The Congress on

Controversies & Consensus in Bovine Health, Industry & Economics

CONGRESS PROGRAM

CoBo

Berlin, Germany

August 27 - 30, 2015

www.congressmed.com/bovine

Timetable

Thursday, August 27, 2015

	OPENING SESSION
18:30-18:45	Chairpersons' Greetings
18:45-19:30	Keynote lecture: Feeding the world in 2050
19:30-20:30	Networking Reception

Friday, August 28, 2015

	Hall A*	Hall B
08:30-10:00	**SUSTAINABILITY OF CATTLE PRODUCTION**	**ECONOMICS OF REPRODUCTION**
10:00-10:20	Coffee break	
10:20-11:50	**END OF MILK QUOTA SCENARIOS**	**HEAT DETECTION OR HORMONE PROTOCOLS**
11:50-12:10	Poster viewing	
12:10-13:40	**COMMUNICATING AND MOTIVATING TO ACHIEVE RESULTS**	**REVERTING DECLINING FERTILITY**
13:40-14:30	Lunch break	
14:30-16:00	**MILK QUALITY FROM AN INDUSTRY'S PERSPECTIVE**	**VACCINATE OR ERRADICATE**
16:00-16:30	Coffee break	
16:30-18:00	**INFORMING CONSUMERS FOR BETTER CHOICES**	**ON FARM MASTITIS DIAGNOSTICS**

Saturday, August 29, 2015

	Hall A*	Hall B
08:30-10:00	**WELFARE AND PRODUCTIVITY: WALKING SIDE-BY-SIDE**	**IN-LINE DETECTION OF DISEASE**
10:00-10:20	Coffee break	
10:20-11:50	**MASTITIS TREATMENT**	**GENOMIC TOOLS**
11:50-12:10	Poster viewing	
12:10-13:40	**CALVES MANAGEMENT: CONTROVERSIES IN EVERY DAY PRACTICE?**	**EMERGENCE OF DISEASE**
13:40-14:30	Lunch break	
14:30-16:10	**MALE DAIRY CALVES**	**ORAL PRESENTATIONS**
16:10-16:30		CLOSING SESSION

* All sessions in Hall A will be simultaneously translated into German

Congress Program

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Table of Contents

CoBo

Welcome letter

Dear Colleagues,

We would like to personally welcome each of you to the first edition of the **Congress on Controversies in Bovine Health, Industry and Economics (CoBo)** in Berlin, Germany

We would like to give you an idea of what you can expect and what we hope to achieve over the next few days. Fifty invited speakers from all over the world, will debate, discuss and lecture in 2 parallel halls. Also included in the program are 10 oral persentations given by participants from Europe, USA, India and Japan.

We would like to thank each of you for attending the CoBo Congress and for bringing your own expertise to our gathering. We are happy to be associated with you, the leaders in your communities, to teach and learn and pave the way to a better future in our field.

Sincerely,

Arcangelo Gentile

Kerstin Müller

Gabi Leitner

Ricardo Bexiga

On behalf of the Organizing Committee

General Information

Congress Venue

Maritim proArte Hotel
Friedrichstraße 151
10117 Berlin, Germany

Language

English is the official language of the Congress.
Simultaneous translation to German will be available in Hall A.

Registration Desk

The registration desk at the Maritim proArte Hotel will operate during the following hours:

Thursday, August 27	16:00-20:00
Friday, August 28	07:30-18:00
Saturday, August 29	08:00-18:00

Congress Kit and Nametag

The congress kit you have received contains your nametag. Please wear your nametag to all sessions and events.

Certificate of Attendance (non CME/CPD)

You may collect your Certifiate of Attendance at the Registration Desk on Saturday, August 29, 2015.

Refreshments

Welcome Reception on Thursday, August 27 at 19:30 will be held at the exhibition area.
Coffee will be served in the exhibition area.
Lunch will be available for participants of the Congress on Friday, August 28 and Saturday, August 29.
Entrance will be with nametags only.

Exhibition Opening Hours

Thursday, August 27	18:30-20:00
Friday, August 28	08:30-18:00
Saturday, August 29	08:30-18:00

Speakers' Preview Room

Invited Speakers are invited to visit the Speakers' Preview Room to upload their presentations at the following times:

Thursday, August 27	16:00-20:00
Friday, August 28	07:30-18:00
Saturday, August 29	08:00-18:00

Posters

Posters can be viewed at any time on Friday, August 28 and Saturday, August 29.
The dedicated posters viewing times are on Friday, August 28 and Saturday, August 29 from 11:50-12:10.
Poster presenters should plan to be at the posters area during these times and during coffee breaks.

Safety and Security

Please do not leave any bags or suitcases unattended at any time, whether inside or outside session halls.

Liability

The Congress Secretariat and Organizers cannot accept liability for personal accidents or loss or damage to private property of participants either during or directly arising from The Congress on Controversies in Bovine Health, Industry and Economics (CoBo). Participants should make their own arrangements with respect to health and travel insurance.

Industry

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Notes

Scientific Program

Thursday, August 27, 2015

18:30-19:30 **OPENING SESSION** HALL A

18:30-18:45 Chairpersons' Greetings

18:45-19:30 Feeding the world in 2050
Felice Adinolfi, Italy

19:30-20:30 Networking reception

Friday, August 28, 2015

HALL A

08:30-10:00 **SUSTAINABILITY OF CATTLE PRODUCTION**
Capsule With a human population expected to grow to 9 billion by 2050, what scenarios exist for ruminant production? Can we maintain the current paradigm of cattle production?

Moderator **Larry Eugene Chase,** USA

08:30-09:00 Modern dairy farming
Larry Eugene Chase, USA

09:00-10:00 Debate: **Are hyper-intensive, mega farms more efficient?**
09:00-09:20 Pro: **Judith Capper,** USA
09:20-09:40 No: **Katrien van't Hooft,** The Netherlands
09:40-10:00 Discussion with the audience

10:00-10:20 **Coffee break**

10:20-11:50 **END OF MILK QUOTA SCENARIOS**
Capsule With the end of the milk quota in April 2015, in the long term, which farmers and industries will be under pressure? In what areas of the world will production increase? Should farmers invest and in what way?

Moderator **Henk Hogeveen,** The Netherlands

10:20-10:50 Introductory lecture
Henk Hogeveen, The Netherlands

10:50-11:50 Discussion: **Who will benefit from the end of the milk quota?**
10:50-11:10 Speaker 1: **Felice Adinolfi,** Italy
11:10-11:30 Speaker 2: **Anna-Maija Heikkilä,** Finland
11:30-11:50 Discussion with the audience

11:50-12:10 **Poster viewing**

12:10-13:40 **COMMUNICATING AND MOTIVATING TO ACHIEVE RESULTS**
Capsule Many tasks on farms are repetitive, physical, and performed out of hours. How can farm workers be motivated to perform certain tasks to the required standard?

Moderator **Kathrin Stock,** Germany

12:10-12:40	Challenges of implementing new traits in dairy breeding: The role of communication from a breeder's point of view **Kathrin Stock,** Germany
12:40-13:40	Debate: **Is good communication the key to achieve good results?**
12:40-13:00	View 1: **Joep Driessen,** The Netherlands
13:00-13:20	View 2: **Joachim Lübbo Kleen**, Germany
13:20-13:40	Discussion with the audience
13:40-14:30	**Lunch break**
14:30-16:00	**MILK QUALITY FROM AN INDUSTRY'S PERSPECTIVE**
Capsule	Historically, milk quality meant low somatic cell counts but what other criteria are the industries and the consumers looking for when talking about milk quality. And are low cell counts really synonymous with better quality milk?
Moderator	**Alan Kelly,** Ireland
14:30-15:00	Milk quality **Alan Kelly,** Ireland
15:00-16:00	Debate: **Is further reduction in somatic cells an indication of better milk quality?**
15:00-15:20	Yes: **Gabriel Leitner,** Israel
15:20-15:40	No: **Gil Katz,** Israel
15:40-16:00	Discussion with the audience
16:00-16:30	**Coffee break**
16:30-18:00	**INFORMING CONSUMERS FOR BETTER CHOICES**
Capsule	Many consumers perceive that on farms there are animal welfare and environmental problems that dictate their choices. Is this dictated by lack of information or by inadequate methods of production?
Moderator	**Timothy Geraghty,** UK
16:30-17:00	Introductory lecture **Timothy Geraghty,** UK
17:00-18:00	Discussion: **Will information change consumers' attitudes?**
17:00-17:20	Animal welfare perspective: **Becky Whay,** UK
17:20-17:40	The environmental perspective: **Jude Capper,** USA
17:40-18:00	Discussion with the audience

Friday, August 28, 2015

08:30-10:00 **ECONOMICS OF REPRODUCTION** HALL B

Capsule — Considering increasing yields and the many diseases that follow calving, should we insist on calving once per year?

Moderator — **Henk Hogeveen,** The Netherlands

08:30-09:00 — Is the 365-day calving interval the best option?
Gerrit Hooijer, The Netherlands

09:00-10:00 — Discussion

Panellists — **Henk Hogeveen,** The Netherlands
Gerrit Hooijer, The Netherlands

Questions to the panel:

- Are there determinants for longer voluntary waiting periods to be economically viable?
- What are the differences between pasture-based and zero-grazing systems in terms of reproduction economics?
- In which situations may extended lactations still be profitable?

10:00-10:20 **Coffee break**

10:20-11:50 **HEAT DETECTION OR HORMONE PROTOCOLS**

Capsule — Increasing labour costs for heat detection and poor conception rates following hormonal treatments for fixed time AI, challenge the way of getting cows pregnant

Moderator — **John Mee,** Ireland

10:20-10:50 — Heat detection vs. hormonal protocols: Reproductive performance, economic benefits and societal acceptance
John Mee, Ireland

10:50-11:50 — Debate: **Can we reach the same reproductive goals through AI following heat detection and through fixed time insemination following hormonal protocols?**

10:50-11:10 — View 1: **David Wolfenson,** Israel
11:10-11:30 — View 2: **Giovanni Gnemmi,** Italy
11:30-11:50 — Discussion with the audience

11:50-12:10 **Poster viewing**

12:10-13:40	**REVERTING DECLINING FERTILITY**
Capsule	Conception rates have been declining for decades in dairy cattle. Can something be done to revert this tendency?
Moderator	**John Mee,** Ireland
12:10-12:40	How can we revert declining dairy cow fertility? **John Mee,** Ireland
12:40-13:40	Debate: **Is declining fertility the price for higher production?**
12:40-13:00	View 1: **Giovanni Gnemmi,** Italy
13:00-13:20	View 2: **Gerrit A. Hooijer,** The Netherlands
13:20-13:40	Discussion with the audience
13:40-14:30	**Lunch break**
14:30-16:00	**VACCINATE OR ERRADICATE**
Capsule	With several infectious diseases, it is often necessary to decide between living with a certain disease or eradicating it, at the farm, region or country level. Is eradication the way?
Moderator	**Christine Fourichon,** France
14:30-15:00	Introductory lecture **Christine Fourichon,** France
15:00-16:00	Debate: **Is eradication of infectious diseases the most efficient way for their control?**
15:00-15:20	Vaccination: **John A. Ellis,** Canada
15:20-15:40	Eradication: **George Gunn,** UK
15:40-16:00	Discussion with the audience
16:00-16:30	**Coffee break**
16:30-18:00	**ON FARM MASTITIS DIAGNOSTICS**
Capsule	On farm diagnosis for mastitis has been used in few farms but there is an increasing number of diagnostic tools for this purpose. If these tools are cheap and accurate enough, will they change the way we perform mastitis treatments?
Moderator	**Filipe Cardoso,** Portugal
16:30-17:00	Introductory lecture **Filipe Cardoso,** Portugal
17:00-18:00	Debate: **Can on farm diagnostics save money and antibiotics?**
17:00-17:20	Yes: **Sofie Piepers,** Belgium
17:20-17:40	No: **Gabriel Leitner,** Israel
17:40-18:00	Discussion with the audience

Saturday, August 29, 2015

HALL A

08:30-10:00 **WELFARE AND PRODUCTIVITY: WALKING SIDE-BY-SIDE**
Capsule
Low stress levels, absence of disease and higher longevity are features common to the pursuit of ruminant welfare and higher productivity. How can we provide conditions that simultaneoulsy lead to higher animal welfare and increased productivity?

Moderator **Becky Whay,** UK

08:30-09:00 Introductory lecture
Becky Whay, UK

09:00-10:00 Debate: **Can welfare and productivity work side by side?**
09:00-09:20 Yes: **Gerrit A. Hooijer,** The Netherlands
09:20-09:40 No: **Joep Driessen,** The Netherlands
09:40-10:00 Discussion with the audience

10:00-10:20 **Coffee break**

10:20-11:50 **MASTITIS TREATMENT**
Capsule
Mastitis is the most costly disease for dairy farmers, but in many instances antibiotic use might not be the best option to deal with udder health problems. In which situations do we really need to use antibiotics in dealing with udder health?

Moderator **Stephen J. Oliver,** USA

10:20-10:50 Introductory lecture
Stephen J. Oliver, USA

10:50-11:50 Debate: **Shall we always rely on antibiotics for udder health?**
10:50-11:10 Yes: **Ricardo Bexiga,** Portugal
11:10-11:30 No: **Bernd-Alois Tenhagen,** Germany
11:30-11:50 Discussion with the audience

11:50-12:10 **Poster viewing**

12:10-13:40 **CALVES MANAGEMENT: CONTROVERSIES IN EVERY DAY PRACTICE?**
Capsule
Farmers' and veterinarians' everyday life is studded with habits and convictions that are not really based on scientific evidences. In respect to calf management, are there some of them that can be based on better evidence?

Discussants **Arcangelo Gentile,** Italy
Ingrid Lorenz, Ireland

Discussion	Topics to be discussed: • Navel dipping in newborn calves • Nutritional level of young dairy calves • Feeding of waste milk in dairy calves • Force-feeding of milk in anorexic calves • Use of antibiotics in calf diarrhoea • Respiratory vaccines in young calves
13:40-14:30	**Lunch break**
14:30-16:00	**MALE DAIRY CALVES**
Capsule	In most countries around the globe, male calves of dairy breeds have low economic value, which dictates their destiny. What alternatives better suit calves, farmers and consumers?
Moderator	**Jörg Hartung,** Germany
14:30-15:00	Male calves in dairy farms: Boon or bane? **Jörg Hartung,** Germany
15:00-15:30	Will we be able to deal with male dairy calves? **Henny Swinkels,** The Netherlands
15:30-16:00	Discussion
Panellists	**Jörg Hartung,** Germany **Henny Swinkels,** The Netherlands
Questions to the panel	• Are there alternatives to the existing markets that could offer a solution? • Are there technological options that could help to deal with the problem? • What can be done to influence the consumers and the market?

Saturday, August 29, 2015

HALL B

08:30-10:00	**IN-LINE DETECTION OF DISEASE**
Capsule	With increasing numbers of animals, detection of disease or of underperformance might prove challenging. Evaluation of several parameters in the milking parlour may help in the early detection of problems
Moderator	**Claudia Kamphuis**, The Netherlands
08:30-09:00	Sensors in the milking parlor: Replacing or complementing human senses in monitoring animal health and performance **Claudia Kamphuis,** The Netherlands
09:00-10:00	Discussion: **Can automatic detection of disease replace direct animal observation?**
09:00-09:20	Speaker 1: **Alon Arazi,** Israel
09:20-09:40	Speaker 2: **Rik van der Tol,** The Netherlands
09:40-10:00	Discussion with the audience
10:00-10:20	**Coffee break**
10:20-11:50	**GENOMIC TOOLS**
Capsule	The increasing availability of genomic tools seems to be an opportunity to solve many problems that affect us in the present. Fertility, immunity, metabolic disease or even production of healthier food - can these be tackled through genomics?
Moderator	**Ricardo Negrini,** Italy
10:20-10:50	Introductory lecutre **Ricardo Negrini,** Italy
10:50-11:50	Debate: **Can genomics solve our problems?**
10:50-11:10	Yes: **Antonello Carta,** Italy
11:10-11:30	No: **Agustin Blasco,** Spain
11:30-11:50	Discussion with the audience
11:50-12:10	**Poster viewing**
12:10-13:40	**EMERGENCE OF DISEASE**
Capsule	Climate change affects the distribution of vectors and infectious agents. What can we expect in a not so distant future in terms of exotic diseases?
Moderator	**Etienne Thiry,** Belguim
12:10-12:40	Introductory lecture **Etienne Thiry,** Belguim
12:40- 13:10	Are we prepared for the next emerging disease? **Franz Josef Conraths,** Germany

13:10-13:40	Discussion
Panellists	**Christine Fourichon,** France **Franz Josef Conraths,** Germany
Questions to the panel:	• Are diseases emerging because we are looking for them more attentively? • What may be the costs of a new infectious disease and what are the costs of being prepared? • What is the role of farmers and veterinary practitioners in detecting emerging diseases?
13:40-14:30	**Lunch break**
14:30-16:00	Oral Presentations
Moderator	**Ricardo Bexiga,** Portugal
14:30-14:39	Controversies in the treatment of clinical mastitis **Jerry Roberson,** USA
14:39-14:48	Prevention of infection by strongyles in grazing cattle. Biological control with feedstuff added duddingtonia flagrans spores **José Ángel Hernández,** Spain
14:48-14:57	Digital dermatitis: Still emerging and a threat to other species **Stuart David Carter,** UK
14:57-15:06	Do clostridia (particularly c. botulinum) play a role in dairy herd health problems? **Moritz Metzner,** Germany
15:06-15:15	Seroprevalence of neospora caninum infection in dairy cattle in central and north-eastern Poland **Corinna N. Weber,** Germany
15:15-15:24	Diagnosis and outcome of surgical management of cecal dilatation in bovine **Gurwinder Singh Sandhu,** India
15:24-15:33	Case-control study on chronic diseases in dairy herds in north western Germany: Symptoms on herd level **Katharina Charlotte Jensen,** Germany
15:33-15:42	Removals, culling reasons and herd mean lifetime in Norwegian dairy herds. Some conflicts and controversies when optimizing herd health management according to economics in combined meat and milk production systems. How do we define longevity correct? **Olav Østerås,** Norway
15:42-15:51	Water spectral pattern of raw milk for oestrus detection in dairy cows **Roumiana Tsenkova,** Japan
15:51-16:00	Topical vapocoolant spray reduces perioperative pain of ear tagging and ear notching in calves **Sabrina Lomax,** Australia
16:00-16:15	**CLOSING SESSION** Chairpersons' closing remarks

Poster Presentations

Board No.

01 A model of barn for the environmental sustainability of beef production
Elisa Baioni, Italy

02 Risk factors for involuntary extended lactations (over 40 months) in holstein cows in a hot environment
Miguel Mellado, Mexico

03 Minimal effect of dna extraction method on relative telomere length measurement by QPCR
Luise Seeker, United Kingdom

04 Promoting an understanding of beef production, and the value of cattle grazing and the ecosystem services it provides to an urban public
Sheila Barry, United States

05 Comparison between individually vs. grouped housed dairy calves
Gal Peleg, Israel

06 Effect of α-lipoic acid on oxidative status, lipid metabolic parameters and liver enzyme activities in transition dairy cows
Jingui Li, China

07 Stress-induced activation of ovarian heat shock protein 90 in a rat model of polycystic ovary syndrome
Minhyung Jung, Korea

08 Value of serum CA125 levels in recurrent epithelial ovarian cancer with complete remission to primary therapy
Woo Dae Kang, Korea

09 Case-control study on chronic diseases in dairy herds in north-western germany: investigations about lameness in affected cows
Katharina Charlotte Jensen, Germany

10 Changes in lipid metabolism, liver function and lipid peroxidation in transition dairy cows
Zongping Liu, China

11 Manufacturing feedstuff with mucor circinelloides spores to prevent cattle infection by calicophoron daubneyi
Fabián Arroyo, Spain

12 “Alheesh” disease of cattle in the Sudan: a chronic encephalopathy caused by histophilus somni or a chronic form of foot and mouth disease?
Kamal Hassan Eltom, Sudan

13 Surveillance of biting midges (diptera, culicoides), the potential vectors of bluetongue and schmallenberg viruses, in Poland in 2008-2014
Maria Grochowska, Poland

14 Can social network analysis (SNA) elucidate the epidemiology of paratuberculosis in dairy and beef herds?
John F Mee, Ireland

15 Schmallenberg: is there evidence that the virus continues to circulate?
John F Mee, Ireland

16 A case report of congenital microencephaly and cerebellar hypoplasia associated with bvd-md virus in aborted fetal.
Reyhaneh Safaei, Islamic Republic of Iran

17 Emergence of extended-spectrum beta-lactamase (esbl) ctx-m-type-producing escherichia coli in dry cows, Brazil.
Luciana Sartori, Brazil

18 More testing, less antibiotics–future trends in mastitis treatment?
Anna-Maija Heikkilä, Finland

19 Effect of somatic cell count on composition of cattle milk
Mahmut Kaliber, Turkey

20 Effect of intramammary infusion of recombinant bovine gm-csf produced in transgenic silkworm at drying-off on mammary gland involution in dairy cows.
Yoshio Kiku, Japan

21 The effect of supportive e. coli mastitis treatment on blood antioxidant status
Hanna Markiewicz, Poland

22 Possible involvement of neutrophil elastase and inflammatory lactoferrin-derived peptides in the development of bovine mastitis induced by intramammary infusion of staphylococcus aureus in the early dry period
Atsushi Watanabe, Japan

23 Listeria monocytogenes in bulk tank milk and its behaviour during the cheese making.
Giorgio Zanardi, Italy

24 The tendency to use crossbreeding in dairy farm is strengthen
David Dror, Israel

Publications

Unveiling the economic costs of the environmental impact and the water footprint of the Holstein intensive production system in the arid lands of northern Mexico
Cesar A. Meza-Herrera, Mexico

Does targeted prepartum supplementation of vitamins and minerals affect postpartum ovarian activity and serum cholesterol and progesterone concentrations in holstein cows?
Cesar A. Meza-Herrera, Mexico

Evaluation of insect growth regulator on fly control and animal welfare
Eial Izak, Argentina

Implications of omitting teat preparation on bacterial levels in bulk tank milk
David Edmond Gleeson, Ireland

Notes

Abstracts

INVITED SPEAKERS

Friday, August 28, Hall A: SUSTAINABILITY OF CATTLE PRODUCTION

S01

MODERN DAIRY FARMING

Larry Eugene Chase
Cornell University, USA

Dairy products are a primary source of high quality protein in human diets. As the world population increases, there will be more demand for dairy products based on both population growth and increased levels of disposable income. How can the dairy industry meet this demand while being profitable, sustainable, environmentally and socially responsible? The structure of the dairy industry and the availability of resources are highly variable throughout the world. Total world milk production increased by 56% between 1982 and 2013. A recent report indicated that worldwide milk production increased 3% in the first 6 months of 2011 and averaged a 1.8% increase in 2010 compared with 2009. These increases have primarily been due to increased productivity per cow rather than more cows. The trend in the dairy industry in is fewer dairy farms, more cows per farm and higher milk per cow. In the U.S., milk production has increased about 136 kg of milk/cow/year in the last 30 years. The current average milk production for U.S. dairy herds is 10,215 kg per cow per year. This is projected to increase to 11,031 kg by 2020. These improvements have been made due to a combination of factors including genetics, forage quality, forage production, nutrition, management, cow comfort and improved herd health. One concern is that higher levels of milk production per cow may be detrimental to cow health and longevity. The Dairy Metrics system from the Raleigh Dairy Records Processing Center was used to assess the differences between Holstein herds at varying milk production levels in June, 2015. There were a total of 10,501 herds used in this analysis. Herds were grouped within milk production levels between 7,258 and 14,497 kg per cow per year by 1,800 kg increments. Cows per herd increased from 110.6 to 526.5 as milk production increased while the culling rate was similar (35.9 versus 38.9%). The percent of the cows that died was also similar (5.5 versus 5.1%) as production increased. Somatic cell count was 186,900 cells/ml in the higher producing herds compared with 283,700 cells/ml in the lower producing herds. The 21 day pregnancy rate increased from 16 to 22.5% as milk increased while the calving interval decreased from 14.7 to 13.5 months as productivity increased. Age a first calving decreased from 27.4 to 24.3 months as milk production increased. These results indicate that high milk production levels can be attained while at least maintaining cow health. The above values are averages for the various milk production levels and do not reflect the standard deviations associated with the mean. The diversity of the structure in the dairy industry makes it difficult to describe a “typical” dairy system. There are still small herds that hand milk cows while others have robotic feeding and milking systems. Robotic systems provide the ability to obtain large amounts of individual cow data that can be used in managing the herd. As an example, one robotic milking system collects about 120 pieces of information on each cow per day. There are also a number of systems available to dairy producers that monitor chewing and rumination activity, body weight, temperature, body condition score, rumen pH, standing time and lying time. Feeding systems are being used that measure and record the actual quantity of each ingredient added to the feed mixer, record the quantity of feed delivered to each group of cows and can account for feed refusals. There are currently a few farms in the world where cows are milked and fed daily using robotic systems. Milking systems have the ability to take samples from individual cows during milking and do some analysis of components in the milk. Systems are in development to do rapid on-farm assessments of milk components taken from in-line samples during milking using NIR technologies. These systems do not fit all farms but do provide insight into what is possible to enhance management capability. Herds are milking more than 500 cows/hour using large milking parlors. Management of any dairy herd to improve profitability, productivity, efficiency and sustainability still relies on simple, basic farm and cow management factors. These apply to herds of a few cows to herds milking in excretes of 20,000 cows. The following are the key points to consider in managing a dairy herd:

1. Genetics – This is the base for potential productivity. In developed countries, about 25-33% of the difference in milk production between herds is attributed to genetics. Very few herds in developed countries are limited in milk production by genetics.
2. Water – A continuous supply of high quality, palatable water is needed to support milk production.
3. Forage quality and quantity – Forage quality has a direct impact on milk production. In many developing countries, forage quality and quantity are key factors that limit potential milk production. The availability of forage analysis data is needed.
4. Ration balancing – This can be done in a large number of ways. Very simple tabular approaches can be used to determine concentrate supplementation to very detailed and sophisticated models. The basic point is to provide adequate energy and protein to support milk production. This can be a challenge in developing countries due to the lack of availability or the high costs of supplemental feeds. Herds at high levels of productivity are balancing for fiber and starch nutrient pools, rates of digestion and amino acids.
5. Cow comfort – Cows need to be in an environment that permits adequate resting (11-13 hours/day) and lying time.
6. Cow management – This is the area that has more impact on productivity than the ration. This includes consistency of daily management and animal observation.
7. Heat stress abatement – In many areas of the world, productivity is severely impacted by heat stress. Abatement practices can be as simple as shade but can also include combinations of fans and sprinklers.

These principles apply to herds of all sizes. Modern dairy herds vary in both size and structure. This diversity is a strength as the industry looks ahead to the future.

Friday, August 28, Hall A: SUSTAINABILITY OF CATTLE PRODUCTION

S02

ARE HYPER-INTENSIVE, MEGA FARMS MORE EFFICIENT? YES

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The debate as to whether cattle should be confined, grazed on pasture or kept within a system that makes use of both practices continues to rage. Critics of intensive systems claim that they stifle natural behaviors, yet given the increase in human population size that is predicted to occur within the next 40 years, the intensity of competition for resources is likely to increase. Efficiency in dairy production means reducing both resource use and waste production per unit of milk. For example, improvements in U.S. dairy farm intensification and efficiency between 1944 and 2007 reduced feed use by 77%, land use by 90%, water use by 65%, manure output by 76% and the carbon footprint of a unit of milk by 63% (Capper et al., 2009). Efficiency is primarily garnered by productivity gains (e.g. milk yield, component yield, reproduction and lifetime productivity); but can be achieved by any production practice that improves output per unit of herd bodyweight (Capper and Cady, 2012).

The U.S. Department of Agriculture undertakes national surveys of dairy performance and practices and stratifies the results according to farm size (USDA, 2007a). In the USA, herds containing over 500 cows produce 46.7% of total milk. The distribution is skewed however, as 76.7% of herds were classified as small (containing less than 100 cows), 19.1% medium (containing between 100 and 499 cows) and 4.2% large (containing over 500 cows; USDA, 2007b). Note that herd size is not necessarily correlated with housing or feeding system, however, the proportion of operations that grazed cows on pasture decreased with increasing herd size, from 68.7% of small herds to 18.6 of large herds, thus it is logical to assume that the

majority of large operations housed cows year-round (USDA, 2007a) and would be considered "intensive".

A positive correlation exists between herd size and milk production per cow, in that annual yield increases from 8,592 kg/year in small herds, to 9,653 kg/year in medium herds and 10,390 kg/year in large herds (USDA, 2007a). Age at first calving also has significant effects upon overall herd efficiency given that heifers are effectively non-producing animals until they enter the milking herd. An earlier age at first calving reduces the proportion of non-productive time within the cow's life, and therefore is a measure of improved efficiency, providing that it is not so early (<22 months) as to impair future reproduction. USDA (2007a) data showed that heifers in small herds tended to calve at 25.4 months compared to medium or large herds at 24.8 and 24.0 months respectively.

One could argue that housing cattle is inherently inefficient as forage has to be harvested mechanically, yet this assumes that pastures are of sufficient quality and the climate is conducive to support milk production. Under drought conditions, when cattle are exposed to temperature extremes or when sufficient feed ingredients are available to produce a balanced ration without the need for grazed pasture, housing may be a significantly more efficient option. Total mixed rations were more commonly-fed in large operations (94.1%) compared to medium-sized (84.7%) or small operations (37.8%), with 90.7% of large operations balancing the ration according to the results of forage test, compared to 70.1% of small operations (USDA, 2007a). Feeding a diet that is balanced to maintain energy and protein and reduces adverse changes in ruminal or intestinal digestion demonstrably improves digestibility of nutrients, as well as productivity and welfare of the dairy cow (NRC, 2001). The greater proportion of large operations using an independent or feed company nutritionist (80.1%) compared to small operations (53.7%; USA, 2007a) does not necessarily imply superior nutrition, but does underline the capacity for larger operations to employ specialized labour rather than relying on on-farm labour to undertake multiple tasks.

Intensive dairy production is often criticized for excessive antibiotic use, yet one of the cornerstones of animal welfare is the ability to be "free from pain, injury and disease" (Brambell, 1965). There is some debate as to whether dairy cow lameness is an inevitable consequence of industrialization: lameness reduces productivity (Green et al., 2002) and is undesirable both from an economic and welfare perspective; however, milk yield itself has not been shown to be a contributing factor (Haskell et al., 2006).

Mastitis is arguably one of the most significant issues within the dairy industry – its severity highlighted by the fact that udder or mastitis problems rank second in the list of producer-reported reasons for culling dairy cows from their herds (USDA, 2007a). There appears to be an association between milk yield and mastitis incidence (Phipps, 1989), yet there is some discussion as to whether this is a direct relationship, or whether it results from greater time spent in the milking parlor as a consequence of increased yield.

Increases in milk production over the past 30 years have been associated with a global reduction in dairy cow fertility, with a producer-reported 26.3% of U.S. cows being removed from the herd due to reproductive problems (USDA, 2007a). The relatively high incidence of culling within dairy herds in the U.S.A.is often cited as evidence of inefficiency. Holstein cows spend an average of 2.5 lactations within the herd (Capper and Cady, 2012), although it is interesting to note that the proportion of cattle removed from the herd (either for sale or cull) does not significantly differ according to herd size (24.1% in small herds, 23.7% in medium-sized herds and 23.4% in large herds; USDA, 2007a).

Productivity and efficiency are key to the continued sustainability of the dairy industry, but only when combined with excellent animal health and welfare. Within the current dairy industry, considerable gains can be made by examining the systems and practices employed by the top 20% of producers, shifting the bell-shaped curve from the current average to a better average and gaining momentum for future change in the process. There is no ideal, one-size-fits-all system, but the efficiency gains made by large-scale operations should not be dismissed simply on philosophical grounds.

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S03

ARE HYPER-INTENSIVE, MEGA FARMS MORE EFFICIENT?

Katrien van't Hooft

Dutch Farm Experience, The Netherlands

An intro on efficiency in dairy farming

Dairy farming is one of the means to obtain high quality, protein rich food for people all over the world. In this process, efficiency is usually expressed as:

- animal productivity (milk/year or lactation)
- in land (kg of milk per ha)
- in greenhouse gasses (CO2 equivalent/kg of milk)
- economic (costs and income per kg of milk)

All of these definitions of efficiency are expressed in kg of milk produced. But what if milk production is not the major product of a cow, but rather a combination of milk, meat and manure to boost crop production? If we want to look and compare efficiency of cattle farming in variety of local settings in the world, we need to look at efficiency from a more holistic perspective – taking the efficiency of the cow in it's different roles, and of the farm as a whole. One of the ways to do this is by making use of mineral (Nitrogen and Phosphate) efficiency, now being promoted in the Netherlands through the so-called 'cycle approach'. On top of this, for truly sustainable dairy farming I believe we need to strike the balance between People, Profit, Planet and Animal/Cow interests (PPP&A).

Productivity and challenges in Dutch dairy farming

In Dutch dairy farming the single focus on specialized milk productivity since the 1960's – moving away from integrated crop-livestock farming - has led to extremely high milk producing cows, requiring high inputs of maize and concentrates. As a result, average milk production per cow has doubled from 4200 kg of milk per year in the 1960's to almost 8.400 in 2014. Average milk production per farm per year has even increased over 20 fold: from 37.000 in 1960 to 753.840 kg milk per year in 2014 – with an average of 88 milking cows per farm. Total milk production in the Netherlands (one of the most densely populated countries in the world) is around 12.7 million tons per year – the 11th milk producer worldwide. 65% of this milk is exported – mainly in the form of cheese, primarily to Germany, Belgium and France. This export had a value of 8 billion Euros in 2014.

