remains challenging for many veterinarians to convince farmers to focus on it. This study was designed to explore underlying psychological constructs to be

able to understand why farmers do or do not (yet) engage in primary preventative practices. Such underlying factors can both facilitate and hinder the performance of primary prevention practices.

Materials & Methods: We conducted an online survey in 15 Dutch veterinary practices. We used three established frameworks in our study: the Transtheoretical model, the Theory of Planned Behavior, and the Capabilities-Opportunities-Motivation-Behavior model.

The survey included close-ended questions probing the relevant psychological constructs from the three guiding frameworks, open-ended questions to allow respondents to provide additional in-depth information about either claw or calf health, and questions about specific preventative behaviors. Responding farmers were randomly assigned to questions on the prevention of claw or calf diseases. For claw health, the explored specific behaviors were keeping floors dry and clean; preventive claw trimming; and preventing overcrowding – for calf health, these specific behaviors were feeding colostrum within 2 hours after birth; using a separate maternity unit; and cleaning the calf hutches after every use.

Results: Respondents were 226 dairy farmers: 111 were assigned to questions on the primary prevention of claw disease, while the remaining 115 completed questions on the prevention of calf disease.

Most dairy farmers appeared to be in the action and maintenance stages of change, with about 70% already engaging in primary preventative behavior regarding claw or calf health. In addition, dairy farmers viewed preventative behaviors in general highly favorably and were highly motivated to perform primary preventative behaviors. Together, this shows a strong willingness to engage in primary prevention to promote claw and calf health among the target group. Results also indicated that there are factors which hamper farmers' ability to consistently engage in all targeted behaviors. These were, primarily, the limited importance of unsupported social norms (i.e. seeing other farmers engage in preventative behaviors and feeling like performing preventative behaviors is supported by others), confined available resources (i.e. time, equipment, facilities), and low habitualness of the behavior (the extent to which a behavior is engrained and performed almost automatically). These are thus important factors to target with tailored interventions, since improving upon them is likely to lead to increased preventative behavior.

Conclusion: We found that participating farmers had a strong willingness to engage in primary prevention, which could be supported by increased the importance of social norms, available resources, and engraining of preventive behavior.

Keywords: Drivers, constraints, primary prevention, dairy farmers.

BRD vaccination strongly reduces the use of antibiotics in Dutch dairy calves

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Objectives: A substantial portion of antibiotics applied in the dairy sector are used for controlling respiratory diseases (BRD) in young stock. Vaccination against BRD pathogens may be a strategy to reduce antibiotics, and therefore an optimization for long-term performance of dairy cattle. In this field observational study, the antibiotic use in young stock on several Dutch dairy farms was measured depending on the used BRD vaccination program.

Materials and Methods: 250 Dutch dairy farms were involved. In 159 farms calves were treated against BRD and/or vaccinated against BRD. These 159 'BRD' farms were divided in 3 groups depending on the BRD vaccination protocol. Group A did not vaccinate, group B vaccinated only in autumn with an inactivated multivalent BRD vaccine (Bovilis® Bovipast RSP) and group C vaccinated all year round with the same vaccine. The antibiotic treatment percentage (TP) was calculated as the number of calves of 60kg bodyweight that could theoretically be treated with the amount of antibiotics actually used in 2017 to treat BRD in young animals divided by the number of calves born in 2017. Groups were compared for the number of farms that had an antibiotic treatment percentage higher than 20 (TP>20).

Results: Only 63 (40%) of the 159 'BRD' farms had a BRD vaccination program. Group A, B, and C had respectively 96, 36 and 27 farms. The TP>20 was respectively 84%, 47% and 26% for group A, B and C (p<0.001). The TP>20 was significantly different between group A and B (p<0.001) and between group A and C (p<0.001), but not between group B and C (p=0.14). The odds to have TP>20 is 83% lower in group B compared to group A, and 94% lower in group C compared to group A (p<0.001).