This phenomenal growth and economic result were possible due to a combination of government financial support and high-input technology development aiming at highest milk yields per animal per year. Between 1988 and April 2015 this growth was restricted, however, by milk quota imposed by the EU. Since April 2015 this was abandoned, leading to a

rapid increase in the number of hyper-intensive large dairy farms in our country, in some parts up to 6% of the farms with 250 milking cows or more. In order to comply with new EU regulations, the government has restricted growth by imposing Phosphate Rights In July 2015, which limit the mineral outputs (and related growth of animal numbers) to the level of 2014.
Over the last decades this process has been subject to serious debates within Dutch society, due to the numerous side effects of this growth. Below I will analyze the challenges that the Dutch dairy sector has faced - and is still facing today. In this analysis it is important to note that farming, including dairy farming, in our country is subject to strict government regulations, which has limited the negative side effects to a certain extent. This is not the case in most other countries where scale enlargement of dairy farming is taking place.

Side effects of hyper-intensive dairy farms in the Netherlands:

People (farmers/consumers):

- Since the 1960's over 90% of the family dairy farms have stopped, and this process of loss continues – with related loss of employment in the rural areas
- Increased stress amongst farmers, especially due to financial uncertainties and higher disease incidence of animals
- Lack of interest and financial problems for young farmers to take over from old generation
- Consumers and producers are no longer linked directly – and increased consumer focus on animal wellbeing clashes with farmers' reality
- Effects on human health in nearby villages: Increased fine dust, smell, risk of multi-resistant microbes and zoonosis
- Milk quality: increasing evidence that milk produced primarily with concentrates and maize has another quality (amino acids) than milk produced mainly on basis of grass, hay and silage

Profit:

- Agricultural subsidies take up over 50% of total EU budget – Dutch agriculture and rural development receive around 1 billion Euros per year – putting smallholder farmers in the rest of the world in an unfavourable position
- Unstable and often low farmer income due to high investments for new stables, combined with dependence on world market prices. Though production increases, farmers' income remains under pressure
- Higher input costs due to reduced farm mineral efficiency - in terms of Nitrogen and Phosphate efficiency – due to loss of soil fertility
- Higher dependence on and dominance of supermarket chains - loss of local markets
- Intensive farming has increased multi-resistant strains of microbes, and the costs for society in terms of human health institutes are not take into account

Planet:

- Intercontinental misbalance between animal feed production & and animal production (soy from Argentina or Brazil, excess manure in Netherlands)
- Excess minerals (N and P) from manure effect water and air quality, putting extra pressure on other natural environments
- The Dutch state law that manure combined with urine is injected into the soil negatively affects soil fertility and soil life
- Loss of connection between animal and crop production resulted in increased use of chemical fertilizer (though this was reduced after the 1980's)
- Higher use of other chemicals, such as antibiotics and anthelmintic, further affect soil life and biodiversity
- Pastures dominated with high yielding grass, especially English Ray grass, have resulted in the loss of meadow birds, insects and other biodiversity
- Environmental pressure has been limited over the past decades, but was partly 'exported' to other countries
- Milk is increasingly being produced on land apt for crop production

Animal/Cow

- Focus on maximum productivity per year leads to higher animal disease incidence (mastitis, claw problems), fertility problems, and shortened life span of cows
- Large scale 'Holsteinization' of the dairy herd runs risk of excessive inbreeding
- With robotization of milking a growing number of dairy cows are kept inside year round; lack of outside grazing is affecting animal health and natural behavior – and there is growing evidence that this also leads to increased greenhouse gas emissions
- Calf management based on separating calves immediately, leads to high antibiotic use due to diarrhoea, pneumonia and mortality (in NL 14% under 6 months of age)
- Risk of increased killing of under-weight new born female calves (currently 2%)

Netherlands-India dairy exchange program

In my presentation I will especially highlight the numerous new initiatives that are being developed within the Netherlands towards more sustainable dairy farming, including initiatives to measure dairy efficiency taking into account the PPP&A elements. Moreover, I will briefly indicate the outcome of the exchange between Dutch and Indian dairy experts to improve sustainability and reduce the use of antibiotics other chemicals, which is having encouraging effects in both countries.

Friday, August 28, Hall A: END OF MILK QUOTA SCENARIOS

S04

CRISIS IN THE DAIRY SECTOR-SHOULD FARMERS STOP INVESTING IN MILK PRODUCTION?

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Background: In the past few years, milk producer prices in Finland have been stable and among the highest within the European Union (EU). The strong domestic market, high-value products, and exports to Russia have contributed to this positive state of affairs. Yet, the abolishment of the EU milk quota system and international trade disorders, such as the recent ban on exporting milk products to Russia, have increased price volatility in an unprecedented way. Concurrently, structural change in Finnish milk production is predicted to speed up because of dairy farmers' high age and due to backwardness in productivity compared with the most competitive countries in the dairy sector. Investments are needed to maintain the viability of dairy farms and Finnish production under increasing pressures from global dairy markets. However, these national goals are seriously hampered by price risks.
Methods: To help investors and their financers to assess the risk caused by milk price volatility, we applied a risk-oriented approach to investments on dairy farms. First, we estimated the current returns on dairy cow facility investments derived from enterprise budgets. Second, we analyzed the robustness of profitability of a building investment in terms of milk price volatility. Instead of the traditional Net Present Value (NPV) based methods, we utilized a method where price volatility is taken into account systematically. The NPV method gives a single maximum bid price for the investment, whereas the applied method gives a distribution of possible outcome values for the investment. This distribution tells the probability of making a profitable investment given that the investment expenditure is known.
In the numerical example, we derived the returns on dairy cow facility investments from the typical Finnish dairy farm with 71 cows, which is one of the Finnish farms in the International Farm Comparison Network (IFCN) in 2014. The farm is located in central Finland and has 1.6 ha/cow for feed production and manure spreading. In 2014, the average milk yield was 8,903 kg and the mean milk price €0.46/liter. However, in the example we used the current milk price, €0.37/liter (May 2015). The building expenditures are highly dependent on technology choices and vary case by case. In this case, the building expenditure of an animal facility was assumed to be €11,000/cow. The price represents costs of a standard, inexpensive facility with an automatic milking system. The NPV of the facility was derived from the annual margin on investment costs

(€775/cow) with an interest rate of 2% and duration of 20 years. In the risk analyses, we utilized @RISK software which generates the distributions of possible outcome values with Monte Carlo simulation.
Results: The results show how the risk related to the investment grows along with the increase in milk price volatility. With an equal milk price, we receive totally different profitability of the investment if we vary the standard deviation of milk price. In our example, the standard deviations were €0.02/liter and €0.04/liter. For comparison, the mean standard deviation in Finland was €0.03/liter from 2007 to 2014. If the building expenditure is €11,000/cow, the probability of a profitable investment is about 73% with smaller price volatility (Figure 1) but only 62% with larger volatility (Figure 2). Ignoring the price risk, dairy farmers may end up making an imprudent investment of €12,670/cow which is the NPV of the livestock facility in both cases.

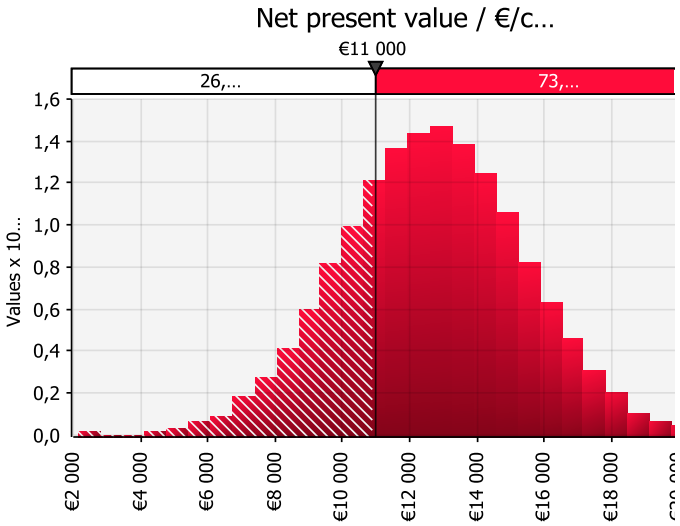

Figure 1. Probability of profitable investment, milk price €0.37 with standard deviation of €0.02

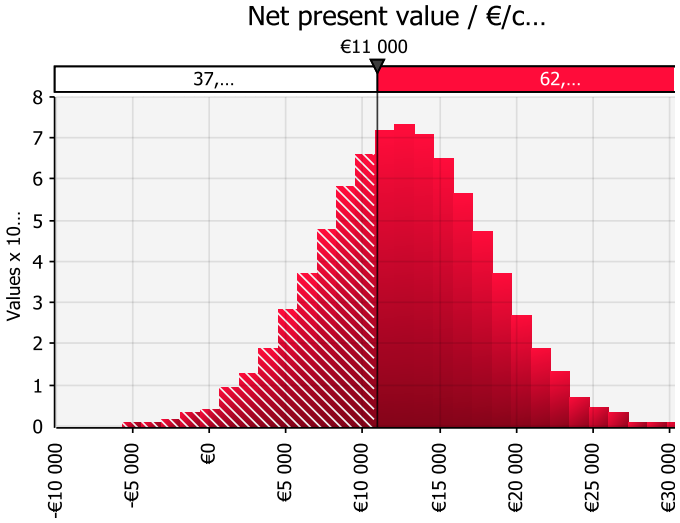

Figure 2. Probability of profitable investment, milk price €0.37 with standard deviation of €0.04

Conclusions

At present, the European dairy sector suffers from production surplus and low producer prices but, in the long run, demand of milk products is expected to significantly grow and more milk is needed to feed the world. In order to respond to this increasing demand, investments in dairy production are necessary. On the other hand, milk price volatility is a permanent phenomenon, which increases the economic risks of investments. Our example from Finland shows that it is important to make a real risk analysis before making an investment decision. This is especially important in milk production where the investments are irreversible and the production difficult to cease. Secondly, price volatility may be decreased with price stabilizing instruments, such as forward price contracts. These contracts may apply to both inputs and outputs of the farm. Further, losses caused by price volatility can be reduced with income insurance systems. This kind of stabilization instruments are worth developing and bringing into use to guarantee the positive development of dairy farms via investing in novel, efficient and animal-friendly technologies.

Friday, August 28, Hall A: COMMUNICATING AND MOTIVATING TO ACHIEVE RESULTS

S05

CHALLENGES OF IMPLEMENTING NEW TRAITS IN DAIRY BREEDING: THE ROLE OF COMMUNICATION FROM A BREEDER'S POINT OF VIEW

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Supply and demand of traits in dairy breeding

The dairy sector has benefitted a lot from the recent technological developments in breeding through which routine genomic applications could be introduced for many traits and in multiple countries. Genomic selection has allowed increasing the genetic gain in production and functional traits that are considered in the breeding programs for dairy cattle worldwide. However, the opportunities for introducing new traits has only insufficiently used so far, although the demand for targeted approaches for improving, for example, efficiency and health of dairy cattle and the potential of genomics in this field have been widely recognized (Boichard & Brochard 2012, Egger-Danner et al. 2015). The major reason for this gap is the unequal development of genotyping logistics and genomic tools on the hand and phenotyping strategies on the other hand. Principally, advantages of genomic over conventional selection are largest for traits with low heritabilities that are difficult to access, and many of the requested new traits fall into this category (Stock & Reents 2013). However, improving the breeding programs by introducing new traits implies increased efforts of dairy breeding to obtain additional phenotype data of high quality and sufficient quantity, so ensuring high motivation for refined phenotyping in a large enough sample of the dairy population has become crucial for the success and long-term competitiveness of breeding organizations (Egger-Danner et al. 2015).

Meeting the challenges of phenotyping for new traits - exemplified for animal health traits

In times of increasing numbers of attractive solutions for automated herd management support and control systems for individual dairy farms, the still important role of the traditional data recording is often neglected. Even if collection of observational and measurement data is considered infeasible on the large scale, so possibly problematic as sole basis of routine applications, identification of good indicators that are easier to record and validation of indicator-based predictions require such data (e.g. Schlageter-Tello et al. 2014). Nevertheless, economic constraints may hinder increasing manpower and time for data recording in the farms as long as there is no convincing proof of benefit. It is therefore crucial, that any initiative for refined phenotyping is accompanied by reporting services that are tailored to suit the needs of the practice. Using health data recording in the context of health monitoring and improvement programs as an example, periodic reports and daily figures of health events allow benchmarking, help optimizing herd management and can significantly facilitate the daily work of farmers, veterinarians and farm advisors (ICAR 2014). Ideally, regular use of the statistics produces own interest of users who are usually also responsible for the recording, in good data quality (Egger-Danner et al. 2012). Knowledge of how to read and use the health statistics provided is crucial in this respect as it makes people recognize the advantages of proper documentation which may go far beyond the

legal minimum requirements, such that continuity of data flow and reliability of the health data reporting can be achieved and maintained. Good communication of results is precondition for visibility of the added value of health monitoring in the daily practice on the farms, so contributing to system performance, stability and long-term success of the health improvement program.
Interdisciplinary approaches promise optimum conditions for improved understanding of the complexity of the animal health and disease situation in the specific environment, with its importance for animal welfare as well as efficiency and profitability of milk production. Observations of farmers, diagnoses of veterinarians, and findings of claw trimmers can all provide valuable information on animal health. The clear benefit of efficient integrated data usage, systematic data analyses within and also across farms, and optimized information-based advisory services has been well documented (Østerås et al. 2007), but the coverage of such comprehensive services in the dairy sector is still limited. Major challenges arise from the often lacking transparency and minimum information exchange and collaboration between the professions that are directly or indirectly concerned with animal health issues (Pothmann et al. 2014). In the light of the intense societal and political discussion about modern livestock keeping and use, there is increased concern about data security and considerable reluctance to share data that may be sensitive. Intensified and improved communication within the dairy sector is needed to create confidence and initiate concerted actions that have the potential to yield substantial synergistic effects: reduced efforts of individual contributors by integration of existing documentation systems and combined use of information from different sources; accessibility of veterinary and non-veterinary expertise with management, veterinary intervention and selection decisions based on the same comprehensive information basis; strengthened position in the public debate on animal health and welfare.
In running interdisciplinary programs, the very different backgrounds, expectations and needs of the professional group requires clear definition of responsibilities and elaborate information policy. Communication skills of contributors may be considerably challenged to specifically address key factors like: pros and cons of available recording systems; data quality issues, support requirements and advisory services; contents, interpretation and use of the output generated (health reports, check and alert lists, case histories and lifetime health information of cows, estimated breeding values of bulls). New tools and advanced didactic methods such as e-learning can help reaching the different target groups, thus supplementing the classical ways of communication and knowledge transfer, while freeing human resources for cases where specific support and individual consultation is needed.

New traits and the new role of communication

Modern agriculture, livestock husbandry and breeding are often critically discussed in terms of responsible use of animals and natural resources, reflecting the increased concern of consumers and politics about food safety, animal welfare and sustainability. However, the recent developments in this sector, as shown for dairy cattle, provide striking opportunities of increasing efficiency in improving traits which were previously hardly accessible. Although phenotyping for new traits is still and will remain to be a challenge to implement, successful programs illustrate how new communication and collaboration strategies within the sector can take effect. However, external communication, i.e. proactive transfer of information to the public, with regard to common practices, initiatives and their results remains to be strengthened in order to ensure wider acceptance and positive recognition of the developing livestock sector.

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Friday, August 28, Hall A: COMMUNICATING AND MOTIVATING TO ACHIEVE RESULTS

S06

IS COMMUNICATION THE KEY TO ACHIEVE GOOD RESULTS?

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In modern dairy farming, good results depend not only on factors like genetics and feeding but also on human behaviour. Examples for this could be: The accurate detection and correct interpretation of oestrus signals in bulling cows, the detection of mastitis and its treatment or the precise composition of a ration according to its calculation. Other examples may include patient herding of cattle or correct administering of obstetric interventions in cases of dystocia. In all these challenges the incorrect or incomplete implementation of measures will lead to suboptimal results in terms of animal production and health eventually impairing key performance indicators of the agricultural enterprise.
The question how optimal results can be achieved is therefore central. In this, understanding and influencing human behaviour is a key component and is subject to growing psychological and economic research (Camerer 1999). It is generally accepted that decisions are not based on purely rational arguing but involve partly irrational, partly subconscious elements influencing the decision. This is often referred to as “framing” (e.g. Druckman 2001). Applied to the field of dairy farming this could mean that certain practices in cattle herding, like using sticks to drive the animals, are not being abandoned because “it has always been that way” or “the animals will not move otherwise” or they may be “aggressive”. This is independent of whether this has actually been proven true, framing thoughts prevents to think through and eventually test and alternative being offered. The adherence in behaviour to standard operating procedures (SOP), best practice or legal standards is referred to as compliance. Compliance is generally defined within the ISO 19600:2014 and forms a fundament of applied risk management.
Active risk management therefore demands compliance control, involving both rational (explaining, controlling) and irrational (motivating, nudging) elements. Motivation to adapt a certain behaviour is generally thought to rest on intrinsic and extrinsic motivators. In the field of farming, an intrinsic motivator would be joy in working with animals, master and improve new techniques or the realization that own work is directly related to one’s own wellbeing, e.g. by economic success. Extrinsic motivation would be motivation by certain benefits if a certain goal is reached, but also external control, e.g. by protocols and sanctions if the desired actions are not taken. The concept of the “theory X and theory Y” (McGregor 1960) uses this dualism to distinguish between two types of management:

→ According to theory X, compliance and in consequence success is achieved by heavy extrinsic motivation, regularly with a strong punitive connotation. The desired behaviour is reached by documentation of all actions to be taken, regular control and direct reward or punishment, e.g. benefits or detriments. The measures according to theory X aims at personnel that lacks insight, has rather unchallenging and repetitive tasks. In this approach, communication

is the means to transfer the standard and consequences if this is not met.

→ Theory Y relies on the ambition and intrinsic motivation of staff. In a system organized on the principles of this theory, a motivating surrounding, regular education and appreciation will increase intrinsic motivation and lead to good compliance. Communication is central in this approach as it is not only the means of transferring standards, but also appreciation

While it is certainly desirable to adapt a "Y-approach", it is necessary to analyse the goals, define the best practice standard before communicating it. Also, means of control are nevertheless necessary in order to attain the effect of measures taken, in other words whether motivation was successful and achieved the effects originally desired.

In order to achieve best practice, managing staff on a farm has therefore to

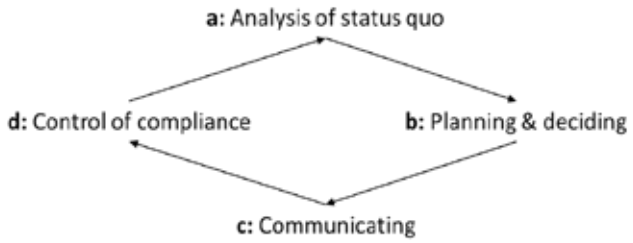
a) Analyse the field in which compliance is to be attained. It demands analysis of data, observation of the status quo and identification of points to be improved. Communication here is just a means to gather information not increasing motivation in itself. On the contrary, asking questions about the actual milking routine, controls of feeding and alike can in itself be perceived as critical and de-motivating.

b) Define goals that can be reached and measured, planning and deciding the working standard. Examples would be: New infection rate in mastitis, percentage of stillbirths, feed leftovers, heat detection rate and alike. The process of defining these goals may be done by communicating with other staff, the goals are nevertheless largely given by the actual economic necessities of the operation. The plan to reach the goals, that is deciding on a working standard, can also be done in an interactive way, e.g. by round-table discussions, this must however, dilute the goals that are to be reached. A decision has eventually be taken by the body responsible for the result.

c) Communicating goals, decisions and plans. In this part of the process communication is indeed central. Communicating the decision should comprise not only of the facts but also the reasons and give room for discussion.

d) Controlling the application of the decision. In this stage the actual compliance is reviewed and this information forms the basis for an ongoing analysis (a). Communication

These elements therefore form a chain of actions:



As it has been shown, communication forms a pivotal element in motivation of staff, nevertheless it's importance has to be seen in the perspective of decision making. While communication is relevant for transfer of decisions, good results depend not only on the how, but also the content of information given.

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Friday, August 28, Hall A: MILK QUALITY FROM AN INDUSTRY'S PERSPECTIVE

S07

IS FURTHER REDUCTION IN SOMATIC CELLS AN INDICATION OF BETTER MILK QUALITY?

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Quantity and quality of dairy animal's milk are the keys for economic success. Thus, any impairment which causes a decrease in milk yield and/or quality can have detrimental effects on the dairy industry. Intamammary infection (IMI) is one of the fundamental causes responsible for lowering milk quality, both on the individual gland and/or the cow level, while its influence decreases on the bulk tank milk level. Regarding inclusion of milk from each infected individual gland, the key factors to be considered are the safety of milk for human consumption and milk quality for the dairy industry. In light of the fact that the number of cows with clinical IMI is relatively low, while their number with chronic-subclinical IMI is considerably higher (frequently in one gland only), this dilemma requires constant and continuous decisions and regulations. Infection results in inflammation as exhibited by an increase in somatic cell count (SCC), which is considered today as the major factor associated with milk quality on the individual gland and the bulk tank milk level. However, regardless of SCC on the individual gland, different pathogens induce damaging modifications to the milk proteins during infection. Moreover, the variability in quality of the bulk milk minimizes this association in the bulk tank milk to < 300,000 cells/mL. The questions that arose are: 1. Apart from the bulk tank milk SCC, which gland's milk should not be allowed to enter the tank. 2. Where is the cut-off level for bulk tank milk SCC that indicates a decrease in milk quality which should be considered in a payment scheme?

Friday, August 28, Hall A: MILK QUALITY FROM AN INDUSTRY'S PERSPECTIVE

S08

IS FURTHER REDUCTION IN SOMATIC CELLS AN INDICATION OF BETTER MILK QUALITY?

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The structure of the milk industry is going through extensive changes in the last decade. The number of farms is dropping, while the average number of animals in each farm is increasing sharply. Modern dairy farms employ high level of automated computerized data acquisition by sensors installed in the dairy parlor or on the individual cows. Computerized management systems utilizes this data to support decision making in high precision farming. These management systems replace familiarity with the individual cow for monitoring and control of production, fertility, animal health and welfare.

Years of extensive efforts to improve milk quality and safety based on reducing somatic cells count (SCC) in the bulk tank milk are approaching convergence in some countries. The improved quality and safety of the bulk tank milk and a new emerging technology is an opportunity to assume new characteristics for quality by addressing the raw material potential for high quality and yields of end-line products.

Cheese making economics is achieved by maximizing yields and quality through efficient recovery of milk constituents and by minimizing constituent's losses in the whey. Cheese manufacturing efficiency is determined mainly by the level the raw milk constituents and its coagulation properties, i.e., rennet clotting time (RCT) and curd firmness (CF), which are influenced by many factors such as genetics, diet, stage of lactation, parity, environment and animal health. These factors vary

between cows, during lactation, between milking sessions and during a single milking of an individual cow.
Consequently, the bulk milk represents milk with an average composition of all the individual milked animals. The approach of optimizing vat's milk quality by payment according to SCC, solids level (fat and protein) and bacteria count in the vat is retrospective and therefore limited. However, the coagulation properties of the milk, which are of major importance for cheese production, are not addressed. The economical goal of cheese making is to maximize yields through the efficient incorporation of milk constituents in the cheese while minimizing its losses in the whey. Therefore, milk processors invest vast efforts in vat milk fortification to a higher level of protein for increasing cheese yields and reducing production costs. Such a fortification is achieved by addition of milk solids (up to 14–17% dry matter in certain products) or by membrane concentration and fractionation of milk proteins (e.g., ultrafiltration, microfiltration and reverse osmosis).
A new approach for on-farm control of bulk tank milk properties for cheese manufacturing is presented. The Afilab™, milk spectrometer (afimilk, Afikim, Israel), evaluates milk coagulation properties in real time during milking and is channeling each pull of milk into one of two particular bulk tanks A or B, depending on predetermined required qualities. The distinction of the milk and the designation of each tank are derived from the dairy's required quotas for different products.
The AfiLab™ milk spectrometer provides on-line information on each cow's milk yield, milk composition and clotting parameters in real time during the milking session. Such a device when installed in a milking parlor equipped with two parallel milk lines and two bulk milk tanks, has the potential of controlling the milk properties in the two bulk milk tanks A and B, based on its on-line properties for cheese making and for other milk products and fluid milk.
The objective of the present research report is to evaluate the economic potential of real time milk segregation as performed by the AfiLabTM, based on its coagulation properties – Afi-CF. Higher cheese yield of about 10-15% attained in the designated production vat from milk with the higher coagulating potential in a commercial dairy plant.
Farm management systems advancing from compilation of production reports to real time decisions making introduces a major leap in high precision dairy farming. By implementing this approach, modern dairy farms can now supply the dairy producers with two types of raw materials. These two "raw materials" designated to optimize different final products will optimize overall production and economics.

Friday, August 28, Hall A: INFORMING CONSUMERS FOR BETTER CHOICES

S09
WILL INFORMATION CHANGE CONSUMERS' ATTITUDES?
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Sustainable food production comprises a myriad of systems and practices across the globe – there is no "one-size-fits-all" that will apply to all regions, climates, markets and operations. Indeed, the most accepted scientific definition of sustainable food systems is simply that they are economically-viable, environmentally-responsible and socially-acceptable (United Nations World Commission on Environment and Development, 1987). The last of the triumvirate is least easy to satisfy, as consumers often appear to be convinced that modern food production methods are inherently unsustainable, particularly with respect to environmental impact. This seems rather oxymoronic - if producers do not cultivate and care for natural resources associated with their operation they are unlikely to have a future within the industry. Nonetheless, the growing media devoted to revolutionizing the food industry, or "exposing" the truth behind food production leads to the supposition that conventional food production and environmental sustainability are mutually incompatible.
By contrast to past information sources of newspapers, radio, television and books, the average consumer now relies on websites as his or her top food system information source, followed by local TV stations, friends and specific search engines (Capper and Yancey, in-press). However, 60% of U.S. consumers say that they don't have a good understanding of how food is produced today (SHS FoodThink, 2013); 70% want to know more about where their food comes from, and 58% will try to learn more about food marketing claims that they question or don't understand (SHS Foodthink, 2012). Although the number of farmers actively participating in social media continues to increase, 45% of consumers do not believe that the agricultural community is transparent about how food is produced, and this number increases to 52% with regards to food company transparency (SHS FoodThink, 2013). This implies that even when consumers are provided with information, they may not fully trust it. Even farm visits are not as effective as otherwise hoped - only 19% of consumers felt better about agriculture after a visit, with 75% of consumers unaffected (SHS FoodThink, 2013).
In order to influence the consumer, we have to consider both the target audience and their existing beliefs and biases in order to establish our shared values (e.g. the hope that our children or grandchildren will enjoy nature as we do, or concern regarding climate change). We confirm our beliefs about controversial issues (e.g. intensive farming or GMO crops) according to the people with whom we share values (Kahan et al., 2011; Tomasello et al., 2005). Thus if our friends and family believe that "information X" is correct, we are more likely to believe it. If new evidence is introduced, our pre-existing bias makes it difficult to change our mind (Kahan and Braman, 2006) as we are more likely to believe information that agrees with our existing opinions (regardless of veracity) and reject that which is contrary to our belief system (Nickerson, 1998).
When pieces of information are reinforced with data or numbers, they also gain credibility. This is useful when referencing data from peer-reviewed sources – for example, a statement such as "*U.S. dairy productivity improvements between 1944 and 2007 allowed for a 59% increase in total milk production, with concurrent decreases in feed use (77%), land use (90%), water use (65%) and conferred a 63% decrease in GHG emissions per kg of milk (Capper et al., 2009)*." may have a greater effect than "*Dairy farmers have reduced their environmental impact*". Moreover, a picture or video sends a far more powerful message than text – if consumers see an appealing image, they are more likely to garner an immediate positive impression than they would from reading an article (Willows and Houghton, 1987).
As consumers, we do not need to fully research or understand an issue to form strong opinions (Arthur, 1994), which may then be reinforced by bad news bias – the assumption that a negative assertion is more important than a positive one. This may be particularly dangerous, as negative pieces of information confer more strongly-held beliefs (Mizerski, 1982) and have longer-lasting effects (Richins, 1983) than positive statements. Indeed, Richey et al. (1975) showed that one negative piece of information was sufficient to neutralize five pieces of positive information.
When searching looking for food production information, a slight majority of U.S. consumers appear to trust friends/family (57%) and farmers (53%), and just under half trust academics (44%; SHS FoodThink, 2014). Recent CFI (Center for Food Integrity, 2014) research demonstrated that confidence (shared values and ethics) was three to five times more important than competence (skills and ability) in building trust with consumers. As noted by Capper and Yancey (in-press), scientists are often wedded to facts and data to get messages across, yet consumers want shared values and relationships – they don't care what we know unless they know how much we care.

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Friday, August 28, Hall B: ECONOMICS OF REPRODUCTION

S10

OPTIMAL DECISIONS ON REPRODUCTION: AN ECONOMIC PERSPECTIVE

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A management area with constant discussion, at least in the Netherlands, is the area of reproduction. Twenty years or so ago, it seemed clear: the optimal calving interval is a short calving interval and farmers should strive for a calving interval of 365 days. However, things changed in the meantime. Milk production increased, the persistency of milk production changed and market circumstances changed. The average calving interval increased from 1993 (394 days) to 2010 (418 days) with little less than a month.
Basically, the following points are of interest when evaluating the calving interval from an economic point of view:

1. The milk production per cow per day. Due to the shape of the lactation curve a longer calving interval leads in most cases to a lower average milk production per cow per day
2. Culling. When the number of open days of a cow become too long, a cow will be culled, which means that a replacing animal has to be bought or raised
3. Value of the born calves. Each newborn calf represents a value, either as possible replacement animal or for sales.
4. Management around drying off and calving. Each calving is associated with costs for management, the drying off of the cow, the assistance with calving, sometimes by a veterinarian, and the raising of the calf for the first two weeks
5. Costs of diseases associated with calving and transition. The transition period is the high risk period for diseases. Reproduction diseases, metabolic diseases, claw health and mastitis have a higher incidence in the first weeks/months after calving. So with more calvings, there will be higher costs for diseases
6. Risk of wearing out the cows if they calf too often. There is no scientific evidence for this argument, but I have heard it being used by veterinarians and farmers.

The economic damage of an extended calving interval needs, therefore, more arguments than only milk production level and value of newborn calves. For Dutch circumstances, taking into account the first five arguments mentioned above, calculations showed in 2011 (Inchaisri et al. 2010) that the net economic effect of an average calving interval (407 days) vs a good calving interval (362 days) is € 34 per cow per year. the difference of a good and a bad calving interval (507 days) is € 231 per cow per year. That was under the quota situation where lower milk production levels do have a relatively low economic effect. Under the current, no-quota, EU market situation, these figures will be higher. We could not model the effects of the sixths argument because we do not have any scientific information about this effect.
In other farming systems, the economic damage of an extended calving interval may differ, it will depend upon seasonality of the calving interval, the price of calves, milk prices etc.
When evaluating the calving interval, there are two main aspects to look at: the craftsmanship of the farmer and physiological circumstances that influence the oestrus detection rate and the conception rate. Besides that there are the choices a farmer makes: when to start with inseminations (voluntary waiting period) and when to stop with inseminations if a cow did not conceive. For most cows under the Dutch circumstances, it was beneficial to have a short voluntary waiting period (Inchaisri et al., 2011, Steeneveld et al., 2012). However, it seems that it is beneficial to continue inseminating quite long, longer than farmers do in practice (Inchaisri et al., 2012). This sounds contradictory since it increases the calving interval. The calving interval, however, should not be decreased by early ceasing of inseminations (and thus early culling of the cow) but by increasing the oestrus detection rate and the conception rate.

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Friday, August 28, Hall B: HEAT DETECTION OR HORMONE PROTOCOLS

S11

HEAT DETECTION VS HORMONAL PROTOCOLS: REPRODUCTIVE PERFORMANCE, ECONOMIC BENEFITS AND SOCIETAL ACCEPTANCE

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Faced with the decline in dairy cow fertility internationally, one of the short-term responses has been to move away from heat detection and towards hormonal protocols to pre-synch-re-synchronise ovulation and oestrus. While this approach is now widely adopted in North America, it is also increasingly applied in dairy herds globally. However, xenobiotic use in food producing animals requires robust justification for consumers within Europe. So, should European veterinarians be concerned about the growing non-therapeutic use of reproductive hormones in dairy cows or have we just accepted this is the way our dairy farmers want to/have to breed their cows? If we adopt the latter view, we need to optimise the use of hormonal protocols in farm-specific reproductive management strategies. If however we have concerns about hormonal use we should empirically evaluate alternatives that may be equally efficacious and cost-effective with minimal pharmacologic intervention but more consumer-acceptable, e.g. automated heat detection technologies. This paper addresses these divergent paradigms.
Key words: dairy, fertility, oestrus detection, synchronisation, debate
Introduction: It is generally (Hudson, et al., 2010, Huang et al., 2009, Rocha and Carvalheira, 2007, Mee, 2004) though not universally accepted by veterinary scientists (LeBlanc, 2010, Refsdal 2007, Hasenpusch, 2007, Chang et al., 2006) that the reproductive performance of dairy cows, particularly Holstein cows, has declined over the last four decades. However, at farmer and agri-industry level this phenomenon has been accepted across heterogeneous dairy management systems (Mee, 2012) long before scientists began publishing about it. Poor reproductive performance in this context has variously been defined as comprising delayed return to normal ovarian cyclicity postpartum, reduced oestrus

expression and low conception rate (Remnant et al., 2015). This decline has been attributed to a multitude of interrelated factors - increasing herd size, increased adoption of confinement management systems, reduced heat stress tolerance, reduced oestrous expression and change from natural service to AI. However, single trait selection for milk production and its inherent antagonistic genetic correlations with body condition score (Loker et al., 2012), cow health (Fleischer et al., 2001, Pryce et al., 1998) and reproductive performance (Bicahlo et al., 2013, Bello et al., 2012, Mackey et al., 2007, Grohn and Rajala-Schulz, 2000) and their interrelationships (Banos et al., 2013) is the most frequently cited risk factor.

Given this background, it is not surprising that increased focus has recently been placed on reversing this decline in fertility over the long-term by altering genetic selection indices to include functional traits such as fertility and reducing emphasis on milk production alone (Berry et al., 2014, Veerkamp and Beerda, 2007, Flint, 2006). In addition, numerous short-term strategies have been proposed (extending the voluntary waiting period, crossbreeding, use of high fertility sires, better transition period management, nutritional modulation to improves onset of cyclicity and increases conception success; Lucy 2001). However, one of the major trends at farm level has been replacement of visual heat detection (HD) with hormonal protocols and timed artificial insemination (TAI).

There is recent evidence that the phenotypic decline in dairy cow fertility has halted and that reproductive performance is now improving (Berry et al., 2014, Bisinotto, et al., 2014, Norman et al., 2009). Given the causal web of risk factors associated with reduced fertility (Mee, 2014) it is likely that any reversal of the decline in fertility would also be multi-factorial. One of the factors which may have contributed to halting declining reproductive performance is increased use of hormonal protocols in dairy herds and reduced reliance on visual HD to breed dairy cows. This is evidenced by unaltered conception rate but declining calving interval implying reproductive management has effected change (Bisinotto, et al., 2014).

This paper address the question of whether we can reach the same reproductive goals through AI following heat detection and through fixed time AI following hormonal protocols by examining the empirical evidence supporting the efficacy and economic value of modern hormonal protocols with TAI to breed dairy cows and compares these results with those generated from HD protocols. Additionally, the social and ethical issues surrounding use of reproductive hormonal protocols are discussed in the context of European consumer acceptance. The focus is on non-therapeutic use of hormonal protocols to control ovulation and oestrus.

From AI to automated oestrus detection: Ever since 'Frosty', the first calf was born from frozen/thawed AI semen in the US in 1953 (Anon, 2010), there has been a greater need for farmers to detect cows in oestrus which was less important when natural service breeding prevailed. In the 1960s the first heat mount detectors (Kamar) were developed (Baker, 1965), measurement of vaginal mucus conductivity was first evaluated (Stan, 1969) and vasectomised bulls were first used for HD (Ayalon and Weis, 1970). In the 1970s tailpaint was first developed on Australian and New Zealand dairy farms (Macmillan and Curnow, 1977), milk progesterone was used in the UK (Lamming and Bulman, 1976) and the first pedometers were tested in the US (Williams et al., 1981). By the 1990s pressure sensitive devices such as the HeatWatch radiotelemetric units (Nebel et al., 1995) and activity monitors were developed. Despite these advances, HD rates declined from 51% in 1985 to 42% in 1999 in US herds (Washburn et al., 2002). This may in part be explained by the attenuation in the duration of oestrus associated with increasing milk production (Lopez et al., 2004). Hence, more recently, agri-tech has been focussed on HD using automated activity monitors (AAM) (Chanvallon et al., 2014) or continuous telemetric recording of body temperature or rumination. The most recent survey of farmers in the US found that 69% of respondents were using technology on their farms and 41% of them were monitoring cow activity for HD (Borchers and Bewley, 2015). It is these latter developments, in conjunction with the emergence of precision livestock farming technologies (and to a much lesser extent, the growth of organic farming) that may present significant alternatives to the growing use of hormonal protocols to breed dairy cows. This hypothesis is supported by a recent survey of German dairy farmers who installed an AAM system; 39% of farmers agreed that their use of reproductive hormones decreased after installation of the system (Michaelis et al., 2013). If similar or better reproductive performance can be achieved using automated HD than with TAI protocols this could also facilitate genetic selection for expression of oestrus thus halting the decline in oestrous activity.

Evolution of hormonal protocols: Hormonal protocols are not new. The first research studies were carried out on oestrus synchrony in dairy cattle over fifty years ago in the US in the 1960s, by the 1970s prostaglandins were being tested, by the 1980s estrogen and progesterone-based breeding control programmes were researched and by the 1990s ovulation synchronisation (ovsynch) with TAI and a new intra-vaginal device for oestrus synchronisation (CIDR-B) were first reported and reproductive ultrasonography was being used to detect early non-pregnancy (Anon, 2010, Macmillan, 2010). With each intervening year the use of hormonal protocols (Miller et al., 2007), reproductive ultrasonography (Mee et al., 2009) and computerised data recording systems has increased globally. Synchronised breeding increased from 2% of cows in 1996 to 35% of cows in 2005 in the US (Miller et al., 2007). Currently in North America hormonal protocols are routinely used in the majority (55-87%) of dairy herds (in particular larger, >300 cows, herds) and account for nearly 30% of all AI services (Stevenson, 2014, Denis-Robichaud et al., 2014, Caraviello et al., 2006). Drylot herds tend to rely more on HD and confinement herds on TAI protocols. A recent UK survey found that only 0.6% of non-organic dairy farms (n=714) never used hormones to assist insemination of cows (Higgins et al., 2013a). In contrast in Scandinavia, hormonal usage is much lower (<1% of cows in Norway) and in Sweden the Farmers Association ceased use of oestrus synchronisation in 1996 because of perceived consumer reaction (Refsdal, 2000). On most dairy farms hormonal protocols are used in combination with HD, but 10% of US herds now use TAI protocols exclusively (Galvao et al., 2013). Of hormonal protocols used today, Ovsynch (and its variations) is the most common TAI programme used in the US and in many other countries (Bisinotto et al., 2014, Smith et al., 2015). While the original TAI protocols (e.g. Ovsynch) were designed to increase insemination risk, but not fertility, the latest protocols (e.g. Presynch-Ovsynch) were developed not only to increase insemination risk, but also the fertility of TAI.

Hormonal protocols vs heat detection: the reproductive evidence: Given the extensive corpus of work on controlled breeding programmes (16,000 results in Google Scholar for estrus/estrous/oestrus/oestrous, synchronisation and dairy, excluding patents and citations; accessed 20.5.15) it is surprising to discover that there are very few recent studies comparing reproductive outcomes to AI following hormonal protocols or HD. This reflects the fact that the control group in most experimental studies now is another hormonal protocol, not AI after HD. This implies that the baseline now within dairy industries to which the results will be extrapolated is a hormonal protocol, not AI after HD, as it would have been in the past. Thus current pharmaco-reproductive research and its funders are following the lead they had previously created in developing hormonal protocols and not really questioning the use of such protocols *per se*. Hence, the endless variations on hormonal protocols with different drugs, doses, routes of administration and timings of administration, most without any comparison with AI after HD.

Given the heterogeneity within hormonal protocols and within HD methods and the definition of reproductive outcomes one would expect heterogeneity within the results from comparative studies. In addition, numerous confounding factors such as pre-existing cow fertility and HD efficiency, ovulatory status, uterine health, lameness, days in milk, body condition score (BCS), heat stress, milk production, breed, genetic strain, parity, management system and the herd effect will inevitably influence the outcome of even statistically robust comparative studies.

Economic simulations of hormonal protocols: Adoption of hormonal protocols is partly dependent upon demonstration of their economic benefit, in comparison with alternative breeding strategies, to users (veterinarians and their clients); other issues include convenience of use, hazards of use, welfare of use and peer-societal acceptance of use. A recent survey of UK veterinary practitioners found that they and their clients would tolerate increased protocol costs if a high success rate was a dependable outcome (Smith et al., 2015).

In a review of the economics of fertility in high-yielding cows on confined TMR systems in the US, Cabrera, (2014) concluded that higher herd milk

production economically favours reproductive management programmes relying more on hormonal protocols and TAI. Given the higher hormonal product prices in Europe, the author advised use of decision support tools to evaluate the economic outcomes of reproductive programmes in different milk production environments

In the most recent extensive economic simulations of US non-seasonal breeding scenarios with various combinations of AI following HD (30-80%) or 100% TAI it was shown that the economic value of these programmes combining HD and TAI depended on the proportion of cows bred following HD and the resulting conception rate (Giordano et al., 2015). Thus, combined programmes with a CR of 35% for cows bred after HD had the greatest economic value, whereas, 100% TAI programmes had greater economic value when the CR to AI following HD was 25%.

Previous case study work by the same authors showed that 100% TAI programmes were economically superior to a 100% HD programme in a modelled US dairy farm (Giordano et al., 2011). Simulated conception and pregnancy rates, days open and projected calving intervals were all inferior for the HD programme. Adding HD to the 100% TAI programmes was only beneficial for programmes with a low CR.

In a modelled comparison of HD only, TAI only and combined HD and TAI programmes in US herds, Galvao et al., (2013) concluded that producers can improve their profits by combining HD and TAI. However, if they can achieve high HD efficiency and high accuracy or high compliance with injections in a TAI protocol, using only HD or TAI might be more profitable than trying to do both.

A recent Australian model in a seasonal breeding scenario demonstrated that even with a low conception rate (20%) to TAI, this produced better reproductive outcomes that AI after HD (Table 1), (Beggs, 2013)

Table 1. Modelled* reproductive responses to AI following oestrous detection or TAI protocols (Beggs, 2013).

Breeding strategy	Six-week in-calf rate(%)	Heifer calves per 500 cows (No.)
No synchrony	47	117
PG @ Day 7 then treat unbred cows with TAI	53	132
TAI protocol	68	170

*assumptions: true heats detected (85%), cows cycling at start of breeding (85%), cows responding to noncycling protocol (85%), conception rate to detected oestrus (40%) and to TAI (20%)

In a cost-benefit analysis of the diagnosis and therapy of anoestrous dairy cows in pasture-based herds in New Zealand, McDougall et al., (2010) showed that hormonal therapy was more cost effective than no therapy. The most cost-effective option was an Ovsynch+CIDR protocol without diagnostic procedure for CL detection.

In a novel approach to assessing the economic impact of hormonal protocols, Archer et al., (2015) recently stochastically simulated the benefits of using hormonal protocols compared to HD on dairy herd methane emissions. They found that the hormonal protocols would improve fertility and that this was associated with a reduction in methane emissions.

Recent experimental studies: Given the rapid developments in both controlled breeding protocols and methods of HD and the focus of this paper; hormonal protocols vs heat detection, it was decided to review only recent studies which compared reproductive outcomes to AI following hormonal protocols vs HD and to subdivide the latter into HD by visual observation and by automated monitoring. Numerous reviews of older studies have been published.

Visual observation for oestrus vs TAI protocols: In a recent attempt to improve reproductive performance of dairy cows bred during the summer and autumn in Israel, Friedman et al., (2014) compared AI following HD (visual observation) alone with AI following oestrous synchrony and post-AI progesterone supplementation in cooled Holstein cows (n=707). While overall conception rate and days open did not differ between treatments, the calving to service interval was shorter for the hormone treated group and the first service conception rates of subpopulations of cows (uterine disease, low BCS, low milk yield) was higher in the treated group. The authors concluded that selective hormonal administration might improve fertility under these environmental conditions.

In a large scale study (3,285 US dairy cows) the type of presynch programme influenced the reproductive outcomes when Ovsynch-56 was compared with cows visually detected in oestrus (using tail paint/chalk) and bred before the scheduled TAI protocol (early bred; EB). The pregnancy/AI rate (P/AI) was consistently lower in the EB compared to the two presynch protocols, though pregnancy loss rate did not differ between treatments (Stevenson and Pulley, 2012). The authors conceded that most EB cows were inseminated on the basis of removal of tail paint, not observed standing oestrus, and this may have reduced P/AI in this cohort.

A recent large scale European study (1,538 Irish dairy cows) conducted in pasture-based seasonal breeding herds found that whole-herd HD-based breeding programmes (using tail paint/chalk) had a longer calving to service interval, lower submission rate but also lower late embryonic mortality rate than progesterone or Ovsynch TAI protocols (Herlihy et al., 2011). The authors concluded that TAI protocols were effective at achieving earlier first service and conception than HD protocols and that this will be particularly useful in seasonal breeding herds with low submission rates and where the mean calving date is later than desired.

In a further analysis the authors showed that progesterone-based TAI protocols were superior to Ovsynch for problem cows (low BCS, anovulatory, <60 DIM), (Herlihy et al., 2013).

In attempting to determine whether it was better to breed cows following Presynch based on HD (using tail paint/chalk) [short voluntary waiting period (VWP); approximately 50 days] or a TAI protocol (long VWP; 72 days), Chebel and Santos (2010) compared these two protocols in US Holsteins (n=639). They found that the short VWP protocol resulted in a shorter calving to first service interval but no difference in P/AI, late embryonic mortality or final pregnancy rate or economic outcomes. The authors concluded that inseminating cows after HD has the potential to reduce the costs of synchronization protocols for first postpartum AI.

Automated activity monitoring (AAM) for oestrus vs TAI protocols

The most recent comparative study of AAM with Ovsynch-based TAI protocols, as yet unpublished (Dolecheck, 2015), using a pedometer, found that both approaches resulted in similar reproductive performance (CR, DO, AI/pregnancy, embryonic mortality), across three dairy herds. However the TAI group had a shorter time to first AI after VWP. Given this outcome, the author emphasised the need for each producer to evaluate the economics for their herd.

The most recently published experiment comparing hormonal protocols (Presynch-Ovsynch/TAI) and HD (using an AAM system) in US Holstein cows (n=1,025) the authors concluded that the AAM protocol reduced the calving to first AI interval, the TAI protocol produced more pregnancies/AI but treatment did not affect the rate at which cows became pregnant or the proportion of cows pregnant by 300 DIM (Fricke et al., 2014). Simulations of costs and revenue suggested relatively minor economic differences between treatments and changes in submission and/or conception rates could favour one strategy over another.

In an attempt to improve the P/AI of cows bred after HD, Valenza et al., (2012) compared US cows bred after HD (using an AAM system) alone with those administered GnRH at AI following AAM oestrus detection. There was no difference in P/AI at 35 or 65 days post AI. This is in contrast to the findings of a meta-analysis on the use of GnRH at AI which showed a 12.5% increase in conception rate for treated cows (Morgan and Lean, 1993). However, the latter studies preceded the use of AAM systems for HD indicating further studies on the timing of GnRH administration relative to activity need to be conducted.

The largest study to date (1,429 Canadian Holstein cows) comparing reproductive outcomes to AI following HD using an AAM system or TAI protocols across multiple herds, demonstrated that time to AI and to pregnancy and pregnancy rates were similar between treatments, however there were significant interactions with herd (Neves et al., 2012). Conception risk did not differ between cows bred following AAM, visual detection of oestrus or TAI. When AIs based on visual detection of oestrus were excluded from both treatments (11-15% of AI in the AAM and 26-44% of AI in the TAI groups), days to pregnancy were significantly fewer in the AAM (82) compared to the TAI (125) group (P<0.0001). The authors concluded that AAM systems can yield comparable reproductive

performance to that of TAI protocols under field conditions but that performance may vary moderately between herds.

Giordano et al., (2015) compared reproductive outcomes to AI following HD using an AAM system or TAI protocols, after non-pregnancy detection at 31 days after first AI. The P/AI at 31 and 67 days was similar for cows bred using AAM or cows with or without a corpus luteum (CL) bred by TAI protocols. Thus while the AAM programme increased the number of cows bred at natural oestrus it failed to reduce the days to pregnancy. The authors stressed that it was imperative to include a TAI protocol for cows which were not detected in oestrus by AAM.

A small scale Israeli study found no difference in reproductive performance (insemination rate, CR, days open) between pedometry and Ovsynch groups of Holstein cows bred during the summer (Galon, 2010).

Hormonal protocols vs heat detection: reproductive conclusions: From the recently published evidence reviewed it may be concluded that modern hormonal protocols with TAI can (when compared to HD by visual or AAM systems) significantly increase submission rate; reduce, increase or have no effect on calving/VWP to service interval; increase or have no effect on conception rate; reduce, increase or have no effect on calving to conception interval; increase or have no effect on late embryonic mortality and have no effect on final pregnancy rate. The heterogeneity in responses reflects the diversity of study designs and experimental conditions under which they were conducted. In reviewing these data, one must be cognisant of the discordance between results achieved under these experimental conditions and the numerous modifications to protocols employed by veterinary practitioners in the field (Mee, 2010).

However, in general, hormonal protocols with TAI can produce comparable or earlier AI and conception when compared to AI following HD by visual or AAM systems. These mixed results are reflected in the blended use of hormonal protocols alongside HD protocols on most modern dairy farms. So, most farmers have decided that it is no longer a debate between hormonal protocols and HD but about which cows and when to use each tool most cost-effectively.

To cite an eminent US bovo-theriogenologist '*the way for farmers to get into the 30% range for 21-day pregnancy rate is some sort of synchronisation program with super aggressive heat detection on top of that*' (Lucy, 2015).

Hormonal protocols vs heat detection: societal acceptability: Reproductive hormonal protocols (calving induction, anoestrous and uterine pathologies therapies, ovulation and oestrus synchronisation) may be the subject of product quality and market risk concerns. These concerns may in future force dairy industries within the EU to explore alternative ways of achieving their reproductive goals. External influences on the responsible use of such products include the entire food chain from EU regulatory bodies and national governments to processors, retailers and consumers. The primary decision makers are often not consumers per se, but pan-European dairy retail companies. In addition, as use of hormonal protocols may alter cow fertility there is a concern that if their use is not recorded and included in breeding programmes (as in most countries apart from Scandinavia) this may bias genetic selection (Refsdal, 2000). The use of hormonal protocols has been shown to substantially reduces residual genetic variances (though not heritabilities) for all reproductive traits thus affecting genetic parameter estimates in selection indices (Goodling et al., 2005).

At the EU level, irrespective of the efficacy of hormonal protocols, their continued acceptance by regulatory bodies is critical to their future use in European dairy herds where the social sustainability of dairying is increasingly challenged. This is evidenced by previous EU prohibitions on the use of efficacious compounds such as hormonal growth promotors (1988) and oestradiol-17b and related products (2006). These EU bans have wider global implications affecting product use in trading partner non-EU countries (Lane et al., 2008). Currently certain reproductive hormones are licensed for use within the EU but availability of non-licensed products, particularly over the internet, is a continuous threat. In addition, the European Food Safety Authority has stated that the use of hormonal treatments in order to achieve a calving interval of 12 to 13 months results in poor welfare as it deprives the animals of a coping mechanism to delay the onset of the reproductive process postpartum (EFSA, 2009).

At the veterinary practitioner level, little is known about current ethical beliefs in relation to reproductive hormone use in the EU. One recent survey of 93 UK practitioners revealed some interesting findings (Higgins et al., 2013a). The majority of respondents believed that hormones were cost effective for farmers (90%), improved herd fertility (>80%), and were an economic necessity for the UK dairy industry (65%). However, the majority of respondents also replied that they would like to see less use of hormones in the future (75%) and that hormones had a detrimental effect on genetic selection (60%). While the majority perceived that drug companies (95%), dairy farmers (90%) and farm vets (88%) saw a need for hormones, most believed that UK consumers (60%) and supermarkets (50%) did not. Expert panel discussions on the issues raised in this paper generated diverse opinions but in general, 'blanket' use of hormones was deemed unacceptable while veterinary-advised hormone use was seen as a necessary intervention (Higgins et al., 2013b, Logue et al., 2012). This echoes the opinion of Opsomer (2006), that before using hormones, veterinarians should focus on improving herd management.

At the consumer level the EU is becoming increasingly urbanised which heightens the rural-urban divide. The separation of food safety and food production regulation has added greater weight to consumer arguments than in the past. There is an increasing demand for 'Clean, Green and Ethical (CGE) products. Towards this end, some food companies have placed restrictions on the use of hormones in dairy cattle in their QA programmes. For example Arla Foods have a requirement in Denmark that 'hormonal synchronisation of the oestrus may never be practiced in lactating animals' (Anon. 2015) while in the UK they require that 'hormones are only used on postparturient animals where the vet has identified a need...' (Edmondson and Porteus, 2015). Consumer concerns about xenobiotic residues in their food, the welfare sensitivities of multiple hormonal injections/administrations and organic standard regulations have all been raised against systematic hormonal treatments in the EU (Chastant-Maillard, 2006). Previously Refsdal (2000) had highlighted that some consumers are not able to distinguish between areas of application of hormones thus growth hormones, bST and reproductive hormones may be viewed similarly. This conjecture appears to be supported by a Google search using the keywords, reproductive, hormone, consumer, concerns, dairy cow for which the vast majority of results were for bST, not reproductive hormones. In New Zealand, a major exporter of dairy products to the EU, Blackwell et al., (2010) stated that 'future approaches to managing reproduction will favour preventive strategies that circumvent the need to intervene with hormones'. In contrast, Lauderdale (2006) concluded that the future of hormonal protocols in the US was excellent; consumer acceptance was not an issue as such products were FDA/CVM approved, economically beneficial and met a producer need. A counter-intuitive argument has recently been voiced about reproductive success in recent years. Biagotti (2015) postulated that with improving herd fertility in the US, partially due to hormonal use, and skewed sex ratios, there has been a glut of replacement heifers. This has contributed to increased culling rates from 34% in 2003 to 42% in 2013. Thus as reproductive performance increases, cow lifespan has decreased and the author believes consumers will not welcome this trend; Q methodological analysis of this issue is warranted.

Conclusions: In addressing the titular question; hormonal protocols vs heat detection – is the debate concluded or should we still be concerned? it is apparent that from a North American perspective, in general, the debate has been concluded for years, hormonal protocols are here to stay and consumer concerns are not overriding. From a European perspective, hormonal protocols are viewed as a necessary, but more controversial, part of the veterinarian management of herd reproduction and consumer concerns are viewed as of greater import.

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Friday, August 28, Hall B: HEAT DETECTION OR HORMONE PROTOCOLS

S12

CAN WE REACH THE SAME REPRODUCTIVE GOALS THROUGH AI FOLLOWING HEAT DETECTION AND THROUGH FIXED TIME INSEMINATION FOLLOWING HORMONAL PROTOCOLS?

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Problems with fertility of lactating cows have been on the rise for the last few decades. Low reproductive performance is a multifactorial issue: environmental, metabolic and pathogenic stresses cause the deterioration of various reproductive processes, and therefore improving fertility requires specific treatments to cope with a complex problem. Used before artificial insemination (AI), gonadotropin-releasing hormone (GnRH) with (or without) PGF2α is a powerful tool to 'correct' disrupted reproductive processes; after AI, addition of exogenous progesterone might be beneficial. A few approaches to improving fertility using various hormonal treatments are presented.
(A) Mastitis, particularly in its subclinical form, is a widespread disease in dairy cattle. Subclinical mastitis-induced reduction of fertility causes significant losses to dairy farms. We recently examined an approach to improving fertility of subclinical mastitic cows (Wolfenson et al., 2014). Probability of conception was examined in more than 1500 subclinical mastitic and uninfected (control) cows following Ovsynch and timed AI (1st GnRH dose followed by PGF2α 7 days later, 2nd GnRH 60 h after that followed by timed AI 16 h later) compared with insemination following natural estrus. The Ovsynch protocol increased conception rate (CR; pregnancies/AI) of mastitic cows to a level similar to that of controls, whereas CR of mastitic cows AI following estrus remained low. The actual mean CR for uninfected–AI at estrus, subclinical–AI at estrus, uninfected–AI following Ovsynch and subclinical–AI following Ovsynch groups were: 41.8, 26.4, 39.3 and 40.5%, respectively. Interestingly, unlike its positive effect on subclinical mastitic cows, Ovsynch did not improve CR of cows diagnosed postpartum with uterine disease.
(B) Summer heat stress is a major cause of low fertility in about 60% of the world cattle population. We recently examined an approach to improving cow fertility in the summer based on the finding that the low quality of the preovulatory follicle and its enclosed oocyte in summer and fall can be improved by enhanced removal of impaired follicles from the ovaries (Roth et al., 2001). This removal was found to induce ovulation of fresh, healthy follicles. Three follicular cycles induced by serial injections of GnRH and PGF2α improved CR in first-calving cows, and in cows with low milk production (Friedman et al., 2011a).
(C) Studies showed that heat stress lowers the preovulatory LH surge. This may consequently be involved in disruption of ovulation, and with formation of a suboptimal corpus luteum secreting a low level of progesterone; both might be associated with low CR in the summer. In a fertility study, we examined the effect of a single GnRH injection at the onset of estrus for improvement of cows' CR in the summer and winter (Kaim et al., 2003). Results showed significantly improved CR in summer (environmental stress), but not in winter, particularly in first-calving cows and in those with low body condition score (metabolic stress). Unfortunately, this interesting approach is not feasible in commercial farms at present.
(D) Studies showed that plasma progesterone concentrations in lactating cows are lower in summer than in winter. This finding could be associated with the formation of a suboptimal corpus luteum in summer that may be determined by the 'quality' of the ovulatory follicle from which it originated, or by low secretion of preovulatory LH surge. Based on these findings, an approach consisting of addition of external progesterone for a period of 2 weeks after insemination was tested (Friedman et al., 2011b). A controlled-intravaginal device containing progesterone (CIDR) improved CR in the summer, particularly in cows with low body condition and those diagnosed with uterine disease postpartum.
In summary, specific hormonal treatments for specifically designated subpopulations of cows are more efficient than the traditional approach of treating the whole herd with a single approach. Specific treatment for designated subgroups of cows is feasible and easy to perform in modern, computerized dairy herds.

Friday, August 28, Hall B: REVERTING DECLINING FERTILITY

S13

HOW CAN WE REVERSE DECLINING DAIRY COW FERTILITY?

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The most recent secular trends in dairy cow reproductive performance indicate that the decline apparent over the last four decades has halted and in some industries performance has improved both phenotypically and genetically. Single trait selection for milk production and its inherent antagonistic genetic correlations with cow fertility played a central, but not exclusive role in the decline. Reversal of the decline will be achieved in the short, medium and long-term by a holistic approach to the causative factors, critical to which is better recording of fertility phenotype data. The overriding importance of national coordination to reverse the decline is emphasised. This paper addresses how best to implement these strategies globally, nationally and at farm-level.
Key words: dairy, fertility, decline, revert, debate
Introduction: The decline in dairy cow fertility has become a 'wicked problem'; this is a problem that lacks a consensus about the optimal solution and an inability of experts and science to resolve the conflicts (Gerloff, 2011). For the purposes of this paper it is accepted that dairy cow fertility has declined and that it hasn't recovered phenotypically to pre-decline levels (at least in many dairy industries) and hence how this decline can be reversed is worthy of debate. However, alternative arguments are set out hereunder indicating that this is a more complex subject than the titular question suggests. We, as veterinarians, need to be conscious that 'we' alone cannot reverse the decline; this can only be achieved through multi-stakeholder decisions and actions. Thus, it must be recognised that the traditional reductionist view by geneticists, veterinarians, nutritionists, etc., will not solve this complex problem. This paper therefore addresses the broader question 'can something be done to reverse the trend in declining dairy cow fertility?'

Has dairy cow fertility actually declined or not? Before debating how we can reverse declining dairy cow fertility, we first need to examine whether dairy cow fertility has actually declined. Central to this sub-debate is our definition of 'fertility' and then the validity of the various secular trend analyses published in recent years. Fertility may be defined as the biological capacity for successful reproduction which is not the same as reproductive performance which is a function of the probability, timing and efficiency of conception success. There are two broad views on the apparent axiomatic fertility decline; those that believe dairy cow fertility has declined and those who don't believe it has. And then there is a third way, i.e. dairy cow fertility has indeed declined but has now recovered. If one supports the latter two arguments then the titular question, 'how can we revert declining dairy cow fertility?' is redundant and requires no debate.

1. Yes, dairy cow fertility has declined

The most recent review of world trends in the reproductive performance of Holstein cows concluded that both genetic and phenotypic fertility has declined since around 1980 with a plateau around 2006 (Pryce et al., 2014). This decline has been documented in diverse production systems (confinement-based - Hudson, et al., 2010, Huang et al., 2009, Rocha and Carvalheira, 2007; pasture-based – Morton et al., 2014, McDougall, 2006, Mee, 2004) for dairy cows, particularly Holstein cows, over the last four decades. However, at farmer and agri-industry level this phenomenon has been accepted long before scientists began publishing about it. Declines in postpartum resumption of ovarian activity, expression of oestrus, oestrus detection rate, submission rate, conception rate and increased multiple ovulation rate, embryonic mortality and calving interval have all been reported.

Causes of the decline? The decline in dairy cow fertility has been attributed to a multitude of interrelated factors - increasing herd size, increased adoption of confinement management systems, increased adoption of DIY-AI, reduced heat stress tolerance, reduced oestrous expression, inbreeding depression, use of bST, change from natural service to AI and global warming. Morton et al., (2014) concluded that no single factor explains the general decline. However, single trait selection for milk production and its inherent antagonistic genetic correlations with body condition score (Loker et al., 2012), cow health (Fleischer et al., 2001, Pryce et al., 1998) and reproductive performance (Bicahlo et al., 2014, Bello et al., 2012, Mackey et al., 2007, Grohn and Rajala-Schulz, 2000) and their interrelationships (Banos et al., 2013) is the most frequently cited risk factor. Both the recent decline in dairy herd fertility and this possible link with increased milk yield were first documented in the 1970s (Dechow, 2012, Berger et al., 1981).

2. No, dairy cow fertility has not declined

The decline in dairy cow fertility is not universally accepted, either within the Holstein cow population (LeBlanc, 2010, Hasenpusch, 2007, Whitaker, 2002) or in other dairy breeds (e.g. Norwegian Red: Refsdal, 2007, Chang et al., 2006). For the latter non-Holstein populations managed and selected differently from Holsteins this is perhaps not surprising. For Holstein cow populations it has been argued that valid primary datasets are scare and that many datasets are incomplete or biased. It is also asserted that where management is good, and cows do not lose body condition at critical times, the negative correlation between higher milk production and poorer reproductive performance does not apply (Whitaker, 2002). In addition Morton et al., (2014) found that variability in reproductive performance was much greater between herds within years than between years, a finding highlighted by Whitaker (2002) to emphasise that decline has only been happening on some, not all herds.

3. Dairy cow fertility has declined but is now improving

There is recent evidence that while dairy cow fertility did decline this has now halted and that reproductive performance began to improve in the mid-2000s (Berry et al., 2014, Bisinotto, et al., 2014, Pryce et al., 2014, Dechow, 2012, Norman et al., 2009). This has occurred in both Holstein and Jersey cow populations (Norman et al., 2009), in confinement and pasture-based dairy industries (Berry et al., 2014) and both phenotypically and genetically (Berry et al., 2014). However, to date there have only been a few documented studies in a limited number of countries showing these reversal trends.

Causes of the improvement? The sparsely documented recent improvements in dairy cow fertility have primarily been attributed to multi-trait genetic selection indices (Berry et al., 2014, Pryce et al., 2014, Norman et al., 2009) and also increased use of hormonal protocols with timed AI (Bisinotto, et al., 2014, Dechow, 2012), though it is likely better transitional nutritional management has also played a major role.

How to reverse the decline? This question has to be addressed globally, nationally and at farm-level. For example, the decisions that are made about genetic selection for the future sires are influenced at a global level by trans-national breeding organisations and companies. At a national level each dairy industry must address the features of the decline unique to their environment. The need for national coordination was emphasised in a review of how to reverse the decline in fertility in Australia which concluded that a national reproductive advisory group should have a high priority as it required little investment, could be instituted rapidly and had a high likelihood of success (Woolaston and Shepard, 2011). At the farm level the challenges will vary by herd, hence veterinary practitioners have a key role here (Mee, 2007). Recent research has shown that reversal of the decline is most likely when genetic selection is improved (Berry et al., 2014) and national reproductive management extension programmes are effective (Brownlie et al., 2015).

Central to reversing a decline is having benchmark metrics to measure past, present and future reproductive performance. Fertility phenotype recording is the major constraint in many dairy industries internationally; a recent review of how to reverse the fertility decline concluded that improving fertility data recording was the highest priority action to take (Table 1), (Woolaston and Shepard, 2011).

Table 1. Prioritisation of actions to reverse the decline in dairy cow fertility (Australia)

Action	Potential impact	Likelihood of success	Priority
Improve fertility data recording	large	moderate	very high
Nutritional strategies	large	moderate	high-very high
Controlled breeding programmes	moderate	moderate-high	high
National fertility campaign	moderate	moderate	high

Given the multi-factorial nature of the problem there are inevitably blended response actions with different actors and time-frames; short, medium and long-term. It has been calculated that a combination of endocrine, nutritional and genetic strategies would reduce calving interval (CI) by 45 days from a baseline of 410 days to 365 days in a 20 year scenario (2.2 days/year) (Maas et al., 2009).

Short-term responses to the fertility decline: Actions that can yield results immediately are those which directly involve or influence dairy farmers. Firstly, a national reproductive advisory group to coordinate the various strategies to the problem is a high priority immediate response. Immediate actions can be taken at farm-level by farmers and their veterinarians to address the many well known risk factors for poor reproductive performance (Mee, 2014). This is the 'back to basics' in reproductive management espoused by Lucy (2001). For example, on a farm with infectious disease issues affecting fertility this would involve improving farm biocontainment and bioexclusion (Mee et al. 2012). Additionally, introduction of automated oestrous detection technologies or TAI protocols have an increasing role to play in short-term improvement of reproductive performance (Mee, 2015).

Medium-term responses to the fertility decline: Actions which take more time to yield results may involve the dairy farmer significantly altering their herd management. Implementation of national awareness extension programmes (e.g. InCalf) at farm-level has been shown to effect change within 2 years of adoption (Brownlie et al., 2015). Improved fertility record collection could yield a response in a 2 to 10 year time frame (Woolaston and Shepard, 2011). Improved nutritional management can significantly improve cow fertility and it has been calculated that this could reduce CI by approximately 12 days (Maas et al., 2009). A 5 to 10 year time frame for a response in fertility to changes in dairy cow nutritional management has been estimated (Woolaston and Shepard, 2011). Introduction of

different dairy cow breeds (Dillon et al., 2003) and crossbreeding has a role to play in reversing the detrimental effects of inbreeding and improving reproductive performance in the medium-term. Simulation of endocrine management programmes through national milk progesterone (MP_4) monitoring has been shown to potentially reduce CI by 3 days (Maas et al., 2009). While gender-selected fresh semen is currently used in heifers, recent simulations indicate that its use can also be extended successfully to lactating cows (Hutchinson et al., 2013).