Conclusion: This study clearly demonstrates the potential of vaccination with a multivalent inactivated BRD vaccine (Bovilis Bovipast RSP) to reduce the antibiotic use in dairy young stock. In this study, a strong reduction was seen in the antibiotic treatment percentage of farms using this vaccine, with the strongest reduction on farms vaccinating all year round.

Keywords: BRD vaccination, reduction antibiotics, dairy calves.

SP-06

Color values as a potential tool for the assessment of raw milk quality and its technological aptitude in cheesemaking

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Objective: This study aims to determine milk hygienic status, composition and coagulation parameters by measuring its color values in order to assess if colorimetry could be used as an effective, quick and economical tool to predict *in situ* quality of raw bovine milk.

Material & methods: This study included the analysis of 1045 individual milk samples from 20 dairy farms located in the Republic of Ireland. Milk samples were collected at similar moments of lactation from heifers and cows from a of wide range of parity groups and with different health statuses. Milk was analyzed using the CIELAB space, which is considered the traditional method for an objective quantification of food color and has been previously used to evaluate bulk tank milk (Jiménez Sobrino et al., 2018). This system expresses color as 3 values: L* (lightness), a* (red/green value) and b* (blue/yellow value) (ISO/CIE 11664-4, 2019). In addition, CIELCh (the cylindrical representation of the CIELAB system) combines lightness with 2 other additional values to represent color: C* (chroma or saturation) and h* (hue). The color of the milk can vary greatly and depends to a large extent on its physical structure, the fat content and the pigmentation due to the presence of carotenoids and riboflavins. Color values of milk were measured with a PCE-CSM2 Color Meter (PCE Instruments Ltd., Southampton, UK) by placing the lens directly over a capsule containing the milk sample, following the methodology used by Figueroa et al. (2019).

Results: After statistical analysis, variables that showed a higher discriminant ability were L*, a* and b*. Preliminary results reveal that color values of milk reflect to a large extent variation in milk composition and the efficiency of the coagulation process. Color values seem to show a predictive ability similar to traditional technologies for quantification of milk quality, such as infrared spectroscopy technologies (for determination of milk composition), or the *Formagraph* lactodinamograph (for monitoring milk coagulation). However, colorimetry appears to provide lesser information on raw milk hygienic quality.

Conclusions: Colorimetry of milk has proved to be a useful tool to reflect variations in milk quality. This method can therefore be considered as an effective test to supplement conventional analysis. In addition, further development and implementation of this test as a low-cost portable technology in farms or dairies would allow better control of raw milk and contribute to the development of precise product characterization (at hygienic, nutritional and technological level).

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SP-07

Post-partum cow milk microbiota: effect of dry cow antimicrobial treatment

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Objective: Given the increased scrutiny of antimicrobial use in livestock due to potential selection for antimicrobial resistance in bacteria, research on the effects of antimicrobial usage on the mammary gland and milk microbiota is vital. The goal of this study was to evaluate the effect of dry cow antimicrobial therapy on the udder milk microbiota by comparing the microbial populations in milk at dry-off (~60 days before calving) and post-partum from cows receiving intra-mammary antibiotic infusion and cows that did not receive therapy.

Methods: Aseptic composite milk samples were collected as part of a selective dry cow therapy trial from 3 commercial dairy farms in California's Central Valley for the purpose of the current study. Samples were stored at -20ºC. Cows with clinical signs of mastitis at enrollment (dry-off) were excluded. Milk samples from 23 cows from the intra-mammary therapy (IMT) group receiving either cephapirin benzatine or sodium cloxacillin and 27 cows from the control (CTL) group that did not receive any IMM therapy were utilized for our study. All cows were sampled at dry-off (DRY) and 4-11 days post-partum (FRESH). Whey and fat was separated from milk, and DNA was extracted using DNeasy PowerSoil Kit (QIAGEN). Library preparation and 16S rRNA gene sequencing of the V4 hypervariable region was conducted using the Illumina Miseq platform.

Results: Initial stepwise discriminant analysis between IMT and CTL group at DRY and FRESH time points did not show significant difference in the abundance of the microbial populations at the phyla level. The 4 most common phyla for any sample point or therapy group were Firmicutes, Proteobacteria, Bacteroidetes, and Actinobacteria. Further analysis

will evaluate differences in microbiota abundance at different time points and therapy groups for lower taxonomic ranks. Richness and Shannon diversity will also be calculated.