Long-term responses to the fertility decline: Increased focus has recently been placed on reversing the decline in fertility over the long-term by altering genetic selection indices to include functional traits such as fertility and reducing emphasis on milk production alone, i.e. conjoint selection (Berry et al., 2014, Veerkamp and Beerda, 2007, Flint, 2006). Emerging technologies will also contribute to reversing the decline in fertility. These include genomic selection, extended life semen, high fertility frozen-thawed sexed semen, automated in-line MP_4 monitoring and gene-based pregnancy testing. In addition, next generation repro-pharmaceuticals (recombinant hormonal products, repro-biotics and repro-immunologics, e.g. metritis vaccines) will impact reproductive performance in the long-term. Ultimately, continued research into dairy cow reproductive physiology and dairy herd reproductive management are essential to resolving this 'wicked problem'.

Conclusions: It is generally, though not universally, accepted that dairy cow fertility has declined in the last four decades but now appears to be improving. While many factors contributed to this decline single trait selection for milk production and its inherent antagonistic genetic correlations with cow fertility played a central role. Reversal of the decline will be achieved in the short, medium and long-term by a holistic approach to the causative factors, critical to which is better recording of fertility phenotype data. The overriding importance of national coordination of strategies to reverse this decline is emphasised.

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Friday August 28, Hall B: REVERTING DECLINING FERTILITY

S14

IS DECLINING FERTILITY THE PRICE FOR HIGHER PRODUCTION?

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The relation between (in)fertility and milk production has been subject of numerous studies. Resumption of ovarian cyclicity after calving is a major condition for a normal reproduction of dairy cows.

In many studies the relation between metabolic disturbances *post partum* and reduced fertility were examined. Restoration of LH pulsatility via release of gonadotropin-releasing hormone (GnRH) from the hypothalamus is a key driver of the process (Lucy *et al.,* 2014). Hormones such as insulin and IGF1 that hypothetically control GnRH activity at the level of the hypothalamus act synergistically with LH at the level of the ovary. In a study of Bold *et al.* (1) starting luteal activity (CLA) was related to percentage of protein and the decline of body condition score (BCS) after calving, but with 100-days milk yield there was no relation. Metabolic imbalances are mostly related to the period of negative energy balance *post partum*, because a strong relation exists with the peak milk yield. The

nadir and the length of NEB are farm specific (or more precisely, cow specific). After the peak milk yield, milk production will stay on a relative high level during 4-6 weeks. From day 80 *post partum* farmers will give the concentrates depending on the milk production and reduce the gift of concentrate in many cases. In that period, most of the cows have to be inseminated or cows are in an early stage of embryonic development. It has to be discussed if this feeding strategy can induce a renewed metabolic imbalance, especially in high productive cows, resulting in repeat breeders or embryonic death. Normally, the percentage of protein reflects the existence of a NEB. So, it can be important to monitor the protein percentages of the group 60-120 days *post partum*. Combined with the data of the clinical investigations (pregnancy, repeat breeding, ovarian cyclicity, oestrus detection) it may be possible to detect feeding management later in lactation as an important issue regarding reproduction problems.

Genetic selection has been of major importance in breeding programmes all over the world. Studies into the possibility of genetic selection in order to improve fertility have been carried out during the last decades. There exists a genetic correlation of 0.40-0.45 between milk yield and grams of fat and protein at one hand and the incidence of cystic ovarian disease (COD) at the other hand (3). In that study, the heritability of COD in Dutch Holstein Friesians was 0.10 but varied significantly between herds. In another study, no direct relationship between a parameter for a negative energy balance (Δfat between 1st and 2nd milk recording *post partum*) and the incidence of COD was found (4). In a study of Bold *et al.* (1) the heritability for CLA was 0.14-0.28. It is questioned if 14-days later CLA will substantially reduce cow's fertility. Thus, the incidence of COD will be influenced by ongoing genetic selection on production parameters.

Between herds big differences exist in the incidence of periparturient diseases such as ketosis, mastitis, and displaced abomasum and of reproduction related diseases such as endometritis and cystic ovarian disease. The underlying factors causing these problems can be judged as farm specific, because they will be mainly influenced by farmers' management. This has been clearly shown in a field study of Hooijer *et al.* (2). In cows with cystic ovarian disease (COD) it would be hypothesised that COD will result in a prolonged interval between calving and conception. In that study it was concluded that in cows with COD a prolonged interval between calving and 1st insemination was responsible for the delayed interval between calving and conception. Treatment of cows with COD with GnRH did not result in a prolonged interval between insemination and conception, but only in a prolonged interval between calving and first insemination. Therefore, regular fertility monitoring can minimize the number of day's open of cows with COD. Intensive monitoring of transition cows, feeding management of dry and periparturient cows, and the feeding regime in the *post* calving periode should reduce the incidence of periparturient diseases, just because of the existing variation between farms related to this.

So, the conclusion can be drawn that measures taken in the feeding strategy for dry cows including transition cows, in the calving process, in the monitoring and treatment of diseased cows (metabolic and fertility related diseases) can reduce or even prevent negative consequences of a higher milk production. Underlying risk factors have to be eliminated as much as possible with a central role for the farmers in cooperation with herd consultants. Generally, the statement "Is declining fertility the price for higher production" has not been judged as correct.

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Friday August 28, Hall B: VACCINATE OR ERRADICATE

S15

IS ERADICATION OF INFECTIOUS DISEASES THE MOST EFFICIENT WAY FOR THEIR CONTROL?

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"Eradication" or iatrogenically-managed extinction of pathogens is the Holy Grail of infectious disease control. How could anyone be against it? In fact, 2 very different viruses, small pox and rinderpest have supposedly been eradicated from human and veterinary populations, respectively, vindicating apparently successful hominid efforts to control nature. But, as is so often the case, and is so often overlooked or ignored by committees rendering policy and procedure god is in the detail.

Firstly, as a matter of context, how is the state of "eradication" to be defined-locally, regionally, nationally, or worldwide? And relatedly, if cynically, how is "eradication" of many pathogens really, often, anything more than a non-tariff trade barrier, that often necessarily becomes a "flexible" definition due to the fickleness of nature. The recent identification of serotypes of bluetongue virus in Swiss goats that haven't read the textbook with regard to obligate transmission (of these viruses) by *Culicoides spp* and resultant angst amongst regulators is perhaps instructive as to a more parsimonious consideration of semantics.

Secondly, how do differences in the often complex biology of host-pathogen interactions together with highly variable management schemes preclude a generic application of eradication for the control of many bovine infections? For example, certainly, it may be possible to (temporarily?) "eradicate" bovine viral diarrhea virus from small countries, with small, often confined, cattle herds, primarily in the hands of rule-bound small holders who dutifully register each animal into a national computerized database. Unfortunately, cows in outback isolated pastures in many parts of the world do not show up on a spreadsheet. Movement and marketing of cattle in many regions or countries could be described, without being overly hyperbolic, as anarchistic. Interactions with wild ungulate reservoirs of pestiviral quasispecies in many cow-calf operations, where the former have not been eliminated by "civilization", is the rule, rather than the exception.

Thirdly, what are the true costs of eradication versus selective and judicious use of relevant vaccines? What was the true cost of the "eradication approach" to the control of the most recent incursion of foot and mouth disease virus into the United Kingdom? Beyond the animal wastage and mid to long term loss of animal agriculture as an industry, what were the psychological costs of the "funeral pyres" and loss of agriculturally-based communities? The latter defy ciphering using the usual "assumptions" in econometric models. What sort of infrastructure has to be in place to maintain eradication? How susceptible is this infrastructure to unforeseen climatic or social events? Delay of the "endgame" of polio eradication in the Middle East and Africa is illustrative of pathogen persistence in places outside of Brigadoon. In the event of unforeseen "lapses" in eradication, what are the biological and economic costs of pathogen incursion into an immunologically naïve population, the (unintended?) consequence of eradication?

The elephant in the room in many discussions of eradication is the arrogance of our species. Moreover, perhaps the biggest problem in discussion of eradication in sanitized offices and hallways is the unfortunately all too frequent biological naivete amongst policymakers and the resultant raising of "Great (unreasonable) Expectations" (for pathogen control) among a digital-centric public who are increasingly out of touch with the biome-the complexity of which is difficult to convey in a text message or tweet, beyond, of course, "life finds a way". Arguably, a more reasonable expectation than eradication in many if not most host-pathogen interactions is the control of the clinical effects of various

infections through the maintenance of herd immunity by the time-tested practice of vaccination.

Friday August 28, Hall B: ON FARM MASTITIS DIAGNOSTICS

S16

CAN ON FARM DIAGNOSTICS SAVE MONEY AND ANTIBIOTICS?

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Introduction: Mastitis is still the most common and costly disease on dairy farms. In particular clinical mastitis (CM) has a negative economic impact on dairy farms in terms of discarded milk, lost milk production, reduced milk quality, and treatment costs. Other significant detriments include adverse effects on cow health and welfare and public health concerns because of the extensive and often injudicious use of antimicrobials for the treatment. There is increasing evidence that the prevention and control of mastitis accounts for the highest antimicrobial drug use on dairy farms. Still, not all CM cases benefit from antibiotic therapy and some cases may benefit from different treatment strategies to optimize cure (e.g. short *vs* long duration). The type of agent causing mastitis may be a major determinant of the treatment strategy selected. Also, two-thirds of all antimicrobials administered on a dairy farm in relation to mastitis are used as dry-cow products. Blanket dry-cow therapy is one of the key measures in the 10-point prevention- and control program of the National Mastitis Council. Still, because of the preventive character of dry cow antibiotics and the large potential reduction in antimicrobial use, it is time to reconsider the blanket dry cow therapy recommendation.
This paper focusses on the potential of on-farm culture systems for saving money and antimicrobials on dairy farms through optimized treatment and dry cow therapy decisions as an example for other (future) on-farm diagnostics.
Treatment decisions: On-farm culture (OFC) systems allow for a rapid and easy identification and enumeration of mastitis pathogens using different selective media for Gram-positive or Gram-negative bacteria or specific mastitis pathogens including Staphylococci, Streptococci and coliforms. Still, a detailed description of the different available OFC systems falls beyond the scope of this paper. The results of OFC systems can be used to either decide not to administer antimicrobial treatment such as in case of no bacterial growth or Gram-negative bacteria or to vary the duration of the treatment. The effects of using OFC systems to guide treatment decisions for CM was recently evaluated[1,2]. In the latter studies, quarters with Gram-positive growth were treated with intramammary antibiotics, while Gram-negative and no growth did not receive intramammary antibiotics based on the OFC results. The culture-based group had a significant reduction in antimicrobial use with only 40 up to 50% of CM cases receiving antimicrobials. As such, there will be reduced drug costs, reduced labor for infusions, and potentially reduced milk discard time for those cows that ultimately are not treated with antimicrobials. Still, the cost-benefit of OFC is not as clear-cut as the effect on the antimicrobial use. In particular herds that routinely use extended-duration therapy without regard for pathogen diagnosis could incur considerable savings by adopting OFC. Treating all CM cases in early lactation immediately after detection for 5 days resulted in an additional loss of 16.7 to 51.6 € for primiparous cows and of 42.9 to 123.6 € for multiparous cows, depending on the prevalence of environmental and contagious mastitis pathogens[3]. Still, the accuracy of diagnosis is critical for on-farm culture systems to be economically advantageous. If cases that actually should be treated are not treated (i.e. Gram-positives falsely classified as Gram-negatives or no growth), the cost might increase with up to 53 € per case[2]. Another interesting strategy from an economic point of view is apparently to use OFC systems but begin the treatment before the results are available and to continue treatment for one extra day in case of a Gram-positive result and to stop treatment in case of no growth or Gram-negative bacteria[3].
Dry cow management decisions: Selective dry cow therapy refers to not dry off all cows with long-acting antimicrobials reserving them to cows with an intramammary infection at dry-off that may benefit from it. A recent Canadian study including 729 low somatic cell count cows (< 200,000 cells/ml) from 16 commercial dairy farms with a bulk milk somatic cell count < 250.000 cells/ml randomly assigned cows to receive either blanket dry cow therapy or OFC-based selective dry cow therapy[4,5]. Cows negative on the OFC were treated solely with an internal teat sealant. Cows positive on the OFC were infused with a commercial dry cow antimicrobial product and an internal teat sealant at drying off. A reduction in dry cow antimicrobials of 21% was realized by targeting antimicrobial treatment at cows with an intramammary infection at dry-off. No effect was observed on post-calving intramammary infection[4], the somatic cell count[5], milk production[5] or incidence of clinical mastitis[4] in the subsequent lactation. Interestingly, the majority of infected and untreated quarters due to misdiagnosis at drying-off experienced an apparent self-cure over the dry period.
Despite the high impact on the antimicrobial use, the cost-benefit of selective dry cow therapy is however rather low. Only on farms combining long-acting antimicrobials with internal teat sealants as the primary dry-off strategy, selective dry cow therapy is likely to result in additional economic benefits.
Conclusions: Using OFC systems for treatment decisions represents a tremendous opportunity to reduce antimicrobial use on commercial dairy farms by as much as 50% for the treatment of CM without hampering the efficacy of the treatment or the long-term health and production potential of the cow. Compared with blanket dry cow therapy, the selective antimicrobial treatment of cows at dry-off based upon on-farm culture results on farms with a good udder health has the potential to reduce the amount of antimicrobials used in the dairy production without negatively affecting milk production, milk quality or the cows' health performances. For both treatment and dry cow management decisions, the impact of using OFC systems on the antimicrobial usage on a dairy farm is much clearer than the impact on the economic benefits.

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Friday August 28, Hall B: ON FARM MASTITIS DIAGNOSTICS

S17

CAN ON FARM DIAGNOSTICS SAVE MONEY AND ANTIBIOTICS?

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Antibiotic treatment in most countries is under strict regulation of authorized personnel such as medical doctors or veterinarians who can prescribe medications. Clinical intramammary infections in some cases justify antibiotic treatment and in these cases the clinical veterinarian should prescribe the precise treatment preferably after diagnosing the infecting agent. However, in several publications it reads as follows: "…most cases are treated by farm personnel without determination of etiology (Hoe and Ruegg, 2006; Oliviera and Ruegg., 2014) and moreover, "about, 35% of these treatments were given to cases which were culture negative at the time of detection and a further 17% were administered to cases for which there are no approved effective antimicrobials (Ruegg, 2014)". If that is the current condition, on farm diagnostics can infer "*providing*" dairy personnel to make the decision of antibiotic treatment. There are three main reasons to oppose on farm diagnostics, 1. Diagnoses require professionalism, what could not be expected from dairyman. 2. Antibiotic treatment is obligatory in the hands of the veterinarian. 3. Diagnostic media and other disposal materials require spatial treatment. Under the view of justifying every treatment and reducing it to a minimum, on farm diagnostic can achieve the opposite and therefore must be prohibited.

Saturday, August 29, Hall A: WELFARE AND PRODUCTIVITY: WALKING SIDE-BY-SIDE

S18

CAN WELFARE AND PRODUCTIVITY WORK SIDE BY SIDE?

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To answer the question "Can welfare and productivity" work side by side?" a clear definition of both welfare and productivity is needed. Animal welfare can be defined based on Brambell's five freedoms being (1) hunger and thirst (2) discomfort (3) pain, injury or disease (4) expresssion of (most) normal behaviour (5) fear and distress. Freedom of pain or disease can be considered to be identical to the term "animal health". Therefore, "animal welfare" might be expressed as "animal welfare including animal health". In this context, productivity might be considered to be high productivity, here defined as a yearly production of > 8000 kg of milk for dairy cows.

One of the striking issues on dairy farms is the big variation in housing systems, feed and milking systems, farmers' management capacities, economic profit, labour efficiency and degree of automated production processes. The latter might be related to the amount of time available for taking care of diseased or periparturient cows, estrous detection and other animal related labour intensive activities. All these factors are in one way or another related to animal welfare. For example, cows held in a modern well-ventilated housing system with appropriate dimensions of the cubicles without overcrowding, will have a slight chance of a disturbed animal welfare. Thus, a large variation exists between herds whereby the conclusion can be drawn that on in may herds animal welfare can be improved. There is no relation with the level of productivity of cows.

Many studies have been carried out on relations between the above mentioned variables on dairy farms and the impact on animal welfare. In some studies it was stated that associations found at the animal level and in experimental settings might not appear at the farm level and in common practice. Therefore it is important to include data analysis on herd and individual level, clinical examinations and evaluation of housing and feeding in an integral analysis of the herd. The demands of high productive cows regarding housing and feeding are not required on many farms. Therefore, in those farms high productivity and animal welfare will not work side by side, but that cannot be a general assertion.

In the last decades the productivity of Dutch dairy cows has been increased to an average yearly production of 8700 kg of milk, however many farms have a productivity of about 9500 kg of milk, boosted by better feeding strategies and genetic improvements. Farmers' management should have to be adapted to a level needed for the higher milk production. A dairy farm is very complicated in its structure, because it consists actually of four major activities such as soil management, crop production, milk production and young stock. Farmers tend to be more active into activities they like and more interested in new developments and will do investments in those activities. Animal welfare (incl. diseased cows) requires dedication to animal care. Especially at this point a big discrepancy exists between farmers. In a Dutch study (2012)[1] nearly all responded farmers considered subclinical lameness to be painless for cows. On the other hand, the increased use of NSAID's during the years shows an increase in farmers' awareness that cows (and calves) can suffer from pain and that a disturbed animal welfare has to be prevented as much as possible. The diversity of activities on farms combined with the favourite work of the farmer will lead to a more or less disturbance of animal welfare. Moreover, no mandatory training for farmers exists. It is questioned whether the productivity of cows and farmers' professional knowledge has been increased equally. So, it might be possible that completely untrained farmers are responsible for treating and caring of diseased cows. Practically, a knowledge transfer of aspects of animal welfare and health exists from veterinarians to farmers. The frequency of farm visits by veterinarians might be correlated with farmers' knowledge. Thus, preferences, know-how and dedication of the farmer for animal related work are key-factors to reduce animal welfare problems on dairy farms.

The Dutch dairy industry has implemented a twice a year farm visit for veterinarians to analyse data, clinical inspection of the herd and inventarisation of work routines (e.g. preventive measures), housing, husbandry, feeding and water, still on voluntary basis. That system has been called "Cow Compass". The purpose is to determine risk factors for the milk production process as a whole including animal welfare and health. The given advices might be give rise to improve farmers' management.

In conclusion, the statement "Can welfare and productivity" work side by side?" can be answered positively. Because of a big variation between herds and farmers in favourite work, know-how and dedication of the farmer on the one hand, and housing, husbandry, feeding and water supply at the other hand, animal welfare can be more or less affected. However, that will be happen independent of the productivity of the cow.

[1] Bruijnis MRN *et al. Thesis Wageningen University, 2012*

Saturday, August 29, Hall A: MASTITIS TREATMENT

S19

ANTIBIOTICS, MASTITIS, AND PRODUCTION OF HIGH QUALITY MILK: SHALL WE ALWAYS RELY ON ANTIBIOTICS FOR UDDER HEALTH?

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Bovine mastitis is one of the most important bacterial diseases of dairy cattle throughout the world. Mastitis is responsible for great economic losses to the dairy producer and to the milk processing industry resulting from reduced milk production, alterations in milk composition, discarded milk, increased replacement costs, extra labor, treatment costs, and veterinary services. Many factors can influence development of mastitis; however, inflammation of the mammary gland is usually a consequence of invasion and colonization of the mammary gland by one or more mastitis pathogens such as *Staphylococcus aureus*, *Streptococcus uberis*, *Escherichia coli* and many others.

Antibiotics are used extensively in food-producing animals to combat disease and to improve animal performance. On dairy farms, antibiotics are used for treatment and prevention of diseases affecting dairy cows, particularly mastitis, and are often administrated routinely to entire herds to prevent mastitis during the dry or non-lactating period. Use of antibiotics in food-producing animals has resulted in healthier, more productive animals; lower disease incidence and reduced morbidity and mortality; and production of abundant quantities of nutritious, high-quality, and low-cost food for human consumption. In spite of these benefits, there is considerable concern from public health, food safety, and regulatory perspectives about use of antibiotics in food-producing animals (Oliver et al., 2011).

Over the last two decades, development of antimicrobial resistance resulting from agricultural use of antibiotics that could impact treatment of diseases affecting the human population that require antibiotic intervention has become a significant global public health concern. When animals are administered an antibiotic that is closely related to an antibiotic used in human medicine, cross-resistance can occur and disease-causing bacteria may become resistant to antibiotics used in human medicine. For example, in a review by Economou and Gousia (2015), new strains of multi-resistant foodborne pathogens including Salmonella, Campylobacter and *Escherichia coli* have been reported that produce extended spectrum beta-lactamases and/or AmpC enzymes that inactivate nearly all beta-lactam antibiotics (which include penicillins and 3rd and 4th generation cephalosporins). There is no doubt that use of antibiotics for treatment and prevention of diseases of dairy cows and other food-producing animals will continue to be scrutinized.

There are basically two positions on this highly controversial polarizing topic (Turnbridge, 2004). One position is that bacterial resistance to antimicrobials used in human medicine does result from agricultural use of antibiotics, and thus immediate action should be taken to prevent this

from happening in the future. The other position is that resistance to antimicrobials used in human medicine does result from agricultural use of antibiotics; however, evidence of this having a major effect on human health and well-being is minimal or non-existent and therefore no action is required. The real difference between these two positions is whether action should be taken, or should have been taken to effectively deal with bacterial antimicrobial resistance developed in food-producing animals. This on-going debate has led to important changes in perceptions and priorities of federal regulatory and public health agencies throughout the world with regard to antimicrobial usage, in particular use of antimicrobials as growth promoters and as prophylactic agents.

The topic of antibiotic use in dairy cows and antimicrobial resistance revolves around some key questions including: (1) are science-based data available to demonstrate antimicrobial resistance in veterinary pathogens that cause disease in dairy cows associated with use of antibiotics in dairy cows?, (2) are science-based data available to demonstrate that antimicrobial resistance in veterinary pathogens that cause disease in dairy cows impact pathogens that cause disease in humans?, and (3) are strategies on prudent use of antibiotics in the dairy industry being advocated and followed. In a comprehensive review on the impact of antibiotic use in adult dairy cows on antimicrobial resistance of veterinary and human pathogens in adult dairy cows, Oliver et al. (2011) concluded that scientific evidence does not support widespread, emerging resistance among mastitis pathogens to antibacterial drugs even though many of these antibiotics have been used in the dairy industry for treatment and prevention of disease for several decades. However, it is clear that use of antibiotics in food-producing animals does contribute to increased antimicrobial resistance. Based on the current scientific literature, the clinical consequences of antimicrobial resistance of dairy pathogens affecting humans appear small. Antimicrobial resistance among dairy pathogens, particularly those found in milk, is likely not a human health concern as long as the milk is pasteurized. However, an increasing number of people choose to consume raw milk (Oliver et al., 2009). Transmission of an antimicrobial resistant mastitis pathogen and/or foodborne pathogen to humans could occur if contaminated unpasteurized milk and/or dairy products made from contaminated raw milk is consumed; which is another very important reason why people should not consume raw milk. Likewise, resistant bacteria contaminating meat from dairy cows should not be a significant human health concern if the meat is cooked properly.

Different countries throughout the world have different laws and regulations regarding antibiotic use in food-producing animals. Much of the focus was and continues to be on antibiotics that were/are used in animal feed as growth promoters. Antimicrobial use in animal agriculture, especially at sub-therapeutic levels, has met with considerable controversy and is at the center of the agriculture antibiotic use debate. A significant concern is that selection pressure from use of antimicrobials in food-producing animals could result in the emergence, maintenance and horizontal transfer of antimicrobial resistant determinants in bacteria. Selection pressure through sustained use of antimicrobials at sub-therapeutic concentrations in animal production systems could result in development of antimicrobial resistance in commensal and pathogenic bacteria. Bacteria exchange antimicrobial resistance genes, and these genes may ultimately enter bacteria pathogenic to man and/or opportunistic bacterial pathogens.

Sweden was the first country to regulate withdrawal of antibiotics as growth promoters in food-producing animals in 1986 (Cogliani et al., 2011). In 1995, Denmark banned use of antibiotics as growth promoters in food animal production and subsequently established a system for monitoring antibiotic resistance in farm animals referred to as DANMAP. Use of all antibiotics as growth promoters was banned in the European Union in 2006. The ban on 'growth promoters' was intended to limit non-essential uses of antibiotics in animal production and to help safeguard the effectiveness of important human antibiotics. The program was very effective in some countries and resulted in substantial reductions in the amount of antibiotics used in animal agriculture. On the other hand, the ban on use of antibiotics as growth promoters had limited impact in other countries. For example, in some countries, the 'growth promoter' ban did not substantially reduce the overall use of antibiotics in food animal production as was intended; there was a subsequent increase in use of 'therapeutic' antibiotics following the ban. It was noted that withdrawing antibiotics as growth promoters needed to be accompanied by a clear definition of "therapeutic" and "non-therapeutic" use of antibiotics, and other interventions including appropriate monitoring and disease control measures (Cogliani et al., 2011).

In the United States, the U.S. Food and Drug Administration recently (June, 2015) announced the Veterinary Feed Directive (VFD) final rule (https://www.federalregister.gov/articles/2015/06/03 /2015-13393/veterinary-feed-directive). The VFD final rule requires veterinarians to issue all VFDs within the context of a veterinarian-client-patient relationship (VCPR) and specifies the key elements that define a VCPR. Key elements include that the veterinarian engage the client (i.e., animal producer or caretaker) to assume responsibility for making clinical judgments about animal health, have sufficient knowledge of the animal by conducting examinations and/or visits to the facility where the animal is managed, and provide for any necessary follow-up evaluation or care. The final rule will require veterinarians to follow state-defined VCPR requirements; in states where the FDA determines that no applicable or appropriate state VCPR requirements exist, veterinarians will need to issue VFDs in compliance with federally defined VCPR requirements. All veterinarians will need to adhere to a VCPR that includes the key elements in the final rule.

Given today's public health and food safety concerns regarding antimicrobial resistance, and antibiotic residues in meat and milk of dairy cows associated with treatment of mastitis and other diseases affecting dairy cows, alternative approaches for disease control has gained considerable attention. Yet, for a variety of reasons, alternative approaches for the prevention and control of dairy cattle diseases have achieved only limited success (Oliver et al., 2011). Even though progress has been made understanding the pathogenesis of many diseases affecting dairy cows, the multiplicity of pathogens capable of causing disease; and lack of knowledge on bovine immunology, bacterial virulence factors, and mechanisms of pathogenesis are factors that have hindered development of effective alternative approaches. Alternatives to antibiotics for disease prevention currently under investigation include improvements in housing, management practices that reduce the likelihood and effect of infectious diseases, management systems and feed formulation, studies to gain a better understanding of animal behavior, and the development of more vaccines, probiotics and competitive exclusion products (Oliver et al., 2009a, Economou and Gousia, 2015). Established practices to prevent or control infectious diseases of dairy cows include improved husbandry practices, quarantines and other biosecurity measures, vaccinations, use of antiseptics such as teat disinfection to prevent mastitis, vector control, and use of probiotics or other competitive microorganisms to exclude pathogens.

Use of antibiotics on dairy farms should not be an all-or-none proposition. Strategies employing prudent use of antimicrobials are needed and this clearly illustrates the importance of effective herd disease prevention and control programs. Prudent use of antibiotics in the dairy industry is important, worthwhile and necessary. Use of antibiotics at times when animals are susceptible to new infection is a sound management decision and a prudent use of antibiotics on the farm. Strategies involving prudent use of antibiotics for treatment encompass identification of the pathogen causing the infection, determining the susceptibility/resistance of the pathogen to assess the most appropriate antibiotic to use for treatment, and a long enough treatment duration to ensure effective concentrations of the antibiotic to eliminate the pathogen (Oliver et al., 2011). Advances in more rapid pathogen detection and characterization systems will undoubtedly play an intergal role in strategies aimed at prudent use of antibiotics.

Lastly, as the debate on use of antibiotics in food-producing animals continues, we need to consider the consequences of "What would happen if antibiotics are banned for use in the dairy industry and in other food-producing animal industries?" The implications of this question are far reaching and include such aspects as animal welfare, health and well-being; and impacts on food quantity, quality, and food costs. This question should be an important aspect in this ongoing and controversial debate.

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Saturday, August 29, Hall A: MASTITIS TREATMENT

S20

SHALL WE ALWAYS RELY ON ANTIBIOTICS FOR UDDER HEALTH?

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Antimicrobials are used to treat cases of clinical mastitis during the lactation, to treat subclinical cases both during the lactation and during the dry period, and to prevent new intramammary infections during the dry period. Mastitis is the most frequent disease and the most common reason for use of antimicrobials in dairy cattle. There are many concerns about the emergence of antimicrobial resistance, despite the mechanisms by which this occurs, still not being fully understood. As a precautionary practice, several countries in Europe have established programs to reduce the use of antimicrobials in farm animals. This makes it important to have a critical look at current practices and future trends in terms of antimicrobial use in mastitis management. Dairy farmers rely on antimicrobial treatments for mastitis, due to animal health and welfare reasons, and to be able to have cows revert to a normal productive activity as soon as possible and with the least possible impact on quantity and quality of milk produced. These views may seem to be conflicting on a first glance, but they probably converge if we consider the economic implications of the excessive use of antimicrobials.

Treatment of clinical mastitis with antimicrobials may have a great variety of results. A large retrospective study comparing the outcome of several antimicrobial treatments with no treatment showed that animals that were not treated had a 65% bacteriological cure rate, whereas animals that were treated with antimicrobials had a 75% cure rate (Wilson et al., 1999). There are several possible explanations for the lack of a higher success rate (du Preez, 2000). Microorganisms may survive inside leukocytes, become walled off inside micro-abcesses, survive in a latent form or be protected inside a biofilm matrix. Antimicrobials may reach insufficient concentrations in the udder to destroy the microorganisms, or they may be antimicrobial resistance. Mastitis episodes may also be caused by pathogens that are not susceptible to currently available antimicrobials (*Mycoplasma* spp., yeast or algae). Many of the reasons for antimicrobial treatment failure are not overcome by using newer antimicrobial compounds, which may be an argument for policy makers to remove some of the latest generation drugs from the veterinary market.

There are however, many examples in the literature of the validity of antimicrobial treatment of mastitis, either clinical or subclinical (Suojala et al., 2013; Halasa et al., 2009). Most trials are performed using antimicrobials according to the manufacturer's recommendations. There is also evidence that using antimicrobials for longer time or with a higher frequency of application may be beneficial. Extended treatment has been shown to benefit the cure rates of mastitis due to pathogens that have lower cure rates, including *Streptococcus uberis* and *Staphylococcus aureus* (Oliver et al., 2004; Roy et al. 2009; Truchetti et al., 2014). In these cases, longer treatments proved to lead to significantly higher cure rates than label recommendations, with lower recurrence also being observed (Swinkels et al., 2013). Similarly, a higher frequency of intramammary application of antimicrobials has also been shown to lead to higher cure rates. Hillerton & Kliem (2002) induced experimental infections with *Strep. uberis* in 54 cows and compared results of intramammary antibiotic at labeled rates (one injector per day over three days), with a higher frequency of administration (two injectors per day over the same time period). Results showed a clinical cure rate at 3 days of treatment of 27% for the conventional treatment and of 70% for the more frequent treatment. In terms of bacteriological cure rates, the rates obtained were 64 and 80% respectively. In this study, the use of systemic antibiotic alone led to lower cure rates and to 14 times more antibiotic to be used. Longer or more frequent antimicrobial treatment may therefore reduce antimicrobial use in the long term.

A very large number of trials for the treatment of clinical mastitis with different antimicrobials have been published. There are however no meta-analysis available on the results of such trials, and only one meta-analysis looking at the result of the use of dry cow antimicrobial therapy on the cure of existing intramammary infections. Some of the common practices now in place have been overlooked in terms of their potential impact on treatment protocols. One such examples is performing three milkings per day, which has become the norm in many areas of the globe. There is very little information regarding antimicrobial levels in the udder with different milking and treatment frequencies (Stockler et al., 2009). An evidence-based approach to mastitis treatment should be used to answer the questions veterinary practitioners are frequently confronted with. Should we treat or not? For how long? With what antimicrobial? With non-steroidal anti-inflammatories? The formation of focus groups to reach consensus could help in defining treatment guidelines.

Mastitis treatment leading to cure, does not necessarily lead to a positive economic result. Treatment of subclinical mastitis during the lactation in most cases will not result in a positive economic result, unless we are faced with situations where the transmission of pathogens in the milking parlor occurs frequently (Swinkels et al., 2005). In those cases, bacteriological cure following treatment has the potential to decrease the number of new cases in the herd as well, potentially leading to an economic benefit. Treatment of recurrent cases of clinical mastitis may also produce a negative economic outcome. Recurrent cases of clinical mastitis seem to occur mostly due to failed bacteriological cure (Pinzon-Sanchez & Ruegg, 2014). Treatment of such cases with antimicrobials is a questionable practice as it is less likely this will lead to cure, despite treatment to avoid unnecessary suffering by the animal still being necessary (for example through the use on non-steroidal anti-inflammatories).

The use of mastitis' pathogen identification systems on farm to make treatment decisions, will increasingly play a role in the way antimicrobials are used. These systems have been shown to reduce intramammary antimicrobial use by half, to decrease milk withholding time by one day, without differing in days to clinical cure, bacteriological cure rates, recurrence of clinical mastitis in the same quarter, somatic cell count, milk production and culling (Lago et al., 2011a; Lago et al., 2011b). Developments in this area will soon allow for more automated diagnosis and its widespread use. This will align the prudent use of antimicrobials with economic benefits for the farmer.

Regarding antimicrobial use in cattle, farmers, veterinarians and the general public opinion need not be on opposite sides of the barricade. Antimicrobial use will likely be reduced because it makes no sense to treat animals that will not benefit from that treatment, leading to economic losses derived from the use of medicines and form milk not being sold for human consumption. As in many other instances, the drive will mostly be of an economic nature, but the end result will benefit us all.

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S21

WHY WE SHOULD NOT USE (SO MUCH) ANTIMICROBIALS FOR THE CONTROL OF MASTITIS

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In Europe and elsewhere, antimicrobial resistance is a major public health challenge. Antimicrobials are important tools for safeguarding human and animal health. In dairy cattle, the main reason for antimicrobial use is the treatment and prevention of mastitis. Therefore, reducing and improving the efficacy of antimicrobial use needs to consider room for improvement in the treatment and control of mastitis.

In Germany antimicrobial resistance in dairy cattle is low if compared to poultry, pigs or veal calves. However, in recent years dairy herds have been shown to harbour multiresistant bacteria such as methicillin-resistant *S. aureus* and ESBL/AmpC producing *E. coli.* In fact, the highest resistance rates to 3rd generation cephalosporins in Germany were observed in calves suffering from diarrhea, i.e. mostly young calves and recent research from the UK and from Germany has shown that the use of waste milk is a major contributor to this resistance especially when containing cephalosporin residues. The public health importance of this finding arises from the transmission of the resistant bacteria from the animals to humans living and working on the farms. This transmission has repeatedly been shown. Moreover, resistant bacteria are traded with calves and introduced into the beef and veal calf populations where they may be further supported by antimicrobial use in these populations.

Antimicrobial use in dairy cattle is characterized by a great diversity of routes of administration. While overall, antimicrobial use in farm animals mainly consists of oral group medication, in dairy cattle treatment is carried out in the individual animal either by injection or by local treatment (intramammaries, intra uterine treatment). Moreover, the drugs used include groups of antimicrobials considered of outmost importance for human and veterinary medicine such as fluoroquinolones, 3rd and 4th generation cephalosporins, and macrolides. Especially the 3rd and 4th generation cephalosporins are used far more frequently than in any other farm animal species.

Therefore, the challenge for dairy practice is twofold:

A: Reduce treatment frequency and improve treatment efficacy

B: Try to overcome use of the prioritized critically important antimicrobials

A: Reduce and improve treatment

Blanket dry cow therapy has been an important feature of programs to control contagious mastitis pathogens such as *Streptococcus agalactiae* and *Staphylococcus aureus*. However, in many cases, especially after the successful control of these bacteria it has turned a preventive treatment with the sole or at least predominant goal to avoid new infections in the early dry period. This approach clearly is not coherent with prudent use principles as in many cases it is used to cover deficits arising from lack of housing hygiene and lack of proper preparation strategies for drying off cows. By improving dry off strategies antimicrobial treatment may be substantially reduced without major drawbacks in udder health.

Treatment of clinical and subclinical mastitis is the second major part of antimicrobial use. It likewise needs to be reconsidered with respect to the balance of treatment success on the one hand and risk of supporting antimicrobial resistance and producing residues on the other. For several bacterial species, treatment success has been shown to be limited with respect to bacteriological cure. It is well established that repeat cases of mastitis in the same quarter are not likely to respond to treatment with bacteriological cure. However, at the same time a substantial amount of antimicrobials is used to treat exactly these cases.

B: Try to overcome use of the prioritized critically important antimicrobials

In Germany, fourth generation cephalosporins are licensed for dry cow therapy, a treatment that in many instances can be considered as a preventive treatment. Considering antimicrobial resistance to the prioritized critically important antimicrobials this is clearly not desirable although it is legal. While this is just the tip of the iceberg, it makes clear, that it is not only off label treatment that we need to address when going for reduced and prudent use of antimicrobials but it is also the legal and label use of antimicrobials.

Is there a way out?

There should be. However, the way out includes prioritization of a downsizing of antimicrobial treatments both in extension and in quality of substances (not quality of products). As antimicrobials are still cheap and sometimes even licensed without or with a very short withdrawal period for the main product of the dairy farm, milk, antimicrobial treatment in many farms is considered a routine management tool rather than the last way out. This approach is only sustainable with regard to eliciting public pressure on farm animal medicine. Several European countries have already minimized use of cephalosporins in dairy practice without a major breakdown in animal health or farm animal economics i.e. addressed the issue of quality of substances and shown that downsizing in this respect is an option. With respect to treatment frequency there is a wide range of treatment frequencies on the dairy farms and there is also a wide range of quality of treatment with respect to treatment efficacy if the latter is measured at all by farmers and veterinarians. Blanket dry cow therapy needs to be overcome and it can be overcome with a mixture of intelligent concepts to identify cows or quarters that still need dry cow treatment and an overall improvement of dry cow management practices other than treating animals with antimicrobials. Clearly, housing and milking time hygiene and strategies to reduce milk production prior to drying off will be cornerstones of the reduction of treatment frequency.

Saturday, May 29, Hall A: MALE DAIRY CALVES

S22

SENSORS IN THE MILKING PARLOUR: REPLACING OR COMPLEMENTING HUMAN SENSES IN MONITORING ANIMAL HEALTH AND PERFORMANCE?

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In most countries around the globe, male calves of dairy breeds have low economic value, which dictates their destiny. What alternatives better suit calves, farmers and consumers?

Modern dairy farming is driven by economic pressures and expectations and demands of the society and the consumer.

First goal is to supply milk and meat for a growing world population (800 mio people starve).

At the same time dairy industry has to meet a number of conditions such as

- Cost efficiency of production (low prices, competition, economic viability),
- Product safety, quality and diversity (consumer health and consumption),
- Low impact on the rural environment and atmosphere (environmental protection) and last but not least
- Animal Health and Animal Welfare (friendly housing and handling).

These conditions may vary in different countries and parts of the world.

The overarching aim of modern dairy farming is to raise healthy animals and to manufacture milk products and meat in a sustainable way.

Cattle are one of the backbones of supply of food of animal origin in many countries. FAO (2012) estimates that 270 million dairy cows worldwide. The world production of milk in 2013 was 780 million tons. The global average for milk production per cow and year is approx. 2.200 liters with a huge variation (FAOstat 2012) which demonstrates the large differences between breeds and production systems.

High producing milking cow herds are usually raised today on specialized farms in modern intensive indoor or combined indoor/outdoor farming systems in order to make best use of their selected genetic qualities which enable them under appropriate housing, feeding, hygiene, management and veterinary control to reach high milk yields and high feed efficiencies. Nearly 54% of the world's dairy cows are living in 10 countries. The largest producer of milk is the European Union producing about 156 million tons of milk per year followed by India (140 mio tons) and the USA (87 mio tons) (FAOstat 2012). There is the general trend to lesser dairy farms with larger herds of high yielding cows. As an example: The number of dairy cows decreased by about 300,000 between 1980 and 2013 from nearly 1.1 million to 786.000 in a northwestern region of Germany. During the same period the number of dairy farms decreased from about 60,000 to 10,000 and the milk production doubled. These results were only possible by intensification of the production, by breeding for high milk yield and technical improvements in housing, management and milking technology. These specialized farms are primarily interested in high milk production and efficient replacement of milking cows. Male calves are rather regarded a bane, an unavoidable by-product or even a nuisance than a boon. They are usually sold after a few weeks of age to specialized fattening farms for veal, rosy beef or beef production. However typical dairy type calves are relatively skinny and do not reach easy high carcass weights compared to typical beef breeds which means that the economic value of this type of veal production highly depends on market prices.

EU figures show that approximately six million calves are reared for veal within the EU every year. The biggest EU producers are France (over 1.4 mio), the Netherlands (1.5 mio) and Italy (almost 800,000).

The public was alarmed by some recent newspaper reports about distinctly higher dead losses of male calves compared to cow calves on dairy farms which initiated a broad debate. Figures from 2013 suggest that in a region of Germany where 50,403 calves were born the death rate of male calves exceeded the loss of cow calves by nearly a factor of three (Hopp and Kirschner 2014). The total loss rate was 8.9% (4,501 animals), 2.3% were females and 6.6% males. Data reported from another northern part of Germany revealed across four different cattle breeds total male calf losses of 3.3% and cow calf losses of 1.6% in 2012.

On the other hand, reports from again another region in Germany do not reveal significant differences between loss rates of male and female calves within the first six months of life. 122,157 male calves and 119.755 cow calves were born in the year 2010. Within 6 month after birth 9,043 male (7.4%) and 9,343 female (7.8%) calves died. The equivalent figures for 2014 are: 120,082 males born, 8024 died (6.7%) within 6 months; 124,560 cow calves born and 8,945 died (7.2%). The generation of the date reported above is not always transparent.

It is generally estimated that about 15% of all new born calves die within the first 6 months of life, 7% in the first week. The figures do not distinguish between various reasons like stillbirth, weakness, disease or others. When taking the long term statistics of all registered dead calves delivered to rendering plants between 2000 and 2015 in Germany the loss rate of male calves is about 0.4 to 1.3 % higher than that of cow calves with a general tendency that the gap is rather closing than widening in recent years. For example: In 2002 5,153,103 calves were borne, 367,520 died within the first 6 months. Total loss rate 7.1% (7.8% male, 6.5% cow calves, difference 1.3%). In 2012 4,824,635 calves were born, 297,595 died within the first 6 months of life. Loss rate was 6.1% (6.4% male, 5.9% cow calves, difference 0.5%).

These confusing figures fueled the debate and farmers are suspected to neglect male calves and accept deliberately higher loss rates. The German Animal Protection Act clearly provides that animals have to be protected from unnecessary injury, pain and suffering. Killing of an animal is only allowed within strict limits and when there is a “reasonable cause” for it, for example, to prevent the animal from considerable and long lasting suffering or pain. It is not allowed to kill a healthy animal for merely economic reasons.

The two subsequent talks will explain in greater detail the positions of the farmers and the veal calf market on the one hand side and the concerned public on the other hand. The discussion should help us to learn from each other and to find out about practical solutions and future options for the sake of the animals. Matters of concern should be addressed such as (1) the reliability of the statistical figures gathered from different regions and sources, (2) the factors influencing the survival of the male calves on farm and in market, (3) the health condition of new born male calves and the legal regulations, (4) The role of the veterinarians, (5) our moral obligation and responsibility for animals in our custody.

There are promising approaches: (1) Recent applied research shows that male calves in dairy herds can be successfully raised to market weight within 20 days. (2) Sperm sexing can influence the gender of the offspring. (3) Cross breeds for dual use (milk and meat). (4) Extension of lactation period can improve cow health and reduce the number of born calves easing the market pressure.

Important is to increase transparency of production and respond to questions of the consumer. This may raise confidence in veal and that male calves can become a boon again for the farmer, not a bane.

Saturday, May 29, Hall B: IN-LINE DETECTION OF DISEASE

S23

SENSORS IN THE MILKING PARLOUR: REPLACING OR COMPLEMENTING HUMAN SENSES IN MONITORING ANIMAL HEALTH AND PERFORMANCE?

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In the past decades, much of the research and development has been dedicated to develop sensors designed to help farmers monitor their cows’ health and productivity. This search for sensors that could aid or even replace human senses was enhanced by the introduction of robotic milking. Sensors were required to make automatic milking systems, where humans are no longer present during milking, comply with EU regulations stating that milk presenting abnormalities should not be used for human consumption. The search started with the development of sensors measuring the electrical conductivity (EC). Abnormal milk caused by mastitis had been associated with increased levels of EC, and since the principle of measuring EC was relatively simple, the developed sensors were cheap. Along with the increase in herd sizes, the need for sensor technologies that helped farmers monitoring their cows increased too. More complicated (and expensive) sensors were developed measuring other milk parameters than EC that were related to cow health or

productivity. In-line measurements of quarter or whole udder somatic cell count (SCC), L-Lactate dehydrogenase (LDH), color, temperature, progesterone, and fat and protein content are just a selection of sensors that were developed for the detection of e.g., mastitis, estrus, or cows with metabolic disorders. Some of these sensors have become mainstream features on today's dairy farms (e.g., EC and milk yield). For some other sensors, farmers display a strong interest in having these sensors in their milking parlor, but where adoption rates of these sensors stay behind expectations (e.g., in-line SCC, fat and protein content). Many aspects play a role in these low adoption rates, but two of them will be highlighted here: (1) imperfect performance of sensors in monitoring cow health and the (economic) consequences of this imperfect performance, and (2) the lack of skills to implement sensor information into daily farm management routines.

Today's sensors are state-of-the-art pieces of technology, that can measure (more) milk parameters more accurately than human senses. Moreover, sensor technologies measure milk parameters more objectively and consistently than their human counterparts. However, whereas milk parameters may be biologically associated with a certain aspect of cow health (e.g., progesterone is associated with estrus), sensors may not accurately measure this milk parameter or they measure a proxy for it (e.g., viscosity measurements as proxy for in-line SCC). Moreover, sensors often monitor one milk parameter and this often appears to be too limited to identify multifactorial diseases like, e.g., mastitis. There are sensor systems that combine data from different sensors, e.g., some automated milking systems combine EC, color, milk yield, milk temperature and SCC to monitor udder health. But so far, no sensor or sensor system is 100% accurate. All of them will miss cows that do have a health issue (that is, they are not 100% sensitive), and all of them will list some cows as having a health issue erroneously (they are not 100% specific). The sensitivity and specificity of a sensor are interrelated; as sensitivity increases the specificity will decrease and *vice versa*. This means that every sensor or sensor system has to find a trade-off between these two performance measures. This trade-off depends on the cow health issue being monitored, the type of dairying system in which the sensor or sensor system is implemented, and on the economic consequences of management decisions based on having incorrect information. For example, farmers that milk robotically prefer mastitis detection systems that minimize the nuisance of fetching and visually checking cows that are alerted falsely. This is so important, that they are willing to accept that cows with (mild) mastitis events remain undetected. Controversially, farmers milking large herds (>500 cows) in a conventional milking parlor may prefer a very high sensitivity level. In that situation, having falsely alerted cows is not an issue since checking for mastitis is done during milking, and thus there is no additional labor of fetching cows. Another example is estrus detection. A sensor with a 70% sensitivity may be good enough when implemented in housed dairying system; in case the system misses an estrus event, there will be another one ~21 days later. The fact that the sensor misses an estrus event will increase the calving interval, but the economic consequences of missing an event is limited. On the other hand, a 70% sensitivity in a seasonal calving dairying systems will have limited practical value. Estrus detection is extremely important in these systems as all cows have to be pregnant within 6 to 8 weeks after the planned start of mating. Missing an estrus event can have huge economic consequences, and disastrous consequences for the cow herself. So, the health issue being monitored, the dairying system in which the sensor is implemented, and the (economic) consequences of the imperfect detection are determinants of the success of a sensor technology.

The second explanation of lower adoption rates involves the lack of knowledge regarding the translation of sensor information into daily management routines. Monitoring milk parameters from every cow from every (quarter) milking does result in a constant stream of interesting data, but as yet, it is not always clear how farmers can translate this data into clear information for management actions. Surely, there is a group of farmers that are highly interested in sensor technologies that spent a lot of time in interpreting the data and to actually work with it. They're self-learning, and in doing so, they are not afraid of making mistakes. For the majority of farmers, however, this is too difficult, too time-consuming and associated with too much uncertainty. This is the group of farmers that will wait with investing in sensor technologies until it is made easier for them to work with the sensor information or the associated software. Development of standard operating procedures may be a first step in this process of large-scale acceptance of sensor technologies in the milking parlor. These standard operating procedures can be customized once farmers have gained more confidence in how to work with these technologies.

In conclusion, dedicated research resulted in sensor technologies that measure milk parameters that are associated with cow health and productivity. Sensors, however, are not yet replacing human senses, but they are complementing them. To make them replace human senses, the challenge lies in finding the appropriate trade-off between sensitivity and specificity, and in teaching farmers the required skills to use the information for management decisions.

Saturday, August 29, Hall B: IN-LINE DETECTION OF DISEASE

S24

CAN AUTOMATIC DETECTION OF DISEASE REPLACE DIRECT ANIMAL OBSERVATION?

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In the last decades two major trends are leading the dairy industry all over the globe. On one hand increase of herds size, resulted in herds of hundreds, thousands and even dozen thousands of animals per herd. These farms managed by a few experts while most of the routine work is done by non-experts employees. On the other hand, small familial farms; these farms are managed by one or a few family members, who have another job outside the dairy farm or need to run multiple tasks at the dairy farm, with very limited time to observe and treat sick animals. In both scenarios (huge farms and small familial farms) finding sick cows based on direct observations become almost impossible.

At the same time, in the last years, we are facing dramatic and fast development of technology for automatic measurements of cows' behavioral and physiological parameters such as; milk quantity and quality, milk conductivity and components, cows' rest, eating and rumination behaviors and other informative parameters as body weight, body temperature, pulse rate and ruminal pH.

Detecting sick cows could be a very challenging task. Since cattle are herdic herbivores animals, showing any signs of sickness or weakness is like a spot light for any potential predators. Some sick cows will not show clinical signs until severe stages of disease, therefore sub-clinical events are abundant.

Manual observations and tests vs automatic detection

Manual observations and tests are very powerful tools for monitoring and detecting health problems, and could lead to very good results if done correctly. However there are some major disadvantages using these methods, which become even deeper, with the changes of the dairy industry in the past decades:

- The observations are subjective and depend heavily on the observer skills.
- The observations and tests (blood, urine, body temperature, etc.) are done based on the farm routine (before or after milking or other daily duties) and could not provide information 24 hours/day.
- Required time.
- In many cases these tests involve stress to the animal (need to be locked in a chute or head locks) and to the worker.
- Very hard to detect sub-clinical cases which do not show any clinical signs.

Automatic measurements from the other hand suffer as well from some disadvantages:

- Many systems provide too many false alerts (detect cows which are not sick).
- Technical failures and release of immature systems.

- Applications and algorithms that were developed on specific and/or small populations, and do not perform well under different conditions/populations (different breeds, intensive vs extensive management, weather conditions and other).

Nonetheless there are some main advantages in the automatic measurements and detection methods which become more and more significant.

- Collecting data 24/7, 365 days a year, allows monitoring and detecting of health problems each hour, without any relation to weather conditions and availability of employees.
- Detection of small to moderate changes on a group level, permits early detection and fix/treatment of disorders even before individual animals become clinically sick.
- Integration of data from different sensors could lead for detection of specific illness and diseases and for reducing the numbers of false alerts.
- Continually monitoring of data could eliminate errors related to the time of the observations or tests – e.g. ketosis detection, see case study below.

Ketosis detection Case study: Current methods for detecting ketosis on dairy cows are based on cow side test of blood or urine for detecting ketones bodies' concentrations. Both tests were found to be very accurate. Nevertheless, there is a question regarding the influence of the timing during the day on the test results. We conducted a test on a commercial dairy farm to evaluate the significance of the timing during the day of the diagnosis of ketosis.

On this test, eighteen Israeli Holstein cows, all of them 5-25 days after calving, were tested three times on the **same day** for blood β-hydroxybutyrate (BHBA). The tests were done after the morning, noon and evening milking. Cows were defined ketotic if blood BHBA were ≥1.4mmole/l. The results are presented in Table 1. It was found that the timing of the test had high influence on the results of the test (blood BHBA concentration) and the diagnosis of ketosis.

Table 1: Eighteen fresh cows' BHBA blood test on three different tests during the same day

	Morning	None	Evening
Average BHBA mmole/l	0.88	1.13	1.19
Ketotic cows (BHBA>1.4 mmole/l)	2	5	6

Using milk components (milk fat and milk protein percentage) measured by a real time milk analyzer, for each cow every milking, allowed detection of eight cows suspected for ketosis out of these eighteen cows on that day. Six out of these cows were found with BHBA≥1.4 mmole/l, at least in one of the three blood tests that were performed on that day.

Detect diseases - the combined approach: Automatic detection should not replace direct observations totally. Instead, using automatic detection should be used as the first line detection, allowing the herd manager and his team focusing on a manageable number of animals, which require special indentation. These animals should be treated or checked based on the farm's protocols. These protocols should be based on the accuracy and specificity of the automatic detection method, and the relevant treatments for each disease.

Using automatic detection enables early detection and treatment of clinical cases as well as sub-clinical events. This will result in faster cure, less use of drugs and reduce stress for the cows.

Summary: With the changes in the dairy industry during the last decades, there is a need to use automatic systems for detecting health disorders and sick cows. The main advantages of automation are continually objective monitoring of the individual animals, which does not depend on weather conditions or other tasks in the farm. In addition these systems allow saving manpower which becomes a heavy factor of the dairy budget and enable early detection of diseases even before any clinical signs could be observed.

Automatic systems are rapidly developing in the last years, adding more data in higher resolution. This leads for improvement of the detection capabilities, which will continue to improve in the future. Combined approach, with automatic detection as the first line to spot sick cows that need special intention, should be used. With that method sick cows will be detected earlier and the farm team could focus on cows that need special care, without spending a lot of precious time, looking for these cows.

Saturday, August 29, Hall B: GENOMIC TOOLS

S25

CAN GENOMICS SOLVE OUR PROBLEMS?

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The availability of panels with tens of thousands markers (SNPs) at a reasonable low price has promoted genomics as a useful tool in genetic analyses. Genomics can be applied to a variety of problems: genetic research, QTL detection, prediction of breeding values, etc. There is no doubt that genomics is useful in genetic research: GWAS, selective sweeps, metagenomics, and many other examples. For QTL detection, particularly for detecting major genes, the main limitation has been the actual existence of those genes; unfortunately, there are only few major genes for production traits that have not been fixed yet by selection or by introgression in other breeds; as Garrick (2011) said, few QTLs have been found useful for beef cattle improvement. For these reasons, we will focus this revision only in genomic selection.

The success of genomic selection in dairy cattle has moved the whole industry of animal breeding to consider the introduction of genomics in current breeding programs. The principle looks obvious: if we have the records and also many SNPs of the animals, we have more information than having only the records; but this simplistic view ignores the cost of genotyping, the amount of the increase in accuracy obtained using genomics, and the organisation problems derived from the introduction of genomics in selection schemes. In dairy cattle, the key of the success of genomic selection has been the reduction of the generation interval, because young bulls could be evaluated with a reasonable accuracy before having daughters. In prolific species, where there is no need of reducing generation interval, the expectations about genomic selection are not so great; for example in pigs, the contribution of genomics to the genetic improvement has been estimated in a 10% approximately (Lillehammer et al., 2013). The difficulties in implementing genomic selection in breeding programs have been recently summarized by Blasco and Toro (2014):

1. *The need of large training populations*

Genomic selection works by associating a large number of markers to phenotypic data. Construction of prediction equations needs a large number of animals to obtain acceptable accuracies for breeding values. In dairy cattle it is relatively easy to have a 'training population' of 5,000 to 10,000 animals for these equations, but this is not feasible for most beef cattle associations. This has led to the proposal of using Multibreed training populations for predictions, but effectiveness is higher when training populations are close to the animals to be predicted, otherwise the prediction is poor (Lund et a., 2014).

2. *The need of continuous phenotyping*

Genomics has also been proposed for novel traits that can have some impact in beef production: traits related to meat quality and consumer preferences, health, feed efficiency etc. (Garrick, 2011; Cleveland, 2015). One of the attractiveness of genomic selection is the possibility of predicting breeding values for traits that are difficult or expensive to measure; unfortunately the associations between SNPs and phenotypes is being lost generation by generation, depending on the linkage disequilibrium between SNPs and causal genes, and the prediction equations need to be reconstructed. This means that new genotyping is needed each generation, which means that expensive or difficult to measure traits will still be phenotyped. Moreover, new traits should not have low heritabilities because if so, the training population should be much larger. They should also be checked in the final commercial

populations, since genotype per environment interactions can be high, as it has been shown in other species.

3. *The cost of implementing genomic selection in a breeding scheme*

Genomic selection is expensive, although costs have decreased in the last years. A recent proposal has been using low density chips and imputing the unknown information from high density chips. Although this is feasible, again this imputation should be repeated time to time, since the SNPs associations with causal genes are lost by recombination. High density chips will be always needed to re-impute the low density chips. Moreover, imputation cannot be precise if the low density chip is used in animals not closely related to the animals in which the high density chip was used (Rolf et al., 2014).

The cost of using genomics should be justified according to the increase in accuracy produced. In beef cattle, the most common traits measured are weights of the individuals to be selected at a determined age. Usually these traits have a heritability relatively high (about 0.40-0.45), which means that the accuracy of the individual phenotype is about 0.6-0.7, and it can be higher adding information from relatives. Therefore, genomics should improve accuracy over 0.7-0.8 when the trait of interest can be measured just using a scale. Nevertheless genomics could improve the accuracy when the objective is weight at slaughter but only weight at weaning is measured, or when predicting genetic merit for traits not measured in the candidate to selection like carcass traits; but in all these suppositions, a careful study should be made taking into account the large training populations needed and the permanent cost of genotyping in relation to the benefits expected. Genomics has been used by commercial companies as a marketing tool (Rolf et al., 2014), but the returns of the investment should be clearly justified before integrating genomic selection in a breeding program.

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Saturday, August 29, Hall B: NEWER OPTIONS FOR HT

S26

CLIMATE CHANGE AFFECTS THE DISTRIBUTION OF VECTORS AND INFECTIOUS AGENTS. WHAT CAN WE EXPECT IN A NOT SO DISTANT FUTURE IN TERMS OF EXOTIC DISEASES?

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An emerging disease is a new disease whose incidence truly increases in a given population at a given time (Toma and Thiry, 2003). Following the definition given by the World Organisation for Animal Health (OIE), emerging disease means “a new occurrence in an animal of a disease, infection or infestation, causing a significant impact on animal or public health resulting from a change of a known pathogenic agent or its spread to a new geographic area or species or a previously unrecognised pathogenic agent or disease diagnosed for the first time. (OIE, 2011). The definition may be extended to a reemerging disease which is a disease that already emerged and disappeared in a given population and whose incidence truly increases in this population at a given time.

Within this context, emerging infectious diseases (EID) will be considered here. Such diseases are therefore caused by infectious or parasitic agents and essentially bacteria or viruses. Depending on the classification of EID, either bacteria or viruses are at the top of the ranking. This mainly depends on the inclusion of antibiotic resistant bacteria as emerging infectious agents (Jones et al., 2008).

Going deeper into this EID classification, we might distinguish:

- Emergence of a new pathogen (unrecognised so far): Schmallenberg virus infection in Western Europe, a bunyavirus so far unrecognised although it harbours genetic relationships with other orthobunyaviruses of the Simbu serogroup;
- Emergence of a new variant (“change of a known pathogenic agent”):
  - Increased or modified virulence in the same species: the reproduction failures and congenital abnormalities observed by bluetongue serotype 8 infection of bovines in Western Europe on 2006-2008;
  - Crossing the species barrier and adaptation to a new animal species: H3N8 equine influenza A virus adapted to the canine species with a specific genetic profile giving rise to “canine influenza”;
- Spread of a known pathogen in a new geographic area: extension of bluetongue virus serotype 1 from Spain to France in 2008;
- Re-emerging pathogen: food and mouth disease in United Kingdom (UK) in 2001, when considering the re-introduction in European Union, and not strictly in UK.

The drivers of emergence are multiple and are often refered as elements of the global change. With this respect, the role of genetic evolution of the pathogenic agents should not be underestimated, by the means of single, insertion or deletion mutations, by genetic recombination or reassortment for segmented genome viruses. The anthropic factors are the other set of key elements taking part of this global change: climatic changes can affect the distribution of vectors and therefore the geographical distribution of infectious diseases; society changes may modify the boundaries between wildlife and human activities providing new interfaces for the transmission of new infectious diseases to livestock; intensification of transport of people, animals and goods might facilitate the geographical spread of infectious agents.

The management of an EID will be completely different depending of the existing knowledge on the pathogen. Complete European Union and/or national law packages may exist for several potential EID, especially exotic diseases that are listed by OIE. Other ones have neither legal basis nor control frame. However, the main threat is likely the emergence of a new pathogen. In such a case, the lack of diagnostics, prevention (vaccination) measures and targeted epidemiosurveillance makes the detection of such an emergence very difficult.

The modern approaches to identify EID caused by a new pathogen relies on the forecasting or long term anticipation or prediction of emerging risks, by analysis of drivers of emerging risks by means of trend analysis or trend watching, for example; a second step would be the early identification of emerging risks by the early identification of an EID already present on the territory but not yet identified, by means of detection of signals provided by syndromic surveillance, for example. The third step would be the early warning by the detection of EID already present on the territory and identified by means of passive and/or active epidemiosurveillance (EFSA, 2010).

In this context, expert committees standing in national agencies and at the European Food Safety Authority (EFSA) play an essential role to make full risk assessments of EID introduction I order to provide the authorities with expert opinion useful for the efficient risk management of EID.

The sophisticated technology of our modern society plays contradictory roles in the emergence of infectious diseases: on one hand, it favours the spread of the infectious agents but, on the other hand, it provides means of detection, control and prevention of EID. The balance between these two aspects merits to be very carefully addressed and the respective roles of authorities, scientific experts, practitioners, farmers and the civil society should be clearly established. It has to be assessed also to what extent the society would agree to pay the cost of the mitigation of the risk of EID introduction.

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Saturday, August 29, Hall B: EMERGENCE OF DISEASE

S27

ARE WE PREPARED FOR THE NEXT EMERGING DISEASE?

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Changing environmental conditions are not only the result of the direct impact of the climate change, but represent also the consequences of migration, urbanisation and the globalisation of trade and human mobility. In consequence, changes in the occurrence of infectious diseases in humans and animals ensue. Several infectious diseases, which were hitherto considered as ‚exotic' for Europe as a whole or at least parts of it, seem now to be able to occur nearly everywhere. These include a number of arthropod-borne diseases such as Bluetongue, which mainly affects ruminants, West Nile Fever in humans, horses and birds, as well as Chikungunya Fever in humans. There is a trend for a global spread of Dengue Fever and Japan Encephalitis, associated with extension of the habitats of the respective arthropod vectors. In addition, transportation of animals and products of animal origin has caused the spread of animal diseases, notably of Rift Valley Fever from Africa to the Arabic peninsula and of African Swine Fever from East Africa into the region of the Caucasus region, Eastern Europe, Poland and Baltic states with a clear tendency of spread in northern and western direction. New diseases such as the infection with Schmallenberg virus, an orthobunyavirus of the Simbu serogroup transmitted by biting midges (*Culicoides* spp.), suddenly appeared in an area, where orthobunyaviruses had never been detected before. Recently, an avian influenza virus of the subtype H5N8 was transmitted from poultry to wild birds, presumably in South Korea, spread to Siberia and from there to Europa, North America and back to South East Asia. H5N8 and related re-assorted viruses (H5N2, H5N1) caused a major epidemic of highly pathogenic avian influenza in North America. A limited number of H5N8 outbreaks were also reported from Europe.

It is therefore necessary to identify gaps, which allow the entry of such pathogens, to reduce the potential exposure of livestock by improving biosecurity and to improve the existing surveillance systems so that emerging infections are rapidly detected and brought under control.

ORAL PRESENTERS

O01

THE EFFECT OF TOPICAL ANAESTHETIC ON THE SENSITIVITY OF SCOOP DEHORNING WOUNDS IN BEEF CALVES

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Problem Statement: Scoop dehorning of beef cattle is a commonly performed procedure that reduces the risk of injury to stock workers and other cattle and decreases bruise trim at slaughter. As a result of distances, animal numbers and expenses, currently available options for pain relief when dehorning cattle are not employed on many extensively managed Australian beef properties. Effective anaesthestic that can be applied topically would offer a more feasible, affordable option for producers to address the post-operative pain of dehorning. Previous studies researching topical anaesthesia for practical incorporation into the mulesing operation of merino sheep, led to the successful commercialisation of a 'farmer applied' spray-on anaesthetic (Tri-Solfen®, Bayer Animal Health). Tri-Solfen®, and a newly developed topical anaesthetic, specifically designed for application to scoop dehorning wounds where excessive haemmorhage is often present, were evaluated in the current study.
Methods: Thirty-six Hereford beef calves (16 – 20 weeks old) were randomly allocated to (1) sham dehorning (CON, n = 7); (2) scoop dehorning (D, n = 7); (3) scoop dehorning with a pre-operative ring block of lignocaine (DLA, n = 7); (4) scoop dehorning with a post-operative application of commercial topical anaesthetic (DTA, n = 7); and scoop dehorning with a post-operative application of novel topical anaesthetic (DNTA, n = 7). Wound anaesthesia was assessed by subjecting four sites on each dehorning wound and surrounding tissue to touch stimulation with two von Frey monofilaments, calibrated to 75 g/f and 300 g/f, at defined time periods, prior to and post treatment (at 0 h, then +1 h, 2 h, 4 h and 6 h). Von Frey monofilaments are instruments designed to exert a specific, calibrated force when placed perpendicular to a surface. Both 75 g and 300 g monofilaments were used to provide light touch and heavier touch stimulation. Wound hypersensitivity was assessed by scoring the responses of the calves to touch stimulation using a customised numerical rating scale of 0 to 3, whereby 0 = no response; 1 = minor facial awareness such as an eye blink or widening or an ear flick; 2 = partial withdrawal reflex such as partial head rotation; and 3 = full withdrawal reflex such as full head jerk or rotation.
Results: There was a significant interaction between time and treatment ($P < 0.001$) and von Frey size and treatment (75 or 300 g/f; $P = 0.011$). CON calves displayed no to mild responses at all time points. DLA calves were the only dehorned calves that did not have increased response scores from before dehorning to 1 h post dehorning, suggesting that the ring block may have had the most rapid onset of anaesthesia. DTA calves were the only dehorned calves to have response scores significantly higher than those of CON calves at 1 h. Despite this, responses from all dehorned groups did not differ significantly at any time, including at 1 h. CON calves were significantly more likely to display no or mild responses to both the 75 g/f and 300 g/f monofilaments compared to all other treatment groups. DTA calves were significantly more likely to display increased severity of responses to the 300 g Von frey monofilament compared to the 75 g Von frey monofilament.
Conclusion: The effect of topically applied anaesthetic on the sensitivity of dehorning wounds is comparable to that of a ring block of lignocaine.