Conclusions: Our initial analysis indicated that IMM dry cow therapy may have minimal impacts on the microbiota at the phylum level. Further analysis of the data will determine if this trend continues at lower taxonomic ranks.

Keywords: Dry cow treatment; milk microbiota; antibiotic resistance.

Male Lidia cattle morphometric study using photogrammetry technique

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Objectives: Lidia cattle constitute an autochthonous breed whose production has great economic and social importance in Spain, Portugal, southern France and some Latin American countries. In Spain, it is the most numerous autochthonous bovine breed and the second, in censuses, after the Friesian. Although in recent years the knowledge about the different genetic variety or *encastes* of Lidia breed has increased substantially, still there are only a few morphometric and zoometrical studies because the difficulty of applying the techniques commonly used in other cattle breeds. The particular patterns of behavior called *bravura* and the extensive rearing conditions made impossible the handling and restraining necessary for the realization of traditional manual measures using standard zoometric tools such as sticks, non-elastic measuring tape, compass, goniometers and calipers.

Considering all of the previously mentioned difficulties the aim of this study was to carry out a first approach to the morphological characterization of the males of Lidia breed using a novel technique for zoometric measurements, called photogrammetry.

Materials and Methods: A total of 184 bulls, 4 to 6 years old, from 21 herds representatives of the 15 genetic lines Miura, Pablo Romero, Veragua, Murube, Santa Coloma-Buendía, Santa Coloma-Graciliano, Gamero Cívico, Conde de la Corte, Atanario-Lisardo, Domecq, Torrestrella, Núñez, Albaserrada, Vega-Villar and Navarra, were used in this study. Farms were chosen for their genetic purity and their clearly belonging to an *encaste* reflected in the racial prototype.

The animals were photographed from a distance between 10 to 15 meters, to minimize the risk for operator and the disturbance of the animals, with a three cameras photogrammetric equipment, patented by our research group, adapted for both arena and farm conditions. The photographs were further processed and transformed into three dimension files with software PhotoModeler Scanner 2010© for Windows©. For each bull 20 standardized morphological measurements were obtained following the reviewed literature standars. A descriptive statistical analysis, ANOVA and determination of Pearson correlation coefficients of the measurements were performed using SPSS® 19.0 package for Windows©.

Results: Fighting bulls can be described as mid-sized compared with bovine species with a mean height at withers of 128 ± 7.7 cm with significant differences between the smallest *encastes* Vega-Villar (111 ± 3.5) and Navarra (113 ± 6.9) and the biggest Miura (136 ± 6.3) and Pablo Romero (135 ± 2.8). There are significant correlations between the heights at withers, loins, rump and tail, with the highest correlation value between height at rump and height at tail (0.96). The mean value of body length of Lidia bull (150 ± 10.8) is shorter than other autochthonous Spanish breeds, with significant differences between Miura (162 ± 4.4) and Vega-Villar (127 ± 7.7). Males of Lidia breed presented a harmonic morphostructural model with 59% of their parameters positively correlated. The *encastes* Núñez, Domecq, Gamero Cívico, Albaserrada and Santa Coloma (Gracialiano and Buendia lines) presented similar morphological characteristics with mean values of heights and greater exterior length of the horns with a maximum mean value of 72 ± 2.7 cm in the Gamero Cívico animals. These *encastes* shared a common phylogenetic provenance (Vistahermosa).

cm Farms were chosen for their genetic purity and their clearly belonging to an encaste reflected in the racial prototype, in which animals were analyzed 17 morphological measurements standardized.

Conclusions: The results showed that Lidia males present smaller dimension than other autochthonous Spanish breeds with a considerable internal variability of the parameters evaluated and a high relation between these morphometric measures and the characteristic morphology for each *encaste* reported in the descriptions of the breed made visually.

Keywords: Lidia cattle, bull, fighting bull.