O02

CONTROVERSIES IN THE TREATMENT OF CLINICAL MASTITIS

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Problem Statement: Management of clincal mastitis (CM) remains a controversial subject of which there is no consensus.
Methods: Two CM studies were conducted over a 6-year period. Cows with naturally occurring CM were assessed as mild, moderate or severe. In study 1, cows were assigned 1 of 4 treatments. Treatment 1 was IMMA (amoxicillin). Treatment 2 consisted of no treatment. Treatment 3 consisted of frequent milk-out (FM). Treatment 4 was a combination of treatments 1 and 3 (FM/IMMA). In study 2, cows with CM were alternately assigned one of two therapeutic protocols based on culture results and severity level. Treatment 1 included an IMM antibiotic that varied by culture result. Except for streptococcus cases, cows assigned to treatment 2 did not receive IMM antibiotics. All cows with severe clinical mastitis were treated with fluids, anti-inflammatory, calcium, systemic ceftiofur as needed and were alternatively assigned an IMM antibiotic or none. Severe Gram-negative CM were alternately assigned IMM ceftiofur at 300 mg, every 12 hour intervals for 6 treatments.
Parameters were assessed on days 1 - 8, then weekly until day 36, then monthly until the cow cured, was culled or died. Outcome variables examined were clinical cure (CC), bacterial cure (BC) and quarter SCC cures.
Results: Of cows with no growth, 100% were classified as mild CM on day 1. Of 19 cows with mild to moderate CM due to *E. coli* that received no treatment, 14 obtained a BC by day 5 and all cows obtained a BC by day 15. Of 8 cows with mild to moderate CM due to *E. coli* that received IMMA, 7 obtained BC by day 5. Ten of 14 cows treated with IMM cephapirin obtained BC by day 5 and 13 by day 15. Two of the 3 cows that survived severe *E. coli* mastitis were bacteriologically cured by sampling day 22; 1 that did not receive IMM ceftiofur and was still *E. coli* positive when cullled. Although there were only two cases of severe *E. coli* cases treated with IMM ceftiofur, the data suggests that this antibiotic is efficacious. In regards to clinical mastitis due to an environmental streptococcus, of 6 cows that received no treatment, only 2 cows (33%) obtained a BC which occurred on day 2. Of 27 cows treated with IMMA, 44% of cows were cured by day 8 and 67% were cured by day 36. In the FM group, only 1 of 11 (9%) cows obtained a BC by day 7. Three cows with moderate CM cultured *Pasteurella multocida*. One case was treated with IMM ceftiofur an no bacterial growth was seen on days 3-6. This cow relapsed and the milk remained clinical with a high SCC through day 36. Another case was initially assigned no treatment. This case was considered a failure, after 2 weeks of no improvement and the appearance of another clinical quarter (right rear: RR) with *P. multocida*. Both quarters were then treated with IMM ceftiofur. The high levels of cfus present prior to IMM treatment were reduced to zero cfu by day 3 again indicating that ceftiofur is effective against *P. multocida.*
Conclusion: There is a need to utilize culture results and assess clinical mastitis severity to best manage clinical mastitis cases. Data presented suggests that some cases of clinical mastitis do not require any therapy. Frequent milk-out was not an effective therapy as performed in these studies. Intramammary antibiotics can be useful in case of severe clinical Gram-negative mastitis cases. Future studies are needed to more definitively determine the most judicious method of managing clinical mastitis in cattle.

O03

PREVENTION OF INFECTION BY STRONGYLES IN GRAZING CATTLE. BIOLOGICAL CONTROL WITH FEEDSTUFF ADDED DUDDINGTONIA FLAGRANS SPORES

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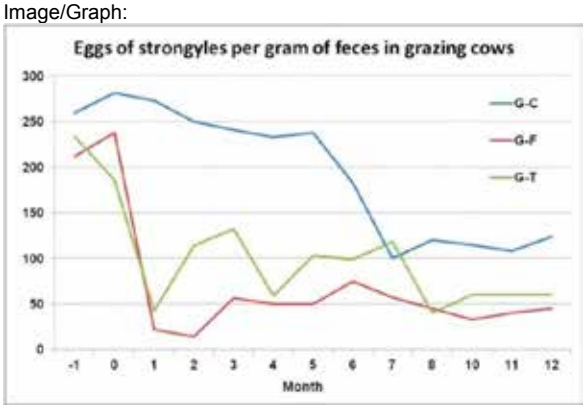
Problem Statement: Strongyles are important parasites affecting livestock. Under suitable environmental conditions, the eggs shed in the feces of parasitized animals develop in the soil to the third-stage larva (L3), the infective stage. Despite efficient parasiticides are commercially available, grazing ruminants become infected as soon as 2-3 months after treatment, because of the presence of L3 contaminating the pasture. In the current investigation, the efficacy of manufacturing feedstuff with spores of

Duddingtonia flagrans, a larvicidal fungus, to prevent infection in pasturing cows has been evaluated.
Methods: Chlamydospores of *Duddingtonia flagrans* obtained in a submerged culture (COPFr) were incorporated during the mixing phase of manufacturing of a commercial formulation (*DL Novillas 18*®, NANTA, Nutreco, Outeiro de Rei, Spain). With the aim to guarantee that cows ingest $3x10^6$ spores / day, a quantity of 2.5 Kg of concentrate carrying $1.2x10^6$ spores / Kg was provided to the ruminants.
Heifers
Three groups of 7 grazing Friesian cows infected by strongyles were considered. Group G-F was composed by heifers supplemented with concentrate + $1.2x10^6$ spores / kg feedstuff; G-T was formed by calves supplemented with concentrate without spores; and G-C composed by bovines receiving concentrate without spores and remaining without deworming as controls. At the beginning of the study, groups G-F and G-T were dewormed by oral administration of albendazole (10 mg/Kg b.w., Albendex, SP Veterinaria SA, Tarragona, Spain). The groups were maintained under rotational pasturing in an area where infection by strongyles was previously reported.
Results: The values of strongyle egg-excretion reduced in the G-F after the administration of albendazole, and counts below 100 were achieved until the end of the study. In the cow of G-T, the values of egg-output did also decrease after the deworming, but counts higher than in G-F during the first 8 months were obtained. In the control animals (G-C), the counts of strongyle eggs remained elevated until the 6th month of study, and then decreased.
Image/Graph:



Conclusion: Pelleted feed is frequently given to the animals due to this presentation ensures a well-balanced diet by preventing the selective intake of ingredients. This provides a very useful way to animals to better utilize the nutrients and as a consequence feed conversion indexes result significantly improved. Other notable advantage relies on the improvement of shipping and handling conditions, as well as storage capabilities.
Our results demonstrate that manufacturing commercial feedstuff with chlamydopsores of *Duddingtonia flagrans* provides a very useful tool to minimize the risk of infection by strongyles in grazing cattle, because the spores are passed in the feces together with the strongyle eggs, and prevent their development to L3.
Acknowledgements: This work was partially supported by the Research Project AGL2012-34355 (Ministerio de Economía y Competitividad, Spain; FEDER) and complies with the current laws for Animal Health Research in Spain.

O04
DIGITAL DERMATITIS – STILL EMERGING AND A THREAT TO OTHER SPECIES S. D. Carter, R. Blowey, N. Evans
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Problem Statement: It is generally accepted that digital dermatitis (DD) is a major cause of infectious lameness in dairy cattle. However, the disease is still emerging in many forms in skin tissues and veterinary researchers need to be aware of these problems and the role that dairy cattle may have in their initiation and spread.
Methods: A combination of clinical observations and microbiological analyses to track the spread of the BDD-associated treponemal bacteria in tissues from dairy and beef cattle, sheep, goats, elk and pigs and in the farm environment.
Results: Bovine DD has spread to UK beef cattle and severe clinical forms of DD are apparent in UK sheep and goats. The DD-associated treponemes are also strongly associated with severe forms of other lesions in cattle feet which are very difficult to treat, including the 'wall ulcer' form of white line disease, sole ulcers and toe necrosis. Worryingly, these organisms are now also readily detectable in other cattle skin lesions, such as pressure sores, ulcerative mammary dermatitis (UMD), and teat necrosis and are seen in tail, ear and flank lesions in pigs. In 2015, we have shown that these organisms are clearly associated with an infectious lameness in wild elk from USA. Genotypic and phenotypic analyses show that the same treponemal organisms are present in these lesions and they are clearly implicated in disease pathology in each case.
Conclusion: Bovine DD was first reported in 1974 in Italy and within 15 years had spread to most countries with dairy cattle. The first sheep DD cases were reported in the UK in 1997 and this disease is now almost endemic on the British Isles. We reported the first cases in UK goats in 2015 and the wild elk form was also recorded this year. The various skin lesions in cattle and pigs were all seen for the first time in 2015. Because these lesions are all so very closely associated with the DD treponemes, it is not difficult to suggest that these bacteria have become opportunistic invaders, particularly in skin tissues, in a number of species. The emergence of DD treponeme association with multiple lesions in multiple livestock species has only been reported in the British Isles so far and we suggest that extreme vigilance is required worldwide in case the UK experience is replicated elsewhere. It is important that the means to reduce transmission between individual animals and species are considered as current treatment options for these lesions appear to have a low efficacy. Vaccine options should be considered, alongside biosecurity measures to reduce the risk of what could be an increasingly severe threat to animal welfare and the economics of livestock industries worldwide.

O05
DO CLOSTRIDIA (PARTICULARLY C. BOTULINUM) PLAY A ROLE IN DAIRY HERD HEALTH PROBLEMS?
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Problem Statement: In recent years, veterinarians and dairy farmers in Germany have reported unusual heard health problems that manifested as chronic suffering with severely decreased milk yield and significant losses up to complete abandonment of a herd with over 600 cows. According to reports, Clostridium (*C.) botulinum* and/or its toxins were detected in affected animals. The authors of these reports named this previously unknown form of botulism "chronic/visceral botulism", and – in contrast to classic botulism – thought it to be caused by toxicoinfection.
Methods: In a case-control study, herds in the case group (n=21) had to meet at least three of the following criteria: a decrease in milk production of more than 15%, more than 5% of animals euthanized or dead within the last twelve months, a culling rate higher than 35%, recumbency in more than 10% of animals, and an increased disease rate. Herds in the control group (n=10) were not allowed to meet any of these criteria. In all farms, investigations of housing, management, and feeding system, as well as clinical examinations, were carried out. Blood, rumen fluid, and faecal samples from a total of 284 cows were collected for microbiological examinations.
Results: Various toxin genes of Clostridium spp. were found in 74% of the farms, with no statistically significant difference in the frequency between

case group and control group or between the clinically conspicuous and inconspicuous animals within a herd. Species of Clostridium were distributed as follows: *C. perfringens* 72%, *C. novyi* 24%, *C. botulinum* 3%, and *C. haemolyticum* 1%. Serum antiodies against BoNT-C1 and -D were detected in 78.2% of the farms with no statistically significant difference between case and control group. However, the difference between the clinically conspicuous and inconspicuous animals in the case group (with 84.6% and 70.2%, respectively) was statistically significant whereas in the control group (with 83.3% and 76.6%, respectively) it was not. The laboratory blood parameters revealed no major deviations.
In both, case and control group, the water supply was insufficient and the sensory evaluation frequently indicated deficiencies in silage quality. Overcrowding of the compartments did not differ significantly between groups: Cow/feeding place ratio and cow/cubicle ratio was inadequate in the case group with 46.6% and 39.9% of the compartments, respectively, as well as in the control group with 37.5% and 69.2% of the compartments, respectively. Cows in the case group were significantly dirtier, skin lesions on bony prominences of the body proximal to the carpus/tarsus were significantly more often detected and prevalence and severity of lameness were significantly higher than in the control group.
Conclusion: The data analysis showed significantly lower hygiene and a significantly higher prevalence of lameness and skin lesions in the case group than in the control group. However, a correlation between any of these factors and the frequency of detection of Clostridium spp. was not found.

O06
SEROPREVALENCE OF NEOSPORA CANINUM INFECTION IN DAIRY CATTLE IN CENTRAL AND NORTHEASTERN POLAND

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Problem Statement: *Neospora caninum* is a protozoan of two-host life cycle with a domestic dog (*Canis lupus familiaris*) or another representative of *Canidae* family as a definitive host. To date, wide range of animal species susceptible to *N. caninum* has been identified including small ruminants, wild ruminants, horses, donkeys, and even brown bear, however, undoubtedly the one of the highest economic importance are cattle. The infection and *Neospora*-associated bovine abortion have already been reported from virtually all European countries. Herd-level seroprevalences varied from below 1% (Norway) to almost 90% (Spain). A cross-sectional study was carried out to characterize the seroprevalence of *Neospora caninum* infection in cattle in central and northeastern Poland and investigate the relationship between grazing policy and *N. caninum* infection.
Methods: Ninety seven dairy cattle herds from 2 provinces of Poland (Podlaskie and Łódzkie) were randomly enrolled in the study. Sample size from each herd ranged from 3 to 16 dairy cows with median of 8 (interquartile range from 6 to 9) and a total number of 734 cows were enrolled. Moreover, 1 to 5 calves (<18 month-old) were randomly selected in 61 of 97 herds (175 calves in all). The animals were screened with a commercial competitive ELISA (Bio-X Diagnostics, Belgium). Then, all 909 tested animals were classified into 5 age categories: <18 months (n=175), 18-36 (n=214), 37-60 (n=285), 61-84 (n=156), >84 (n=79) and true individual-level seroprevalence was calculated for each of them. To calculate true-herd level seroprevalence the test sensitivity and specificity were adjusted from an individual- to a herd-level using FreeCalc method.
Results: The true herd-level seroprevalence of *N. caninum* infection was 56.7% (95% CI: 46.8%, 66.1%). One hundred forty three of 734 cows (19.5%) were seropositive which gave the true overall individual-level seroprevalence of 20.1% (95% CI: 17.4%, 23.2%). Percentage of seropositive cows in each herd varied from 6% to 80%. No difference between seropositive and seronegative herds was found with respect to the median herd size (21.5 vs. 21.0 dairy cows; p=0.645), grazing policy (full-day: 42.9% vs. 45.0%, half-day: 8.9% vs. 12.5%, no grazing: 48.2% vs. 42.5%, respectively; p=0.690) nor grazing season length (median of 5.0 months in both herd groups; p=0.445). Individual-level seroprevalence proved to increase along with animal age (p=0.018).
Conclusion: *N. caninum* infection is widespread in Polish dairy cattle population and thus has to be considered as a potential cause of spontaneous abortions.

O07
DIAGNOSIS AND OUTCOME OF SURGICAL MANAGEMENT OF CECAL DILATATION IN BOVINE

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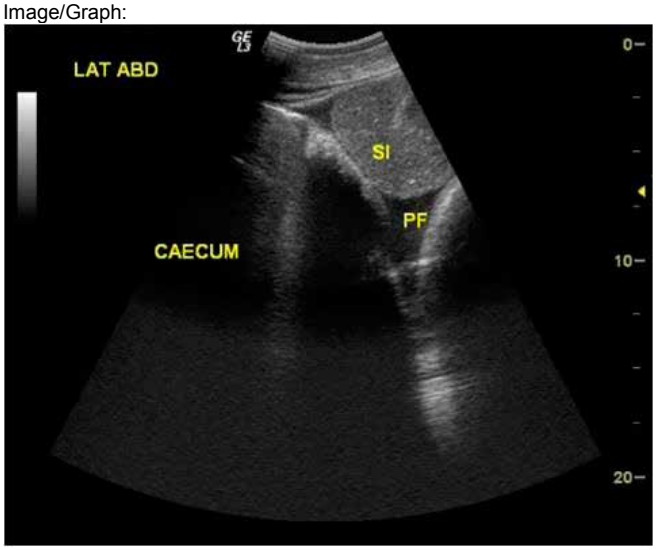
Problem Statement: This prospective study describes the clinical and laboratory findings, surgical treatment and outcomes of bovine with cecal dilatation.
Methods: Seven bovine (4 cows and 3 buffaloes) with cecal dilatation were studied. Each animal was subjected to clinical, per rectal, hemato-biochemical examination, radiography of the reticular region and ultrasonography of the abdomen. All the sick animals initially received intravenous fluids and analgesics for 24 hours prior to surgery. Animals (n=3) having potential foreign bodies in the reticulum were treated by left flank laparo-rumenotomy and dilated cecum was massaged. In remaining animals (n=4) right flank cecotomy was done to decompress dilated cecum. Post operatively follow up was recorded for survivability and production level.
Results: All the animals were female with mean age of 4.31±0.98 years. The general condition/appearance of the animals was abnormal in 71.43% of cases and 85.71% of the patients had an episode of pain. Duration of the illness was 5.00±0.72 days. Mucus membrane was seen congested in 3 animals and pale in one animal. Ruminal motility was reduced or absent. The 85.71% of animals were showing anorexia and majority showed unilateral distension to the right side. Loss of defecation with mucus was recorded in six animals except one buffalo. The 4 animals were pregnant while 3 were non pregnant. Six animals were lactating with an average milk yield of 7.70±0.42 and 4.50±0.30 litres in cows (3) and buffaloes (3), respectively. Only relative neutrophilia (71.00±1.68) was observed. Peritoneal fluid examination revealed hyperchloremia and hyperproteinemia. In serum mild hypoproteinemia, hypoalbuminimia and hypochloremia was observed (Table 1). On ultrasonographic examination, dilated organ with thick echogenic wall was scanned in the right flank and extending up to 10th intercostal space (Fig 1). Small intestines were moderately dilated (4.10±0.11 cm) with mild motility. Dilated cecum was palpated on per rectal examination but ultrasonography was used as a confirmatory diagnostic tool in decision making for surgical intervention. Survival rate of left and right flank approach was comparable and no recurrence was reported up to 6 months. Significant hypokalemia (2.73±0.15) was noticed in non survivors as compared to survivors. Milk production was significantly increased within one month in survived animals up to 14.20±0.20 and 9.10±0.90 litres in cows (n=2) and buffaloes (n=2) respectively, on long term follow up.
Table:

Table 1. Serum Biochemical parameters in bovine suffering from cecal dilatation

Biochemical Parameters	Biochemical values (Diseased animals)(Mean±SE)	Normal Range
Total protein (g/dl)	6.37± 0.42	6.5-7.5
Albumin (g/dl)	2.37± 0.27	2.5-3.8
Sodium (mmol/l)	138.71± 5.37	132-152
Potassium (mmol/l)	3.59± 0.60	3.6-4.9
Chloride (mmol/l)	90.09± 4.99	98-107
Calcium (mg/dl)	8.55± 0.92	8-11.4

Image/Graph:



Conclusion: Diagnosis of cecal dilatation can be done based on clinical and per rectal findings while ultrasonography can be used as a confirmatory diagnostic tool. Significant hypokalemia was associated with non survivability. Cecal dilatation can also be associated with foreign body syndrome, secondarily. Overall prognosis of cecal dilatation is fair with resumption of good health and normal production level of the survivors.

O08

CASE-CONTROL STUDY ON CHRONIC DISEASES IN DAIRY HERDS IN NORTHWESTERN GERMANY: SYMPTOMS ON HERD LEVEL

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Problem Statement: Chronic health problems in dairy herds are known to be linked to a compromised animal welfare and economic losses. In the last two decades, unspecific chronic herd health problems occurred in Germany which were supposed to be caused by *Clostridium botulinum*.
Methods: To examine these herd health problems, a case-control study was conducted. Due to the unspecific clinical picture, case-farms were defined to fulfill at least three of the following five criteria: decreased milk yield, increased mortality, increased culling rate, increased number of downer cows and farmers´ impression of herd health problems. Control farms (n=47) did not fulfill any of these criteria. Case 1-farms (no vaccination against any Clostridia; n=45) and case 2-farms (multi-clostridia-vaccination was applied; n=47) were compared to control-farms separately to determine a clinical picture of chronic diseased herds in the northwest of Germany. During a single farm visit, trained study veterinarians collected data on the following symptoms: lameness, body condition, fertility, udder health, hygiene, skin lesions and cow comfort-indices.
Results: Inner-herd prevalences of lameness (mean of the percentage of the herd with a locomotion score >1: case-1=66.5%, case-2=67.5%, control=58.6%), thin cows (mean of the percentage of the herd with a body condition score under reference for the lactation stage: case-1=44.8%, case-2=47.5%, control=38.4%) and cows with skin lesions (mean of the percentage of the herd with score of 3 or 4 at the legs: case-1=30.1%, case-2=32.5%, control=21.8%) were partly very high, even on control-farms.
Multifactorial logistic regression modeling revealed that case-farms had significantly fewer cows with an extended body condition score (case 1: *p*-value=0.0102, case 2: *p*-value=0.0041), more cows with skin lesions on legs (case 1: *p*-value=0.0400, case 2: *p*-value=0.0054), and a lower cow-comfort-quotient than control-farms (case 1: global *p*-value=0.0095, case 2: global *p*-value=0.0048). Moreover, case 1-farms had a longer calving interval (*p*-value=0.0120), and more often a deficient cow hygiene (*p*-value=0.0419) than control farms. Case 2-farms had a lower cud-chewing-index than control-farms (*p*-value=0.0282).
In summary, the results of this study indicate that a combination of symptoms from all analyzed fields except udder health showed a significant relation to the case-control status.
Conclusion: Firstly, it can be concluded that the case-control definition, a rough estimation of farm performance and health status, permitted a good separation of herds with a better and worse herd health situation. This finding can be important in order to assess animal welfare. Secondly, the detected symptoms confirm that herd health problems were unspecific. It seems unlikely that these problems were caused by one exclusive infectious agent. In fact, the observed symptoms are well-known and causes may be found in farm management. Therefore, it can be concluded that a systematic and thorough examination of the herd is absolutely necessary when farm performance parameters decrease in order to take targeted measures. Thereby, animal welfare and farmers´ economic situations could be improved.

O09

REMOVALS, CULLING REASONS AND HERD MEAN LIFETIME IN NORWEGIAN DAIRY HERDS. SOME CONFLICTS AND CONTROVERSIES WHEN OPTIMIZING HERD HEALTH MANAGEMENT ACCORDING TO ECONOMICS IN COMBINED MEAT AND MILK PRODUCTION SYSTEMS. HOW DO WE DEFINE LONGEVITY CORRECT?

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Problem Statement: Longevity is important in farm economics, breeding, and green-house gasses emission. The interest of longevity in dairy production has increased lately. A search in Schoolar Google using keyword “dairy cattle longevity” resulted in 2,930 publications between 1990 and 2000 and 10,900 during the period 2000 to 2014, and 2,030 of them are published in 2014. Longevity is very difficult to define as illustrated by Essl (1998). One example is the Norwegian dairy production whit a high replacement rate. The Norwegian Red is a dual breed and about 25 % of the farm income is from meat production. Economic models regarding optimal time of culling have shown that under the condition of a healthy herd, milk producing animals should be selected at 3-4 months into their 1st lactation. A cow which has been selected for further milk production, should be kept for several years. Thus, if the definition of longevity only includes replacement rate, the alternative benefit of meat production would be a bias in such an estimate.
Methods: From the Norwegian Dairy Herd Recording System, all culled animals during 2014 were extracted. The relative distribution of parities and reason for culling, defined by the farmer, was analyzed. Mean lifetime per herd was calculated with and without including 1st parity cows.
Results: All together 237,788 dairy cows were removed from the herds during the year 2014. Of these, 36.6 % was removed during 1st parity, 25.7 % during 2nd, 17.4 % during 3rd, 10.4 % during 4th and 9.9 % after the 4th parity. The two oldest cows had 16 parities. The 1st parity cows were removed from the herds due to these reasons; 83.1 % slaughtered, 9.0 % sold as live animals 3.7 % emergency slaughtered, 2.2 % died, and for 1.9 % the farmer quitted the recording system. The older cows (>1st parity) the reason for removal was: 86.3 % slaughtered, 3.7 % sold as live animals, 5.7 % emergency slaughtered, 3.1 % died, and 1.2 % quitted the recording system.
Those who were removed during 1st parity, 40.2 % had the primary cause of diseases or reproduction, defined as “involuntary” culling. Most frequent was reproduction (19.9 %) and high somatic cell count (SCC) (6.8 %). Poor milk production was highest for “voluntary” reasons with 10.7 %. Those culled after 1st parity, 50.2 % was due to disease or reproduction failure. Most frequent was reproduction (14.3 %) and high SCC (13.3 %). Poor udder quality was highest for “voluntary” reasons with 13.9 %.

Among herds, there is a huge diversity on the proportion of removal of animals that are in 1st parity, and 80 % of the herds have a proportion between 0.20 and 0.67. The most extremes high figures are probably due to combined meat and milk production. The correlation between the herd mean lifetime when including, compared to excluding 1st parity was 0.78. The correlation between proportion of removals during 1st parity and herd mean lifetime was – 0.67 when including 1st parity cows, while the same for mean lifetime when excluding 1st parity was only – 0.16. This indicates that removals during 1st parity should not be included in definition of longevity.
Conclusion: Primary data indicates that longevity has to be defined as lifetime after 2nd calving and additionally adjusted to involuntary culling or death before that time.

O10
NOVEL COMBINATIONAL PROTOCOL FOR ENDOMETRIOSIS MANAGEMENT; A SURVEY ON MEDICAL & LAPAROSCOPIC TREATMENT
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Problem Statement: Endometriosis is the third reason for women to be hospitalized and one of the reasons for hysterectomy. Endometriosis with medication, surgery treatment or the combination of both is effectively curable. Many studies were conducted about surgery as well as medication treatment but their results were still under discussion. Laparoscopy is acceptable as the standard golden treatment method for endometriosis. There is no explanation for ineffectiveness of medication treatment before removing endometriomal cysts. So, we performed a study to survey the effect of the combination treatment in various grades.
Methods: In one year period, all clinicaliy suspicion patients for endometriosis attending to Sarem Women's Hospital were candidate to laparoscopy procedure for final giagnosis. Total of 47 documented endometriosis patients were categorized as grade-1 to 4 of severity based on American Infertility Society guideline. For all patients from different grades, laparoscopy surgery was performed (electro-coagulation and the adhesions removing), and then they treated for monthly injection of GnRH analogues (375 mg of Decapeptyl). Second & third laparoscopy procedure was performed after 3 & 6 months respectively. Results: In grade-1 endometriosis patients, after 3 months of treatment, 9/10 cases (90%) showed complete recovery (1 case after 6 months). 16/20 of cases from grade-2 (80%) and 5/10 cases from grade-3 (50%) showed also complete recovery after 6 months of the treatment. The remains patients had GnRH treatment for another 3 months & all of them showed complete recovery after 9 months. In grade-4, 3 out of 5 patients were candidate to laparatomy.
Conclusion: In our study, we proved that high grades endometriosis were required aggressive treatments. In grade-1, we advised to use 3 month & for grade-2 and 3, 6 months of long-acting GnRH agonist injection besides electro-coagulation, for complete recovery. More treatment with GnRH agonist was depending on the second look laparoscopy.

O11
WATER SPECTRAL PATTERN OF RAW MILK FOR OESTRUS DETECTION IN DAIRY COWS
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Problem Statement: Rapid and costeffective method for oestrus detection in dairy cows by means of near infrared spectroscopy and aquaphotomics, using raw milk from individual cows has been presented.
Methods: Animals: Within four experiments (two in summer and two in winter), 18 Holstein cows (Cows-A~R) were monitored through 31-day milking period.Blood serum was investigated for P4 level to certify the hormonal changes of cows at oestrus. Milk samples and near infrared spectroscopy Individual foremilk samples of Cows-D~R (n = 15, 50 ml per sample) were collected by hand before milking during the entire sampling periods. Individual milk samples of all cows (n = 18, 50 ml per sample) were collected from the milk yield meter of the pneumatic milking system, during AM and PM milking. Transmittance spectra were recorded in the range of 400–2500 nm at 0.5 nm interval using a FOSS XDS spectrometer. Acquisition of absorbance values (logT1) was performed with the VISION 3.50 software (FOSS NIRSystems, Inc.). Three consecutive scans were recorded during random measurement of foremilk and milk samples (total nr. of spectra = 2910). NIR spectra were evaluated using Pirouette (ver. 4.0) spectral analytical program (Infometrics, Inc., Woodinville, WA, USA), MS Excel 2010 (Microsoft Co., Redmond, WA, USA) and R Project (ver. 3.0.2) statistical software package (www.r-project.org). All data analyses were performed using the first overtone region of water, at 1300–1600 nm spectral interval. The variation of the light absorbance at specific water matrix coordinates (WAMACs) (Tsenkova 2009) described the water spectral pattern (WASP), visualized in aquagrams (Tsenkova 2010; Kinoshita et al. 2012).
Results: EIA test of blood serum P4 level confirmed the hormonal changes of investigated cows. Evaluations were performed on data of individual cows only. Based on the concept of aquaphotomics, water acts as a molecular mirror, and the complex changes of milk caused by tiny level of otherwise hardly detectable hormonal changes can be seen through the respective water spectrum. Systematic spectral treatments were applied to identify the specific spectral regions of water (WAMACs), representing the most information related to physiological changes caused by the hormonal changes in the oestrus period. The best results were achieved with NIR spectra of AM foremilk samples. The water spectral pattern (WASP) of the high P4 and low P4 groups were different from each other and showed the spectral pattern of oestrus in 71% of AM foremilk samples. Control cows showed completely different WASP at the identified WAMACs in 75% of the AM foremilk samples.
Conclusion: This study has proven strong interaction between the hormone level of blood serum and the NIR spectral properties of milk samples. Aquaphotomics approach showed specific water spectral pattern of milk at oestrus period of the investigated Holstein cows compared to non-oestrus period. Milk can be analysed in lactating cows at every milking, thus, an automatized online monitoring system for milk evaluation can advocate the oestrus detection for reproductive management.

O11
TOPICAL VAPOCOOLANT SPRAY REDUCES PERIOPERATIVE PAIN OF EAR TAGGING AND EAR NOTCHING IN CALVES
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Cryoanaesthesia has been investigated in various species for the reduction of procedural pain. During cooling nerve conduction decreases linearly until approximately 10C, where nerve conduction velocity, receptor sensitivity and neural transmission is virtually blocked. This method of anaesthesia may be suited to ear notching and tagging.
The objective of this study was to evaluate the efficacy of a vapocoolant spray to provide local anaesthesia for calves during ear tagging and ear notching.
Temperature validation studies using thermocouples and a temperature data logger were conducted on dead and live tissue to determine optimal spray distance and duration to achieve tissue anaesthesia (<10C). A behavioural study was conducted to assess efficacy for ear tagging and ear notching. Black Angus calves (n=20) aged 4-16 weeks old were randomly assigned to a vapocoolant spray (VS) or water spray (WS) group. A three second spray was administered from 10cm to both sides of the ear immediately prior to ear tagging and ear notching. A numerical rating scale (NRS) was used to score behavioural response to each procedure, with response categorised from 0 (no response) to 3 (severe). Temperature and tissue validation studies indicated the vapocoolant spray reduced dead and live tissue temperature to below nociceptive threshold levels (10C) for 10-16 seconds. Univariate analysis indicated ear notching

was more painful than ear tagging (odds ratio 19.2, 95% CI odds ratio 5.34 to 68.99, P <0.001). When adjusted for the multivariate model, there was a significant effect of treatment, with WS calves showing greater pain response scores than VS calves (odds ratio 4.08, 95% CI odds ratio 1.34 to 12.42, P=0.011). Ear notching resulted in greater pain response scores than ear tagging (odds ratio 23.19, 95% CI odds ratio 6.18 to 87.05, P <0.001).

The vapocoolant spray induced local anaesthesia and significantly reduced the pain response to ear tagging and ear notching in calves. Ear notching is more painful than ear tagging. Cryoanaesthesia is an effective option for quickly and practically reducing the perioperative pain associated with these simple husbandry procedures.

POSTER PRESENTERS

P01

A MODEL OF BARN FOR THE ENVIRONMENTAL SUSTAINABILITY OF BEEF PRODUCTION

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Problem Statement: For the evaluation of cattle production sustainability researchers should not fail to carefully appraise the animal welfare and health concepts. Conditions, these latter, which in turn are directly linked to the functionality and appropriateness of areas dedicated to the cattle breeding. The planning of a beef barn with criteria that reduce the risk for the development of diseases stress correlated can contribute to the decrease of drug treatment and to the environmental sustainability of livestock production. Aim of the present work is to identify a model of barn that could optimize the animal welfare and health condition increasing the environment sustainability of beef farming.

Methods: In order to plan a farm building model for beef sheltering, architectural aspects that mainly affect animal welfare, health and sustainability parameters were taken into account. Spaces were planned to assure freedom of movement of animals, according to their physiological and ethological needs as recommended by Dir. 98/58/CE. The number and size of boxes and paddocks were prorated to the number of beef and functional groups reared. Spaces were designed in order to allow interaction and establishment of herd hierarchies. Given the influence of direct solar radiation on brightness and temperature, the mobility and insulation of walls was redefined. To fulfill the physiological needs (light/dark time period) and reduce behavioural atypias (aggressiveness), natural lighting was preferred. The natural ventilation system was planned to maintain an appropriate and constant microclimate into the shelters thanks to the control of air circulation, temperature, humidity and the abatement of toxic gases concentration generated from bedding. The selection of paving and bedding was based on their important role in decreasing foot injuries and respiratory diseases. The management of bedding has indeed a strong influence on a proper maturation of manure and gets to affect directly the cattle production sustainability.

Results: The result of the project is a physical model of a beef barn (figure 1). Principle of functional planning of spaces, bioclimate and sustainability architecture, oriented to improve animal welfare and health, were applied to the stall design. The model has a longitudinal development on the east west axis, the south facing side can be completely opened, otherwise the north facing wall is closed and insulated with the stored straw. The building envelope is provided with a control system for solar radiation and ventilation (fixed and mobile protections) that can maximize the incoming solar radiation during the winter and can shade from the sun during the summer guaranteeing proper air circulation. The model is provided with mobile outwards opening and solar chimney for the ventilation. The building composition allows a good integration in the landscape.

Figure 1. The stall model for the sustainability of beef production

Conclusion: Thanks to a multidisciplinary approach, the research group has arrived to define a stall model that support a sustainable cattle production. Researchers with different expertise, veterinarians, architects and agronomist, worked together in order the propose a barn model that combine the economic requirements with the environmental sustainability and animal health.

of Interest: None Declared

P02

RISK FACTORS FOR INVOLUNTARY EXTENDED LACTATIONS (OVER 40 MONTHS) IN HOLSTEIN COWS IN A HOT ENVIRONMENT

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Problem Statement: In temperate regions, 305-d lactation length with high-yielding dairy cows is considered optimum. Yet, this lactation length is untenable in zones with low reproductive efficiency due to high ambient temperature. Under these circumstances, extended lactations offer the possibility of improve reproductive performance, decrease culling rates, increase milk yield and reduce costs of production.