Using cattle tracing system databases to monitor cattle production efficiency, unnecessary carbon emissions and financial losses at herd, sector and national level

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Objectives: All sectors of the economy are required to reduce carbon emissions. Methane emissions, primarily from ruminant enteric fermentation, account for over 50% of agricultural emissions in the UK. Improving livestock production efficiency reduces carbon output and achieves financial gain and is the most cost-effective carbon mitigation strategy available to producers. Cattle Tracing Systems (CTS) databases are a legal requirement in the EU and UK and contain the dates of birth, death and movements of all cattle in the state. CTS databases have been underutilised for monitoring production efficiency. We present a novel method of analysing CTS da-

tabases to measure production efficiency of the entire cattle population and present results from CTS data from England and Scotland over 6 years.

Materials and methods: CTS datasets for Scotland and England for the years 2015-2020 were included. Animal-day of life (d) was considered an economic input relating directly to carbon emissions (enteric methane) and cost of production (variable on-farm costs). Slaughter (S) and new calf registration (B for the calf born, C for the dam calving) were considered productive output, and death on farm (D) as loss. A comprehensive model of optimal efficiency accounting for growth, fertility, slaughter of breeding stock and death on farm was derived from accepted Key Performance Indicators in terms of d required prior to or between productive events: birth to slaughter ($B-S$=600d, growth); birth to first calf registration ($B-C1$=730d, growth); inter-calving interval ($Cn-Cn+1$=365d, fertility); final calf registration to slaughter ($Cf – S$=365d, slaughter of breeding stock) and prior to death on farm ($B-D$=all life up to 600d, death). Actual data was compared to the optimal model with days meeting threshold considered productive (required to achieve an economic output) and those above thresholds as non-productive (leading to no additional output). Non-productive days were considered as resource waste and were sub-classified as being due to growth, fertility, slaughter of breeding stock or death according to the threshold broken. Crude conversion factors of 5.5KgCO2e and £1.50 cost per animal day were used to quantify the associated resource waste. A basic hierarchical logical process was used to categorise herd types within the CTS database into one of six primary systems: seasonal dairy, non-seasonal dairy, beef breeder, beef breeder-finisher, beef finisher and grower. Total productive efficiency was calculated at the herd, sector and national level as:

Production Day Efficiency PDE%= ($\sum$〖productive animal days〗)/($\sum$〖total animal days〗)

Results: The dataset contained 14.9 billion d in total, of which 11.15 billion (74.9%) were classified as productive. Total d declined from 2.49 billion in 2015 to 2.42 billion in 2020 and PDE% increased from 74.3% in 2015 to 76.4% in 2020 (only 2018 had lower PDE% than the preceding year). Total non-productive days declined from 642 million in 2015 to 575 million in 2020 (only 2018 had more non-productive days than the preceding year) equating to reduced waste emissions of 369,000t CO2e and a saving of over £100million.

54.8% of non-productive days were due to slow growth, 21.0% due to death, 20.2% due to sub-fertility and 3.8% due to late slaughter of breeding cows. Total non-productive days reduced for all sub-categories over the period, most notably in growth (12.8% reduction). Non-productive days due to death increased in 2018 (5.2% higher than in any other year). There were marked differences in PDE% between sectors and herds within sectors. Dairy herds showed the greatest improved PDE% (3.6%) while beef breeding herds had no change in PDE%.

Discussion: This novel method can derive a comprehensive measure of cattle production efficiency from CTS datasets, track efficiency over time, quantify improvements in terms of carbon emissions and financial gain, and offer valuable insight into causes of sub-optimal productivity. Technical efficiency of the cattle herds in England and Scotland improved between 2015 and 2020, leading to reductions in waste CO2e emissions and financial savings. Efficiency improvements were not evenly distributed between sectors with the beef breeding sector showing no improvement. Production efficiency reduced in 2018 most likely due to an extreme weather event demonstrating the further potential of this model as a syndromic surveillance tool. The method needs to be further improved by measuring performance that is better than the optimal model and improving the conversion method to better quantify resource waste.

Keywords: Efficiency, carbon, data, production, statutory.