Methods: To analyze risk factors contributing to the occurrence of extended lactation, a multivariable logistic regression model of SAS was used, applying a backward stepwise logistic model. The GENMOD procedure of SAS was used to assess the statistical significance of number of previous cumulative services on conception rate. A Kaplan-Meier survival analysis using the LIFETEST procedure in SAS was performed to illustrate the difference in lactation length between pregnant (fecundation at the final stage of lactation) and non pregnant cows. A non-linear regression was used to describe the association between total milk yield and lactation lenght.

Results: Thirty percent of lactations were between 450 and 1399 days. Full lactation yield of cows with lactations >900 days was over 30,000 kg. The epidemiological analysis of risk factors for involuntary extended lactations using a multiple variable logistic regression indicated that retained placenta (odds ratio (OR) = 1.3), metritis (OR = 1.8), ketosis (OR = 1.4), peak milk yield (<50 vs >50 kg, OR=1.4), temperature-humidity index at 60 days postpartum (<82 vs >82 units, OR = 1.4), ketosis (OR = 1.4) and 305-d milk yield (<11,000 vs >11,000 kg, OR = 1.6) significantly increased the risk for lactations >15 months. Primiparous cows had less than half the risk of extended lactations (OR = 0.3) compared to multiparous cows. Once a cow had conceived, her risk of having a prolonged lactation decreased sharply (P<0.01). A strong non-linear association was found between lactation length and total milk yield for primiparous (up to 1393 days in milk, maximum milk yield 35,236 kg; r= 0.80) and pluriparous (up to 1399 days in milk, maximum milk yield 37,218 kg; r= 0.77). Conception rate in cows with extended lactation decreased linearly as number of services increased (conception rate = 50.5% for 4 services and 13% for ≥ 14 services).

Conclusion: The data showed that well-managed Holstein cows milked three times daily were capable of lactating for over 40 months with remarkable high persistency and with high milk yield at drying-off. Additionally, this study showed that reproductive and metabolic disorders

associated with calving are important risk factors for involuntary extended lactations, derived from the link of periparturient diseases with depressed reproductive function in dairy cows.

P03

MINIMAL EFFECT OF DNA EXTRACTION METHOD ON RELATIVE TELOMERE LENGTH MEASUREMENT BY QPCR

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Problem Statement: By improving functional longevity of dairy cows fewer replacement heifers would be required to keep a constant herd size. Resources such as feed and land would be utilised more efficiently and the environmental impact of dairy farming due to greenhouse gas emission would be reduced. Improved functional longevity would promote productivity on limited agricultural space that is crucial to provide sufficient food supply for the growing world population.

Conventional breeding for improved longevity is difficult, because it is a trait measured late in life and on females only, and has a low heritability. Therefore, a predictive biomarker measured early in life would be helpful for the selection of breeding animals.

Average leukocyte telomere length (LTL) might be a suitable biomarker to improve functional longevity in dairy cattle. Telomeres cap the ends of chromosomes and shorten with every cell division. This is believed to be an underlying molecular mechanism of ageing. Former studies have shown that individuals of the same age vary widely in average LTL and that individuals with long LTL early in life are more likely to live longer.

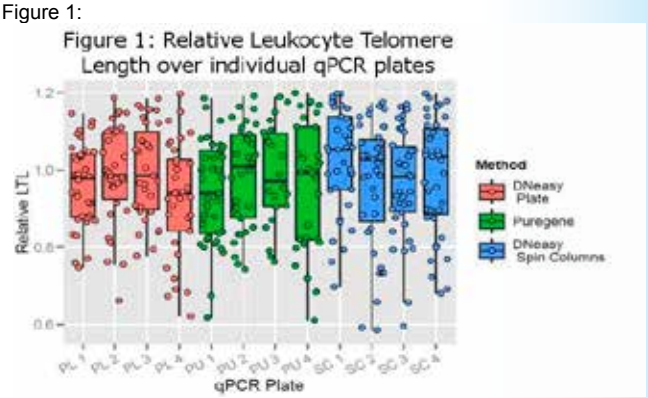
There are different methods to measure LTL but most of them are underpinned by DNA extraction. Recent studies suggest that the choice of DNA extraction method alters LTL measurements with silica based methods producing shorter LTL. In the present study we tested three different DNA extraction protocols- one salting out and two silica based protocols- to test more systematically if silica membranes alter LTL measurements on qPCR.

Methods: Whole blood samples were taken from 51 Holstein Friesian cows at the Crichton Royal Farm (Dumfries, Scotland) and DNA was extracted from each sample following three different protocols: a salting out method (Gentra Puregene kit by QIAGEN) and both the spin column and 96 well plate protocol of a silica based method (DNeasy Blood & Tissue kit by QUIAGEN).

Four identical qPCR plates per DNA extraction method were run to measure relative LTL in relation to the reference gene B2M. Calibrator DNA of the same animal was included on each plate to account for plate to plate variation. A linear statistical model was used to assess the effect of each method on LTL measurement.

Results: The qPCR assay produced results with a very high repeatability of 82.5%. Furthermore, repeated measurements for each sample varied little even when calculated across different DNA extraction methods (pooled coefficient of variation: 8.2%). The correlation between DNA extraction methods was high (>78%). Although there was a statistically significant effect of DNA extraction method on relative LTL measurement, the magnitude of this effect was very small and actually lower than inter-plate variation observed within extraction methods (Figure 1).

Figure 1:



Conclusion: Although we found a statistically significant effect of DNA extraction method on relative LTL, the effect size is very small and not of biological significance. Therefore, it is concluded that all DNA extraction methods tested here yield comparable results for telomere length measurement on qPCR.

P04

PROMOTING AN UNDERSTANDING OF BEEF PRODUCTION, AND THE VALUE OF CATTLE GRAZING AND THE ECOSYSTEM SERVICES IT PROVIDES TO AN URBAN PUBLIC

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Problem Statement: In the western U.S., open space whether in private or public ownership is often grazed by beef cattle. It is the most substantial use of land use in the western U.S. Cattle grazing supports the raising of beef cattle for meat and other by-products and provides other ecosystem services including vegetation and watershed management, fire fuel control and increasingly management of habitat of rare and endangered species. Decision makers and the public have little knowledge of animal agriculture production or the ecosystems services provided by livestock grazing on western open space lands. Their lack of knowledge puts the future of livestock grazing in the western U.S at risk and threatens our ability to manage large-scale landscapes for a variety of conservation values.

Methods: A project titled, “Understanding Working Rangelands” is educating decision makers and the public about beef cattle production. The project conducted through the University of California Cooperative Extension in cooperation with the East Bay Regional Park District and Sonoma County Regional Parks is targeted towards San Francisco Bay Area decision makers, park interpreters, and park users. Over 2.5 million people visit grazed open space annually in the Bay Area. Information on beef cattle husbandry, cattle behavior, grazing management, ranching economics and infrastructure is extended through a series of fact sheets and an intrepretative trail on working rangelands, which is under construction. Although information for the fact sheets and trail signage is readily available, it is generally written for practioners with a focus on “how to” instead of “why.” In creating the fact sheet series we focused on "why", i.e. Why are bulls grazing in the parks? Why do ranchers brand and castrate cattle? Why is barbed wire fencing necessary? and other aspects of beef cattle production that have caught the uninformed public and decisions makers off guard in recent years.

Results: Two fact sheets, "Grazing Benefits" and "Sharing Open Space: What to Expect from Grazing Cattle" have generated positive media attention just after they were published in April 2015. "Grazing Benefits" explains and provides research-based information about the role of livestock grazing in managing open space. "Sharing Open Space" was used by local media to inform the public about cattle behavior after negative interactions between dogs and cattle in parks were reported. Factsheet "A Year in the Life of a Cow" will be instrumental in helping park interpreters explain why grass-finished beef is not widely produced on

public open space lands and the important role of animal feeding operations in supporting rangeland livestock production. Similarly, the factsheet "Infrastructure for Livestock and Rancher Safety, and Healthy Rangelands" will help managers and decision makers address policies and regulatory obstacles that have contributed to lack of ranching infrastructure in many places.
Conclusion: Decision makers and the public in the United States need to not only understand that cattle grazing in the western U.S provides a variety of ecosystem services, but also understand the production system required to care for the health and well being of cattle and the environment. Providing comprehensive, research-based information that promotes animal agriculture literacy is a key first step.

P05
COMPARISON BETWEEN INDIVIDUALLY VS. GROUPED HOUSED DAIRY CALVES
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Problem Statement: Recently, due to public opinion pressures, the "on farm" welfare of the dairy cow became an issue of major public concern. The main items which are about to go through legislation in the near future are: 1.The rearing system of calves 2. Cow mutilation 3.Standardizing the housing system of the dairy cow. Social interaction between calves has been well documented. However, despite the importance of this interaction it seems that most of the calves are housed individually. The main reason for doing so is "health concern"
Methods: In this research we focused on the housing system in order to grapple with the question of whether the dairy calves should be housed individually or in a group – social pens. A group of 40 female dairy calves were divided into two and each one received a different housing treatment: 20 calves were put in individual pens (IP) and 20 calves in social pens (SP). The calves were moved in to the different housing treatment from day 7 until 65 days of age. Body weight, starter mix intake, pedometer stool sample and health events were recorded. Blood sample was taken for IgG and antioxidants as measurement of stress. Calves were recorded on camera for their natural behavioral
Results: Pedometer – average daily steps (IP 1456.6/SP 1746.4) (*P<0.0001*), average no. of daily lying (IP 19.8/SP 18) *(P=0.0078)*. Stool sample: Coccidia (IP 1/SP 3). Morbidity (IP 1/SP 5).
Conclusion: Calf that were housed in social pen preferred to expressed more social behavior, as in nature, never the less, they had greater tendency for morbidity

P06
EFFECT OF A-LIPOIC ACID ON OXIDATIVE STATUS, LIPID METABOLIC PARAMETERS AND LIVER ENZYME ACTIVITIES IN TRANSITION DAIRY COWS
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Problem Statement: Periparturient dairy cows inevitably experience metabolic challenges that result in a negative energy balance (EB), and passively mobilize fatty acids from adipose tissues, which can lead to fatty liver disease, and to be in oxidative stress state. Alpha-lipoic acid, a potent antioxidant and essential member of mitochondrial dehydrogenases, has shown potent reactive oxygen species-scavenging capabilities along with a proven clinical safety record, and thus this study was conducted to determine whether α-lipoic acid has beneficial effects on EB, lipid metabolism, and hepatoprotective effects in periparturient dairy cows.
Methods: Forty-eight Holstein dairy cows at 20d before parturition were allocated into four groups. Group Ⅰ was used as the control, except the cows in control group. Each cow in other three groups was fed with different doses (3, 5 or 8g/d evenly mixed with the concentrate feed) of α-lipoic acid for consecutive 50 days, respectively. To determine the status of oxidative stress, lipid mobilization and liver enzyme activities, blood samples were collected at the beginning and at intervals of 10 days after supplementation. The activities of glutathione peroxidase (GSH-Px), superoxide dismutase (SOD), catalase (CAT) and malondialdehyde (MDA) content in serum were measured using the corresponding specific kits. Meanwhile, the following parameters indicative of lipid metabolism and serum enzyme activities were measured with an automatic biochemical analyzer: triglyceride (TG), cholesterol (Chol), nonesterified fatty acid (NEFA), high-density lipoprotein (HDL), low-density lipoprotein (LDL) and alkaline phosphatase (AKP), γ-glutamyl transferase (γ-GT), lactate dehydrogenase (LDH), alanine aminotransferase (ALT) and aspartate aminotransferase (AST)
Results: The indicators of oxidative status displayed that serum GSH-Px, SOD activities were significantly higher from d 20 to 50 in group Ⅲ and d 40 to d 50 in group Ⅳ than in control group, respectively (P<0.05 or P<0.01). Serum CAT activities were markedly higher on d 30 in group Ⅱ and d 30, 40 and 50 in group Ⅲ and Ⅳ (P<0.05), whereas serum MDA contents were significantly reduced on d 40 in group Ⅲ and d 50 in group Ⅳ when compared with control group (P<0.05). The data of lipid metabolic parameters were shown as a general declining trend without significant differences in the groups with α-lipoic acid treatment, only serum NEFA concentrations were markedly changed on d 30 in group Ⅳ when compared with control group (P<0.05). Serum liver enzyme tests showed that AST activities were significantly lower on d 30 in group Ⅱ, Ⅲ and Ⅳ than in control group (P<0.05 or P<0.01), and no significant differences could be observed in other parameters between the treated groups and the control.
Conclusion: These findings indicate that α-lipoic acid supplementation can improve antioxidant capacity, lipid metabolism and protect liver function in transition dairy cows.

P07
STRESS-INDUCED ACTIVATION OF OVARIAN HEAT SHOCK PROTEIN 90 IN A RAT MODEL OF POLYCYSTIC OVARY SYNDROME
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Problem Statement: Polycystic ovarian syndrome is the most common endocrine disorder affecting infertile women of reproductive age. This study evaluated the activation of heat shock protein 90 (Hsp 90) during the formation of stress-induced polycystic ovaries.
Methods: Female Sprague-Dawley rats (180-200 g) were subjected to one of two stress-inducing conditions; animals were either treated with adrenocorticotropic hormone daily for 18 days or were exposed to daily cold stress for three weeks. Non-treated rats sampled during proestrus or diestrous served as controls. Blood samples were collected from the left ventricles of anesthetized rats and concentrations of follicle-stimulating hormone, luteinizing hormone, estradiol, testosterone and corticosterone were measured in all rats. The expression of messenger RNA for androgen receptor, estrogen receptor-a and -ß, nerve growth factor receptor, and glucocorticoid receptor, and protein expression for Hsp 90 was also assessed in the rat ovaries.
Results: Stress increased glucocorticoid receptor and androgen receptor expression, and decreased estrogen expression. Nerve growth factor receptor expression was greater in treated than diestrous rats and less in treated than proestrous rats. Ovarian Hsp 90 protein expression was increased in rats treated with adrenocorticotropic hormone or cold stress. Serum follicle-stimulating hormone levels were reduced and testosterone and corticosterone levels increased by stress, whilst luteinizing hormone and estradiol levels were similar to levels in diestrous and proestrus control rats respectively.
Conclusion: The results indicate that stress, via the activation of ovarian Hsp 90 and changes in steroid hormone receptor expression and serum reproductive hormone levels, may be involved in the induction of polycystic ovaries in rats.

P08
VALUE OF SERUM CA125 LEVELS IN RECURRENT EPITHELIAL OVARIAN CANCER WITH COMPLETE REMISSION TO PRIMARY THERAPY
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Problem Statement: The aim of this study was to ascertain whether serum CA125 level is the prognostic value in patients with recurrent epithelial ovarian cancer who have achieved a complete response to primary treatment.
Methods: Between January 1995 and April 2007, we reviewed the records of 134 recurrent ovarian cancer patients who reached complete remission (i.e. no physical or radiological sings of residual disease and CA125 values ≤ 35 U/mL) after primary treatment were included. A receiver operating characteristic curve was used to determine the most useful CA125 level in predicting overall survival (OS) and Cox proportional hazards models adjusted for covariates were used for analyses.
Results: The 5-year OS rate was 25.3%. The optimal cutoff point of CA125 after completing adjuvant chemotherapy to predict disease progression was 10 U/mL (sensitivity, 76.0%; specificity, 76.5%). On multivariate analysis, CA125 level > 10 U/mL after primary treatment was an independent prognostic factor predictive for disease progression. The risk of recurrence was higher for CA125 level > 10 U/mL (hazards ratio = 2.869; $P < 0.001$). The 5-year OS rate for patients with CA125 level ≤ 10 U/mL was 52.0%, which was higher than a OS of 9.5% for CA125 > 10 U/mL ($P < 0.001$).
Conclusion: CA125 level after primary treatment is a strong independent prognostic factor for recurrent epithelial ovarian cancer who has achieved a complete response to primary treatment.
Disclosure of Interest: None Declared

P09
CASE-CONTROL STUDY ON CHRONIC DISEASES IN DAIRY HERDS IN NORTH-WESTERN GERMANY: INVESTIGATIONS ABOUT LAMENESS IN AFFECTED COWS
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Problem Statement: In the last two decades, unspecific chronic herd health problems occurred in Germany, which were supposed to be caused by *Clostridium botulinum*. Common in all descriptions about this until now hypothetical disease is a higher number of cows with inexplicable disorders of locomotion, sometimes combined with ataxia, paralysis and paresis. Due to many possible reasons for lameness in cattle, consistent and proper diagnostic measures are necessary.
Methods: In order to clarify this postulated new form of disease in general and in particular with respect to the symptom of lameness, a case – control study was conducted. First, case farms had to fulfill at least three of five criteria for inclusion into the study: decreased milk yield, increased mortality, increased culling rate, increased number of downer cows and farmers´ impression of herd health problems. Control farms did not fulfill any of these criteria. Due to regional differences in vaccination protocols, case-farms were divided into case1 farms, which did not vaccinate against any Clostridia, and farms, which applied a multi-clostridia-vaccination (case2 farms). During a one-time visit, four trained study veterinarians selected five affected cows by random according to the described symptoms in conjunction with the postulated so called “chronic” botulism (Böhnel et al. 2001).
Main criteria were the habitus of a chronically sick animal combined with a low body condition (BCS ≤ 2.5; Edmondson et al. 1989). Furthermore, at least one of eleven additional criteria was supposed to be present, including a locomotion score of ≥ 3 (Sprecher et al. 1997), obvious signs of laminitis or paresis, paralysis and ataxia, respectively. These cows underwent further examination at the claw trimming chute. The five unaffected and also randomly selected control animals did not fulfill any of these criteria.
Results: With 77.4% (n=182) in control farms (n=47), 82.7% (n=186) in case1 farms (n=45) and 86.4% (n=203) in case2 farms (n=47), respectively, lameness was the most frequently occurring criterion in affected cows (n=695). In comparison, paresis, paralysis and ataxia as well as laminitis was obvious in only 2.6% (n=6), 2.7% (n=6) and 0.8% (n=2). In the 584 lame cows, lesions at the claws were responsible for locomotion disorders. By further examination of 1.131 hind legs at the claw trimming unit about 43.5 % (n=254) cows (n=78 in control-, n=80 in case1- and n=96 in case2 farms) had deep or perforating sole ulcers, severe laminar wall lesions or lesions of the claw apex. Additionally as well as separately, 31.9% (n=186) cows (n=46 in control-, n=52 in case1- and n=87 in case2 farms) had severe mortellaro-associated lesions (M2, Doepfer 2009).
Conclusion: Irrespective to case or control status of the farms, claw diseases were of utmost importance for disorders of locomotion associated with chronic disease status. All claw lesions were well-known with clear described pathogenesis, so there is no evidence for a new form of disease.
Literature: available from the authors

P10
CHANGES IN LIPID METABOLISM, LIVER FUNCTION AND LIPID PEROXIDATION IN TRANSITION DAIRY COWS
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Problem Statement: Fat mobilization to meet energy requirements during early lactation is inevitable because of insufficient feed intake, and this results in a negative energy balance and fatty liver diseases. To know the characteristics of metabolic changes, thirty Holstein dairy cows at 30d before calving were selected for this study.
Methods: Serum samples were collected at d 30, 20, 10, 5 before and d 0, 5, 10, 15, 20d after parturition. Lipid metabolites (concentrations of GT, Chol, NEFA, HDL and LDL), activities of liver enzymes (AKP, LDH, ALT and AST), and lipid peroxidation status (GSH-Px, SOD and CAT activities, MDA content) in serum were measured.
Results: The results showed that: 1) there was a declining trend of serum TG concentrations before calving, flowed with a dramatic decline on the day of calving. Whereas, Chol concentrations had the similar trend to TG in prepartum period, but with an increasing trend postpartum. NEFA concentrations increased at calving, reaching peak level on d 5 postpartum and thereafter started to decrease. Serum HDL and LDL concentrations decreased slightly prepartum and increased gradually postpartum. 2) LDH and AST activities were the highest at d 5 prepartum and the day of calving, respectively. There were no significant difference in serum ALT and AKP activities at any period. 3) CAT and GSH-Px activities showed a declining trend prepartum and increased at the day of calving, then followed by a decrease. SOD activity had an increasing trend from day -30 to 0 and started to decrease thereafter. 4) MDA content increased from d 5 prepartum and then decreased from d 5 postpartum.
Conclusion: These results indicate that dairy cows seem to undergo extensive fat mobilization and an imbalance in the oxidative status in the transition period, and liver function is impaired owing to hepatic lipidosis.

P11
MANUFACTURING FEEDSTUFF WITH MUCOR CIRCINELLOIDES SPORES TO PREVENT CATTLE INFECTION BY CALICOPHORON DAUBNEYI
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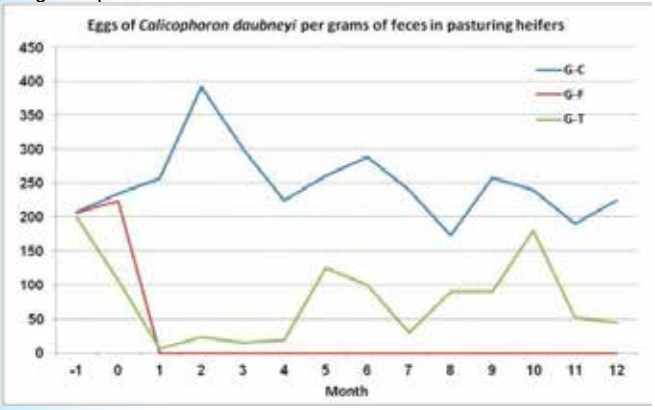
Problem Statement: Grazing animals become infected when ingesting forage contaminated with oocysts (protozoa), metacercariae (flukes), cysticercoids (tapeworms), eggs containing larvae inside (roundworm, whipworm) or larvae (gastrointestinal and pulmonary nematodes). Many antiparasitic drugs have been developed during decades, and most of them are commercially available. Although elevated efficacy can be obtained, several problems have been reported, mainly based on the need for a repeated administration of therapy, which can lead to the development of strains resistant to different parasiticides. Herein the usefulness of biological control against the gastric fluke *Calicophoron daubneyi* in infected cattle was assayed.
Methods: The current assay consisted of analyzing the usefulness of feedstuff elaborated with spores of an ovicidal fungus to reduce the risk of cattle infection by the gastric trematode *Calicophoron daubneyi*. Spores of *Mucor circinelloides* were obtained in a submerged culture (COPFr) and then incorporated during the mixing phase, before the pelleting. A quantity of $1.2x10^6$ spores was added by Kg of a commercial formulation (*DL Novillas 18*®, NANTA, Nutreco, Outeiro de Rei, Spain). This guarantees that heifers ingest $3x10^6$ spores / day.
Heifers
Three groups of 7 grazing Friesian heifers each and passing eggs of the gastric fluke *Calicophoron daubneyi* in their feces were considered. Group G-F was composed by heifers supplemented with concentrate + $1.2x10^6$ spores / kg feedstuff; G-T was formed by calves supplemented with concentrate without spores; and G-C composed by bovines receiving concentrate without spores and remaining without deworming as controls. At the beginning of the study, groups G-F and G-T were dewormed by oral administration of closantel (10 mg / Kg bw Endoex, SP Veterinaria, Spain). The groups were maintained under rotational pasturing in an area where infection by the gastric fluke has been previously detected.
Results: In the G-F, eggs of *Calicophoron* were not observed from one month after the deworming. In the G-T, low levels of trematode eggs were detected after the administration of the parasiticide. A decreasing tendency in the values of eggs passed in the feces of G-C was observed until the end of the study.
Image/Graph:



Conclusion: Despite the deworming of cattle with efficient parasiticides, the presence of free-living stages that develop in the feces becomes a risk of infection.
Our results demonstrate that by providing commercial feedstuff carrying spores of *Mucor* to cattle in risk of infection by *Calicophoron daubneyi*, their possibilities to become infected again are significantly reduced, due to the fungal spores shed into the feces together with the trematode eggs are capable to destroy them.
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of Interest: None Declared

P12
"ALHEESH" DISEASE OF CATTLE IN THE SUDAN: A CHRONIC ENCEPHALOPATHY CAUSED BY HISTOPHILUS SOMNI OR A CHRONIC FORM OF FOOT AND MOUTH DISEASE?
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Problem Statement: A peculiar syndrome – characterized by decreased heat tolerance, loss of condition and rough coat with long erected hair – affected cattle in many areas of the central and western states of the Sudan during the last years. Symptoms of the syndrome included elevated body temperature, respiratory distress with protrusion of the tongue, hypersalivation, loss of appetite, decreased milk yield, abortion, stiff gait, plegia, recumbency, and death in acute cases. The disease, which is locally known as "*Alheesh*, was firstly observed in cattle that survived a foot and mouth disease (FMD) outbreak. Accordingly, some veterinarians diagnosed it as a chronic form of FMD. Other veterinarians related it to some blood parasitic diseases (babesiosis, trypanosomiasis or theileriosis).
Methods: Post-mortem examination of affected cattle (one adult cow and one calf) was carried out; bacteriological cultures from different internal organs were made and histopathology sections were prepared. Treatment of two affected animals (a pregnant heifer and a lactating cow) for five days with trimethoprim/sulphamethoxazole and enrofloxacin, respectively, was tried.
Results: The brain showed macroscopic and microscopic lesions indicating a CNS involvement. *Histophilus somni* was isolated from affected animals and confirmed by PCR and partial sequencing of the 16S rDNA gene. Treatment with the antibacterial drugs improved the condition of affected animals, as reflected by improved appetite, increase of milk yield in the lactating cow, less prominent respiratory distress, drop in the rectal temperature and decrease in the average hair length.
Table:

Treatment trial of "*Alheesh*" disease of cattle

Parameter	Animal 1		Animal 2	
	Before*	After*	Before*	After*
Temperature (ºC)	41.2	39.0	39.9	38.8
Respiratory rate (cycle/ min)	92	80	56	48
Hair length** (cm)	3.04	2.68	3.22	2.98
Milk yield (L)	NA***	NA***	5	6

Animal 1: a 5-months' pregnant heifer, treated with trimethoprim/ sulphamethoxazole (1 ml/ 20 kg b. wt. for 5 days)
Animal 2: a lactating cow treated with enrofloxacin (5 mg/ kg b. wt.) for 5 days
*Before: before treatment; After: 7 days after treatment
**Hair length: average hair length of the flank region
***NA: not applicable

Conclusion: "*Alheesh*" is a bacterial disease caused by *Histophilus somni* and can be treated with antibacterial drugs acting against this organism, especially in the early stages of the disease. As *Histophilus somni* is an opportunistic pathogen, stresses caused by viral diseases such as FMD or by blood parasitic diseases (theileriosis, babesiosis and trypanosomiasis) are pre-disposing factors for cattle to "*Alheesh*" disease. The authors described this disease as a "Chronic Encephalopathy of Cattle".

P13

SURVEILLANCE OF BITING MIDGES (DIPTERA, CULICOIDES), THE POTENTIAL VECTORS OF BLUETONGUE AND SCHMALLENBERG VIRUSES, IN POLAND IN 2008-2014

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Problem Statement: Two arbovirus species (BTV and SBV) that cause disease in ruminants have been spreading in Europe in recent years. Accordingly, interest in the *Culicoides* vectors of these viruses has risen. While the aspect of vector competence in virus transmission has been thoroughly studied, less is known about vector capacity. Vector capacity is corollary to a variety of environmental factors (mainly temperature) and population features (abundance, activity, fertility, etc.). The components of vector capacity underlie the frequency of exposure of susceptible ruminants to the vector, which has instrumental in effective virus transmission. Access to data on abundance and activity periods of *Culicoides* significantly aids the prevention of diseases caused by these viruses. The present paper describes variation in the abundance and activity of the main vectors of BTV and SBV of the genus *Culicoides*.
Methods: The insects were captured into OVI traps activated one night a week from the beginning of April until the end of November. The catches were conducted in 23-24 herds of ruminants (different numbers investigated in different years) and two stands in a forest habitat. A total of 4,992 samples were collected. The methodology was compatible with the guidelines of Commission Regulation (EC) No 1266/2007 on the principles of monitoring of BTV vectors, including the division of the insects into four groups, namely, the Obsoletus Complex, Pulicaris Complex, Nubeculosus Complex and others.
Results: A total of 4,983,044 individuals of *Culicoides* were captured in the period of study. The following species of competent vectors of both BTV and SBV were recorded near cattle herds: of the Obsoletus Complex - *C. obsoletus, C. scoticus, C. chiopterus, C. dewulfi*; and of the Pulicaris Complex - *C. punctatus, C. pulicaris*. Overall abundance of the midges relied on two species, namely *C. obsoletus* i *C. punctatus*. Maximum abundance of *C. obsoletus* was reached in mid-May (with up to 38,360 individuals/trap/night), while *C. punctatus* reached peak abundance at the end of May (to a maximum of 49,230 individuals/trap/night). Other species, including those regarded as competent vectors or potential vectors (mainly *C. nubeculosus* and *C. riethi*), accounted for a small percentage of *Culicoides* captured in the vicinity of cattle herds.
These relationships were altered in the forest habitat, where species regarded in published papers as not involved in the transmission of BTV and SBV occurred very abundantly, with *C. achrayi*, as their representative, accounting for almost 90% of this group and more than 50% of all *Culicoide*s. Its peak abundance was in mid-July (53,350 individuals/trap/night). The mean abundance of *C. obsoletus* and *C. punctatus* was also higher than in most cattle herd captures.
Conclusion: These findings indicate a high potential for arbovirus transmission in Poland, as shown by a very high abundance of two competent vectors of BTV and SBV (*C. obsoletus* and *C. punctatus*). Considering the recently attested high seroprevalence of SBV in the European bison (up to 80% of the population), it may be supposed that *C. achrayi*, being so abundant in the vicinity of European bison herds, may also play a significant role in the transmission of this virus.

P14

CAN SOCIAL NETWORK ANALYSIS (SNA) ELUCIDATE THE EPIDEMIOLOGY OF PARATUBERCULOSIS IN DAIRY AND BEEF HERDS?

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Problem Statement: National risk-based surveillance programmes for paratuberculosis can be hampered by the difficulty in networking disparate databases across organisations. This is particularly important when attempting to track the movement of *Mycobacterium avium* subspecies *paratuberculosis* (MAP)-positive animals between herds. Social network analysis (SNA) is a formal methodology for the analysis and illustration of the relationship between movements of animals and transmission of contagious pathogens associated with those movements. While it is widely used in the social sciences and human disease epidemiology, it has only sporadically been applied to veterinary diseases. This study reports the first use of this technique in the epidemiology of paratuberculosis. The aim of the study was to describe the network of confirmed (fecal culture) MAP-positive animals in the southern province of Ireland (Munster) by linking their movements through different premises throughout their life.
Methods: Networks were constructed by linking a dataset of laboratory records of MAP culture-positive animals over a 13-year period (2000-2012) with the national Animal Identification and Movement System (AIMS) database. Networks represent patterns of connectivity of populations and describe aspects of disease transmission. In total there were 179 confirmed (fecal culture) MAP-positive animals with a total of 327 movements. The network was organised in an adjacency matrix consisting of a collection of nodes (n=217 premises; 118 MAP-positive, 99 MAP-unknown status) and an array of directed movements arcs linking the nodes.
Results: The network was fragmented into 84 subgraphs, 21 (25%) of which had two or more MAP-positive herds (nodes) linked by movement of MAP-positive animals. MAP-positive animals were moved once (47%), twice (36%), thrice (9%) or more times (8%) between nodes. By calculating the out-degree centrality of each node it was possible to determine its relative potential for MAP spread.
Conclusion: This study identified connectivity between those premises most likely to facilitate the transmission of MAP via animal movements which was not apparent from either the laboratory records or AIMS databases. Thus SNA provides a novel approach to the development of risk-based surveillance for MAP and potentially for other veterinary disease prevention programs.

P15

SCHMALLENBERG: IS THERE EVIDENCE THAT THE VIRUS CONTINUES TO CIRCULATE?

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Problem Statement: Schmallenberg virus (SBV) was first identified in north-western Europe in 2011. The virus rapidly achieved a pan-European distribution resulting in an epidemic of ruminant abortions, congenital deformities and mild clinical signs in adult dairy cattle. Currently, there is limited research investigating whether SBV continues to circulate in previously infected regions. Therefore, the aim of this study was to investigate SBV circulation in dairy herds in 2013 and 2014 following initial exposure to the virus in 2012.
Methods: Blood samples were collected from 26 Irish dairy herds (herd size range: 58-444 lactating animals per herd) before the peak vector-active period in the spring (between 14 March and 5 April) and after the vector-active season in the autumn (between 1 November and 11 December) of 2014. In the spring, 5,527 individual animal blood samples were collected; from 4,047 [73%] cows and 1480 [27%] heifers (12-24 months age). In the autumn 2,444 individual animal blood samples were collected; from 1,519 [62%] spring-born weanlings (6-8 months old) and a subsample of the sero-negative animals identified in the spring (n = 925; 285 cows [12%] and 640 [26%] heifers). Serum samples were analysed for SBV-specific antibodies using a competitive ELISA (ID screen® Schmallenberg virus Competition Multi-species, ID Vet). Test sensitivity was 97.6% and specificity was 100%.
Results: In the spring of 2014, the animal-level seroprevalence was 61.1%. Sero-negative animals (38.0%) were predominantly 2013 spring-born heifers (97.4%) suggesting they were not exposed to SBV during 2013. Within-herd seroprevalence ranged widely (8.3% to 97.5%) in the 26 herds demonstrating individual herds had different levels of risk of new

infection during the 2014 vector-active season. In the autumn of 2014, a total of 2,382 (97.5%) animals were sero-negative, 38 (1.55%) animals were inconclusive and 24 (0.98%) animals tested positive for antibodies. Of weanlings, 1,491 [98%] were sero-negative, 19 [1.25%] were inconclusive and antibodies were detected in 9 [0.59%]. Of the 925 resampled spring sero-negative animals, 891 [96%] animals (268 [29%] cows and 623 [67%] heifers) remained sero-negative, 18 [2.05%] animals (7 cows and 11 heifers) were inconclusive and 15 [1.62%] animals (10 cows and 5 heifers) tested positive for SBV antibodies. The 24 seropositive animals (9 weanlings, 5 heifers and 10 cows) identified in the autumn sampling originated in 14 different herds and the number of seropositive animals in seropositive herds ranged from 1 to 3 animals [0.5-2.8%].
Conclusion: These findings are inconsistent with SBV transmission characteristics and arbovirus epidemiology. Thus, we suggest that these are false-positive results. It is concluded that there was no evidence of SBV circulation in 2013 and 2014 in these Irish herds. However, a large population of naïve animals, weanlings and heifers in particular, was identified. These animals may be at risk of SBV infection in the 2015 and future vector-active seasons should the virus recirculate.

P16
A CASE REPORT OF CONGENITAL MICROENCEPHALY AND CEREBELLAR HYPOPLASIA ASSOCIATED WITH BVD-MD VIRUS IN ABORTED FETAL.
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Problem Statement: Failure of pregnancy in cow can occur with non-infectious and infectious agent. Reproductive losses are the most economically important result of BVDV infectionThe important virus are in cattle pestivirus (BVD virus) usually affected immature cell in CNS of fetus between 90 to 120 days of gestation and produce a similar spectrum of teratogenic lesion.According to the virus strain and the time of gestation at which the infection occurs, different reproductive manifestations could occur.Usually the frequency of viral cause of failure of pregnancy in cattle, especially those caused by BVD is probably underreported virusBVDV-1 and BVDV-2 may exist as two different biotypes, CP and NCP and are of varying pathogenicity from a pathogenic to highly pathogenic.
Methods: This case belong to a large herd of cattle around Tehran. We visited dairy cow with an abortion rate over 50%. One cases of this abortion were studied .serological and microbiological examination for diagnoses were done. Arthrogryposis was not seen in musculoskeletal .After removal calvarium cerebellum was virtually absent with cerebellar hypoplasia. There was no recognizable cerebellar cortex. Only brain stem, including pones and medulla oblongata were distinguishable. The main microscopic lesion were microencephaly and cerebellar hypoplasia. Many of different area in brain such as pones hippocampus, and specially cerebellum were absent. The cortical part of cerebellum was necrosis and most portion of cerebellar were replaced by an irregular cavity lined by thin wall consisting of neuropil. A mild non –suppurative encephalitis characterized by foci of perivascular cuffing with mononuclear cells predominantly lymphocyte was observed. Mild focal gliosis associated with acute neuronal necrosis were seen. Hyperemia, Multifocal hemorrhage and degenerating neurons can be found but any inclusion were not observed .the perivascular and perineuronal edema was severe. Other congenital defection like retinal dysplasia and renal dysplasia were not seen .There was no inflammatory reaction in eyes and optic nerve. historically BVD –MD disease was diagnosed in this farm with immunologic test (Elisa).For differentiated diagnosis tissue sample from fetus brain sent to microbiological lab .PCR test confirm the antigen of BVD –MD virus
Results: BVDV must infected the cow at the critical stage of pregnancy .The virus has a direct effect on the developing embryo as well as on the uterus Pregnant dam persistently or acutely infected with BVDV shows viremia, which is the source of the virus that replicates in the placenta and later infects the fetus..Central nervous system malformations such as microencephaly, cerebellar hypoplasia, hydranencephaly, hydrocephalus, hypomyelinogenesis and hypomyelination are common lesion. Immunohistochemistry on formalin-fixed paraffin-embedded (FFPE) sections using monoclonal antibody 15C5 is a sensitive and specific method for diagnosis.
Conclusion: Infection with BVDV results in a wide variety of clinical presentations in cattle, including abortion, congenital defects, persistent infection and diarrhea. There are seldom macroscopic and microscopic lesions of BVD virus infection in the fetus and placenta.Animal that has had BVDV isolated from serum on two separate occasions at least 3 weeks apart is considered persistently infected (PI) with BVDV. which are the major source of viral transmission within a farm and between farms
of Interest: None Declared

P17
EMERGENCE OF EXTENDED-SPECTRUM BETA-LACTAMASE (ESBL) CTX-M-TYPE-PRODUCING ESCHERICHIA COLI IN DRY COWS, BRAZIL
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Problem Statement: In the last years, extended-spectrum beta-lactamase (CTX-M-type)-producing bacteria have become frequently isolated from livestock, which is public health issue worldwide. In this study, we report for the first time, the occurrence of CTX-M-producing E. coli in in dry cows, highlighting a new reservoir of ESBL producers.
Methods: During a local surveillance study established to monitor the occurrence of broad-spectrum cephalosporin Enterobacteriaceae in food-producing animals, 25 ESBL positive E. coli strains were recovered from fecal samples collected from 30 cows during dry period, in a Dairy Farm in São Paulo, Brazil. The fecal samples were cultured on MacConkey agar supplemented with Enrofloxacin (1 µg/mL) or Ceftiofur (1 µg/mL) to select resistant isolates. The antimicrobial susceptibility profile was evaluated by Kirby-Bauer method and ESBL screening was performed by using double-disk synergy test and ESBL E-Test® strips. The presence of ESBL genes was investigated by PCR technique. Species identification was performed by MALDI-TOF Mass Spectrometry and E. coli phylogroups were determined by the Clermont typing method. The 25 ESBL-producing E. coli strains harbored blaCTX-M-type ESBL genes.
Results: Among these isolates, 60% (n= 15) carried blaCTX-M-15 genes and 36% (n= 9) carried blaCTX-M-1 genes. Regarding E. coli phylogroups, 20% of the strains (n= 5) belonged to the low-virulence phylogroup A, 32% (n= 8) belonged to an unknow group, and 48% (n= 12) belonged to the low-virulence phylogroup group B1.
Conclusion: In summary, we hereby report a high prevalence of CTX-M-type-producing E. coli in cows during dry period, which is a worse prospect, since this ESBL variants have been widely identified from human and animals, being associated with difficult-to-treat infections. Most likely, overuse of broad-spectrum cephalosporins in lactating dairy cattle can be contributing for the selection of silent carriers of acquired resistance genes, among commensal *E. coli*.

P18
MORE TESTING, LESS ANTIBIOTICS−FUTURE TRENDS IN MASTITIS TREATMENT?
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Problem Statement: Knowledge on the bacteriological etiology of mastitis is important for efficient mastitis control and treatment. In Finland, milk samples are tested for bacteria in most mastitis cases. Since 2010, the majority of samples have been analyzed using a quantitative polymerase chain reaction (PCR) test (PathoProofTM Mastitis PCR Assay, Thermo Fisher Scientific, Finland). The test targets the DNA of 15 bacterial species or groups of species and the staphylococcal *bla*Z gene coding for penicillin resistance mediated by beta-lactamase production.
Methods: We analyzed bacteriological data consisting of 240,069 quarter milk samples sent to Valio Laboratory in 2010−2012. The number of milk

samples increased annually along with the introduction of the PCR test. The milk samples were taken from 93,530 individual dairy cows on 4,725 dairy farms. The data containing records of analyzed milk samples were merged with the data from the Finnish dairy herd recording system. In addition to production data, this system includes information on veterinary treatments and culling of cows. Descriptive statistical analyses were implemented to describe the results of PCR tests and possible differences in the treatment history of cows with diverse findings from their milk samples. This study focuses on treatments associated with the findings of *Staphylococcus (S.) aureus* and coagulase-negative staphylococci (CNS) in milk samples.
Results: Staphylococci were the most common findings in the PCR-tested milk samples. CNS were detected in 46% and *S. aureus* in 20% of the samples. The shares of the next frequent bacteria (*Streptococcus uberis, Streptococcus dysgalactiae, Corynebacterium bovis*) were less than 10%. 34% of the samples positive for *S. aureus* were also positive for the *blaZ* gene. Among the samples with CNS, the share was 31%. An *S. aureus* finding in the milk sample resulted in veterinary treatment more often than a CNS one. Cows with penicillin-susceptible *S. aureus* were treated more frequently than cows with penicillin-resistant *S. aureus* but, in contrast, cows with penicillin-susceptible CNS were treated less frequently than cows with penicillin-resistant CNS. If the finding of *S. aureus* or CNS was penicillin-resistant, there were more repeated treatments than in the case of penicillin-susceptible findings. Cows with *S. aureus* were culled from the herd more often than cows with CNS and, in both cases, the positive *blaZ* gene finding resulted more often in culling than the negative finding. Correspondingly, mastitis was the culling reason more frequently with the *S. aureus* and *blaZ* gene positive finding.
Conclusion: Testing the samples of mastitic milk provides valuable information for dairy farmers' decision-making. *S. aureus* mastitis is treated more frequently than CNS mastitis that is often subclinical or mild clinical. Penicillin-resistant *S. aureus* and CNS seem to cause repeated treatments as the cure rates of mastitis caused by penicillin-resistant staphylococci are inferior compared to those of penicillin-susceptible staphylococci. It is recommended to cull cows with chronic *S. aureus* mastitis and, indeed, it seems that dairy producers follow this recommendation as well as that of culling cows with penicillin-resistant staphylococci. Hence, they also promote the goal of reducing the use of antibiotics.

P19
EFFECT OF SOMATIC CELL COUNT ON COMPOSITION OF CATTLE MILK
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Problem Statement: The somatic cell count (SCC) is commonly used as a measure of udder health and milk quality. Thus, to determine the milk quality standards in many countries, SCC determined as an indicator of somatic cell count for raw milk and for the level of payments to milk producers.
Methods: The present study investigated the effects of somatic cell count on milk composition in a Holstein population, reared in Turkiye. Fat %, SNF %, density, prot %, freeze point, temperature, lactose %, conducdivity, pH were examined as milk composition traits. Data consisted of second lactation records of Holstein cows calving from 2013 to 2014. Every cow is assigned to one of the five SCC groups; group 1 is corresponding with a SCC <50.000 cells/ml, group 2 is corresponding with a SCC between 50.000-200.000, group 3 is corresponding with a SCC between 200.000-500.000 cells/ml, group 4 is corresponding with a SCC between 500.000 and 1.000.000 cells/ml and group 5 is corresponding with a SCC >1.000.000 cells/ml.
Results: Results showed that, SCC signifcantly affects fat %, SNF %, density, freeze point, temperature, lactose %, conducdivity and pH parameters. On the other hand, effect of SCC was not observed on SNF % and protein % parameters.
Conclusion: These findings suggest that SCC has important effects on some of the milk composition parameters.

P20
EFFECT OF INTRAMAMMARY INFUSION OF RECOMBINANT BOVINE GM-CSF PRODUCED IN TRANSGENIC SILKWORM AT DRYING-OFF ON MAMMARY GLAND INVOLUTION IN DAIRY COWS.
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Problem Statement: Dry cow therapy, administered at the end of lactation, is aimed at eliminating current and preventing future intramammary bacterial infections and typically involves intramammary administration of antibiotics. However, the antimicrobial therapy of bacterial infection has a risk of developing antimicrobial resistant bacteria. As a result, interest has shifted from the more conventional antibiotic therapies towards the field of immunological control of the disease.
Although the intramammary infusion of recombinant bovine granulocyte-macrophage colony-stimulating factor (rbGM-CSF) produced in transgenic silkworm in a lactation period has a high potential as a therapeutic agent for mastitis of dairy cows, the contribution of rbGM-CSF as a dry cow treatment remains unclear. The objective of this study was to investigate the effect for treatment or prevention of bovine mastitis of the intramammary infusion of rbGM-CSF produced in transgenic silkworm as a dry cow therapy.
Methods: For this experiment, five Holstein dairy cows with naturally mastitis and 4 healthy cows in late lactation were used. As the treatment trial, one of the quarter with bacterial infection of each mastitic cow were assigned at drying-off to an intramammary infusion of rbGM-CSF (400 µg/5 ml/quarter) solutions. As the preventive trial, one of the predetermined healthy quarter were also assigned. The rbGM-CSF was produced in transgenic silkworm. Each quarter milk samples were collected at dry-off and at 0, 7, 14, 21 and 28 days after calving for bacteriological examination, California mastitis test and somatic cell count (SCC). Blood samples were collected at 0, 1, 2, 3 and 7 days after drying-off and at 0, 7, 14, 21 and 28 days after calving for determining concentrations of blood cell counts and biochemical markers. In order to determine the efficacy of intramammary infusion of rbGM-CSF at drying-off, these parameters in milk and blood at dry-off and after calving were analyzed.
Results: None of the cows showed any abnormal clinical signs or any visible local reactions in the areas infused with rbGM-CSF. In both trials, rectal temperature, total leukocyte count and the biochemical marker were little affected by the infusion of rbGM-CSF.
In the treatment trial, the bacterial examination revealed that the causes of mastitis of late-lactating were *Staphylococcus aureus* and coagulase-negative staphylococci. Total bacterial counts in milk was significantly lower at 0, 7, 14 and 28 days ($2.3\pm0.7 \times 10^2$, $3.2\pm3.2 \times 10^3$, $1.1\pm1.1 \times 10^3$, $6.4\pm6.4 \times 10^2$ cfu/mL, not detectable; $p<0.01$, respectively) after calving than at dry-off ($8.2\pm1.9 \times 10^3$ cfu/mL). SCC was followed by a smooth decline at 0, 7, 14 and 28 days after calving. In the prevention trial, the new intramammary infection of all cows was not detected at 0, 7 and 14 days after calving.
Conclusion: Infusion of rbGM-CSF into mammary glands at commencement of dry period was associated with reduction in the number of preexisting bacterial pathogens and less new intramammary infections after calving. The results suggest that the intramammary infusion of rbGM-CSF produced in transgenic silkworm at drying off has a high potential as an agent of dry cow therapy.

P21

THE EFFECT OF SUPPORTIVE E. COLI MASTITIS TREATMENT ON BLOOD ANTIOXIDANT STATUS

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Problem Statement: Mastitic cows are characterized by intensified free radical reactions related to the ongoing inflammatory process. The consequence of this is disturbed prooxidant - antioxidant balance.
The aim of this field study was to assess the impact of a single *i.m.* injection of lysozyme dimer and flunixin meglumine in combination with intramammary and systemic antibiotic on blood antioxidant status of cows with E. coli mastitis.
Methods: Examinations were performed on 30 dairy cows affected with naturally occurring acute form of *E. coli* mastitis. Cows were randomly divided into three groups according to the method of treatment. The first group was treated with approved intramammary antibiotic product, the same antibiotic in *i.m.* injection and one injection of flunixin meglumine on the first day of therapy. Next group was treated with the same antibiotic and additionally one injection of lysozyme dimer on the first day of therapy. The third one was treated only with an antibiotic and served as a control group. Blood samples were taken before treatment and on days 3 and 7. In samples GPX, SOD, CAT activity were determined, TAS, MDA measurements were performed and nonenzymatic antioxidants (uric acid, cholesterol, albumin, bilirubin) were assayed. Two-factorial ANOVA was performed to evaluate the effect of supportive treatment and sampling time from Statistica v.6.0. by StatSoft ® Poland.
Results: A single injection of flunixin meglumine or lysozyme dimer on the day of the beginning of treatment of *E. coli* mastitis, does not affect on the antioxidant status of blood in the analysed period of time.
Conclusion: The supportive treatment in the form of a single injection of the above-mentioned drugs did not fulfil the assumptions.

P22

POSSIBLE INVOLVEMENT OF NEUTROPHIL ELASTASE AND INFLAMMATORY LACTOFERRIN-DERIVED PEPTIDES IN THE DEVELOPMENT OF BOVINE MASTITIS INDUCED BY INTRAMAMMARY INFUSION OF STAPHYLOCOCCUS AUREUS IN THE EARLY DRY PERIOD

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Problem Statement: CXCL8, a mediator of the recruitment and activation of neutrophils, is involved in the development of *Staphylococcus aureus* (SA) mastitis. Activated neutrophils release lactoferrin and elastase. Neutrophil elastase digests lactoferrin, thereby producing various peptides. Lactoferrin-derived peptides (LDP) containing the GQRDLLFKDSL sequence, such as 22- and 23-kDa LDP, induce CXCL8 expression in bovine mammary epithelial cells. However, changes in neutrophil elastase activity and in concentrations of 22- and 23-kDa LDP in bovine mammary secretions have not been extensively investigated in mastitis. To understand the inflammatory process of SA bovine mastitis, we examined the changes in neutrophil elastase activity and LDP and CXCL8 concentrations in mammary secretions during the dry-period in bovine mastitis induced by intramammary infusion of SA.
Methods: Four cows at dry-off were inoculated with SA (65-80 colony forming units) suspended in sterile saline, which was infused in a front teat cistern, while sterile saline alone was infused into another front teat cistern. Following the challenge with SA, mammary secretions were collected at various time points. In the mammary secretions, SA counts, polymorphonuclear leukocyte (PMNL) counts, concentrations of CXCL8 and 22- and 23-kDa LDP were determined, and neutrophil elastase activity was evaluated. Immediately after the final sampling (18–39 days post inoculation), mammary tissues were collected and subjected to pathological examination.
Results: The study showed the following:
(1) In the period from 1 day post infusion to the final sampling time point, SA was recovered from all of the udders infused with SA, and PMNL counts were increased in the mammary secretions. Significant increases in CXCL8 and 22- and 23-kDa LDP concentrations were observed from 3 or 6 days post infusion to the final sampling time point. Mastitis was found to be in the sub-acute or chronic phase, as determined by the pathological examination of the mammary tissues. (2) Changes in PMNL counts in the mammary secretions from the udders infused with saline alone were similar to those observed in the mammary secretions obtained during the normal dry period. In the mammary secretions, neutrophil elastase activity, CXCL8, and 22- and 23-kDa LDP were not detected and there was no indication of intramammary infection.
Conclusion: Neutrophil elastase and 22- and 23-kDa LDP might be involved in the prolonged secretion of CXCL8 in mastitic mammary glands and in the development of SA mastitis.

P23

LISTERIA MONOCYTOGENES IN BULK TANK MILK AND ITS BEHAVIOUR DURING THE CHEESE MAKING

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Problem Statement: *Listeria monocytogenes* is one of the main pathogen considered as a microbiological hazard associated with raw milk and its dairy products. Aim of this work is to describe a case of natural contamination by *L. monocytogenes* of raw milk and to assess the behaviour of *L. monocytogenes* during the cheese making and ripening (60 days) from two batches of contaminated milk.
Methods: Bulk tank milk (BTM) from 258 on 1,500 (17.2%) dairy herds in province of Brescia – Lombardy Region, Italy – was examined for the presence of foodborne pathogens.
In particular, *Listeria monocytogenes* was detected by Real-Time PCR (iQ-*Check Listeria monocytogenes II* (Biorad®) and confirmed by microbiological test (ISO 11290-1: 1999/Amd 1:2004).In order to assess the behaviour of *L. monocytogenes* during the cheese making and ripening, two batches of naturally contaminated milk (25 L milk/batch) were used. Milk, curd and cheese samples were evaluated for the presence of the pathogen, lactic acid bacteria (LAB) levels, pH and aw values. The temperature during the cheese making was registered by a data logger. All analyses were carried out in triplicate.
Results: Real-Time PCR detected *L. monocytogenes* in 7 milk samples (2.7%), 3 of which confirmed by microbiology (1.2%).
The follow up performed on three positive farms always showed *L. monocytogenes* from a quarter milk sample of a single cow as source of whole milk contamination. Neither general symptoms nor macroscopical abnormalities in milk were observed. One carrier asymptomatic cow, shedding 10^3 CFU/ml, was able to contaminate the BTM (e.g. 260 dairy cows for 65 q/die).
Swabs from milking equipment and milk tank resulted always negative to the bacteriological tests. In two farms *Listeria gray* was detected in the maize feed as index of ideal microclimate conditions for the presence of Listeria spp.
Bulk tank milk became negative after the removal or the antibiotic treatment of the affected cow.
Regarding to the behaviour of *L. monocytogens* during the manufacture of four cheeses, the LAB increased from 6.7 to 9 log CFU/g in the first four days. This increase in LAB levels generated a slight acidification of the cheese. An increase in the concentration of *L. monocytogenes* level from 3.5 to 5.7 log CFU/g was observed during the first days of ripening. Then, the growth of the pathogen stunted until the end of the ripening period. The results show that LAB are able to induce an early stationary state in

L. monocytogenes and its growth is inhibited when LAB reached a critical density (Jameson effect).
Conclusion: The source of *L. monocytogenes* was always identified in infected animals. Antibiotic therapy or the removal of the positive animal, hygienic improvement of milk production and the Good Manufacturing Practices applied to the feed production eliminated the bacteriological contamination of milk.
Considering that the cheese making procedure in case of raw milk didn't guarantee the elimination of the pathogen but only its growth inhibition, the *L. monocytogenes* concentration in milk should not exceed 1CFU/ml to produce raw milk cheese ripened for 60 days or less.
The risk analysis has also to consider the low contamination of raw milk by *L. monocytogenes*, because of an asymptomatic shedder dairy cow.

P24
THE TENDENCY TO USE CROSSBREEDING IN DAIRY FARM IS STRENGTHEN
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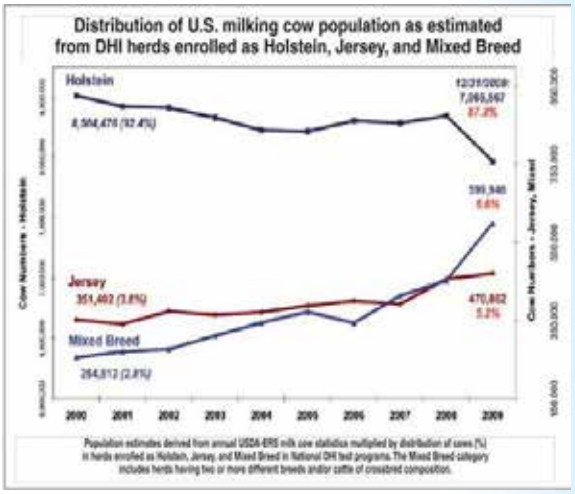
The demand for dairy cows that are healthier, with more fertility, smaller animals, with higher milk and protein, is increasingly growing around the world. Animals welfare is one of the high lite topic.Approximately 85% of the cows in intensive dairy farming are of the Holstein breed which were breeds in recent decades for higher milk yield and whose immune system has consequently suffered due to lines becoming too inbreeding. Several studies have been published in the last 10 years regarding cross X Hol clearly showed that a breeding program with crossbreeding (with the rights breeds) would increase the fertility, health and profitability of each cow and each liter of milk. According to data published on the www.nabb-css.org site - which holds official data regarding sale of using semen in the USA, between 2010-2014. By breeds - sales of non-Holstein milking breeds are up 46% compared +6% in sales of Holstein semen. Among the breeds, the increased use of the NRF semen from Norway is particularly notable. It has raised from about 20,000 units in 2010, up to 100,000 units in 2014, an increase of 400%.

breed	2010	2014	2010-2014
HOL	19,471,182	20,305,131	+4%
Red Holstein	223,413	561,306	+151%
Total HOL	19,694,595	20,866,437	+6%
JE	1,985,998	2,983,295	+50%
BS	125,162	104,754	-16%
NRF	19,450	98,169	+405%
SRB	32,024	22,861	-29%
MON	34,988	29,735	-15%
Non HOL	2,111,160	3,088,049	+46%

The reason for this figure can be successful due to the USDA data publication, which showed the NRF breed with highest fertility results as well as high milk yield and high protein content. It should be noted that an extremely large farm in Idaho (6,000 cows) has recently published its Feed efficiency and profitability results and clearly show that the profit from a crossbreed cows was $0.95 per day higher than pure Holstein.



Results from two farms in Israel that work more than 10 years with Twoplus crossbreeding program vs. farms in same geographic zone and same feeding centre that have pure Holstein.
Officially report source: NOA (ICBA farm management program-ISRAEL)

	LEAL farm Golan Highest	Family farmers in the geographic zone	
No of cows	197	7,000 ~	
% cross	95%	2%	
Milk liter *per/cow/day	29.2	27.3	+1.9
Fat %	3.78	3.73	+0.05
Prot %	3.46	3.34	+0.12
ECM liter*	31.8	28.4	+3.4
	Klien Farm Seacoast	**Family farmers in the geographic zone**	
No of cows	171	8,000~	
% cross	100%	2%	
Milk liter *per/cow/day	29.4	25.9	+3.5
Fat %	3.83	3.75	+0.08
Prot %	3.43	3.36	+0.07
ECM liter*	32.0	27.7	+4.3

* include dry cows
* Israel ECM =0.1x milk lt. +9.7 fat kg +18.01 protein kg

According to information presented in ICBA site, 2,660 NRF daughters, yield, in first lactation, 11,875 Kg adjusted ECM, with 0.06% more protein than Holsteins. Research in Israel clearly, shows a 28% reduction after calving diseases, a significant improvement in the BCS, and a clear decrease in abortions. Cross breeding must be part of any genetic program that Acceptable without contestation in each the branches of the agriculture (beef cattle, sheep & goats, swine, vegetables …

PUBLICATION ONLY

PL01

UNVEILING THE ECONOMIC COSTS OF THE ENVIRONMENTAL IMPACT AND THE WATER FOOTPRINT OF THE HOLSTEIN INTENSIVE PRODUCTION SYSTEM IN THE ARID LANDS OF NORTHERN MEXICO

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Problem Statement: The dairy cattle industry (DCI) is one of the main users of land in Latin America. Although the DCI is a productive activity which impacts in a direct fashion both food production and income generation, it also promotes noxious effects, being the environmental, one of the core factors generating such adverse effects. Besides, DCI promotes deforestation, desertification, soil degradation, landscape fragmentation while decreases biodiversity. This study aimed to evaluate the cost of both the environmental and economic impacts produced by the emission of Greenhouse Gas (GHG) and the Water Footprint (WFP) generated by the DCI in the arid lands of Northern Mexico.
Methods: This study was performed in the Comarca Lagunera (CL), located between 102° 22' & 104° 47' LO, 24° 22' & 26° 23' LN. During the last 60 years, the CL has shown a significant growth of the DCI, placing to this region as one of the most important dairy cow areas not only in Mexico but Latin America. The environmental impact of the DCI can be assessed throughout quantification of methane (CH4) emissions, enteric fermentation, and excretion of nitric oxide (N2O) both in feces and urine. In addition to that, indirect emissions from the DCI are also dependent on feces excretion As well as forage and grain crops production for animal consumption. Quantifications of GHG emissions considered those proposed by the IPCC. Besides, the WFP quantified the use of either blue, gray & green water by the DCI and related activities. Economic cost (EC) quantification considered an international average price of water.
Results: According to the SIAP, 2014, the CL registered a dairy cow inventory greater than 440,000 heads, with 242,000 lactating cows, a production of 2,260 million liters per year, with a correspondent economic value (EV) of €867 million. Yet, the climatic conditions of the area include high environmental temperatures and solar radiation in summer while a quite low annual rainfall average (< 220 mm). Therefore, water availability is very limited, resulting in high levels of groundwater extraction through more than 2,200 deep water wheels mainly to support the DCI; such water extraction has generated a significant groundwater deficit, since the extracted volume exceeds its recharge. The WFP from the DCI is the second largest, just behind beef production. However, if we confront the DCI-EV with respect to the EC generated by the GHG emissions (€ 115 million) plus the DCI-WFP-EC (€ 13,137 million) it can be unveiled not only the noteworthy environmental impact but also the significant and senseless biological and economic costs.
Conclusion: It is imperative to define mitigation strategies to promote an optimum use of water, a fundamental resource for the sustainability of the CL, located in an extreme arid environment. If such negligent while irresponsible scenario remains, it will jeopardize not only the DCI, but even more critical, the biologic, economic and social viability of the Comarca Lagunera.

PL02

DOES TARGETED PREPARTUM SUPPLEMENTATION OF VITAMINS AND MINERALS AFFECT POSTPARTUM OVARIAN ACTIVITY AND SERUM CHOLESTEROL AND PROGESTERONE CONCENTRATIONS IN HOLSTEIN COWS?

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Problem Statement: There is a generally accepted idea that dietary supply and ruminal synthesis of hydrosoluble vitamins are adequate to meet dairy cow requirements. Yet, under some physiological scenarios, fertility has been enhanced by supplementing dietary Se and vitamin E. Besides, during the peri-partum period, both vitamins and minerals play a central role in the prevention of diseases which may impact, in a negative fashion, the subsequent fertility of dairy cows. The possible effects of extra daily dietary supplementation of vitamins and minerals to dairy cows around calving upon resumption of postpartum ovarian activity and on serum concentrations of cholesterol (CHOL) and progesterone (P4) were evaluated.
Methods: Adult pregnant dairy cows (n=30, 3.5 body condition score) from a large dairy farm in northern Mexico (25.6º N, 103º W, 1,120 m) facing a severe environmental heat stress (April-July: Tmax-avg: 36.8°C), were randomly assigned to one of two treatments: Mineral and vitamin supplemented group (MVSG, n=15, 13.3 g cow^{-1} d^{-1}) and Non-supplemented group (CONT, n=15). The supplementation period considered 3-weeks prepartum until calving; while the MVSG-cows received a multi-vitamin and mineral product dissolved in drinking water (200 g per 1000 L), the CONT-cows had free access to untreated water. Each 100 g of the experimental product contained: 0.5 g of ciproheptadine, 12.5 g of nicotinamide, 6.7 g of calcium pantotenathe, 5,000,000 U.I. of Vitamin A, 0.75 g of thiamine, 2.0 g of rivoblavin, 1.75 g of piridoxin, 0.005 g of cianocobalamin, 500,000 IU of vitamin D, 5,000 UI of vitamin E, 2 g of vitamin K, 2.5 g of calcium gluconate, potassium chloride and traces of Mg, Mn, Zn, Cu and Co. In order to quantify serum CHOL and P4 concentrations, blood samples were collected at both onset-end of the dry period, at calving and every two weeks until d-45 postpartum. In addition, estrus and ovarian activity were also registered.
Results: While increased concentrations of serum CHOL ($P<0.05$) occurred in the MVSG-cows (196 vs 145 mg dL^{-1}), serum P4 levels did not differ between groups (2.99 vs 2.45 ng mL^{-1}; $P>0.05$). Yet, the proportion of cows showing ovarian activity was greater in the MVSG-cows ($P<0.05$; 85.7 vs. 61.5%). Resumption of pospartum ovarian activity in dairy cows depends on several factors, among which energy balance is fundamental. Results suggest that high serum CHOL levels at parturition may had promoted an increased percentage of the MVSG-cows depicting an earlier ovarian activity. Daily supplementation of vitamins and minerals throughout the dry period not only increased serum cholesterol but also generated a higher proportion of cows depicting ovarian activity at 45 d postpartum.
Conclusion: Dairy cow producers can benefit from the daily supplementation of vitamins and minerals of their cows, independently of dietary energy intake during the dry period. Nonetheless, the specific mechanistic and physiologic actions of such supplementation remains to be solved.

PL03

EVALUATION OF INSECT GROWTH REGULATOR ON FLY CONTROL AND ANIMAL WELFARE

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Problem Statement: Flies are and economic and welfare concern in dairy farms. Most fly control programs focused on adult fly. However, adults' flies are the tip of the iceberg. The remaining 85% is hidden away as eggs, maggots and pupae. Insect growth regulators (IGR´s), interfer with the moulting processes of the maggot preventing it developing into an adult. The objective of this study was to evaluate IGR diflubenzuron on fly control and animal welfare.
Methods: From September 2014 to February 2015, ten dairy farms were assigned to five blocks by herd size, geographic location and production system. On treated dairy farms, 0.10 mg diflubenzuron/kg/BW/day (Ambiflud Benzuron, Vetanco S.A., Argentina) was added to vitamin and

mineral premix and was provided during the study in combination with pour-on formulation. Dairy farms in the control group, received only adulticides pour-on formulations. Weekly monitoring of flies per side was performed in twenty cows per herd according to DeRouen et al., 2009. Weekly evaluation of milking behavior including frequencies of steps, lifts and kicks per minute and kicks-off per milking (cow kicks the milking cluster off the udder), was recorded in twenty cows per herd according to Medrano-Galarza et al., 2012. Flies per side counts, were analyzed using linear least squares procedure models. Frequencies of steps, lifts and kicks per minute and kicks-off per milking, were analyzed by a general linear model.
Results: The average number of adult flies per side for treated group was 25 flies/side, whereas the control group averaged 250 flies/side. The accepted economic threshold of 50 flies/side (Foil et al., 1994), was exceeded in the control group. The reduction in fly populations for the treated group in comparison with the control group was 90% ($P < 0.01$). For all behavioral variables, significant differences between the treated and control group were found. The control group had a higher mean frequency of steps (8.20 ± 1.67 vs. 2.10 ± 0.83 steps/minute), lifts (3.18 ± 0.97 vs. 1.40 ± 0.49 lifts/minute), kicks (3.78 ± 0.81 vs. 0.20 ± 0.40 kicks/minute) and kicks-off (1.70 ± 0.78 vs. 0.10 ± 0.30 kicks-off/milking), compared with the treated group ($P < 0.01$) during the entire observation period.
Conclusion: The current study demonstrated that the use of larvicide in combination with adulticide, is effective in reducing the fly populations to levels that remain below the threshold of economic threat. The reduction in avoidance behaviors in treated animals, improve the comfort and welfare of milking cows. Increasing intensification of milk production systems in Argentina, will further increase fly populations. Therefore, the use of combination treatment with IGR and adulticide is a practical option to reduce the fly populations. Dairy integrated pest management for fly control must rely on accurate identification, monitoring and combination of cultural and chemical control strategies.

PL04

IMPLICATIONS OF OMITTING TEAT PREPARATION ON BACTERIAL LEVELS IN BULK TANK MILK

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Problem Statement: It is a common practise on seasonal farms in Ireland to omit teat preparation entirely prior to cluster application and this may have implications for bacterial levels in milk and new infection rates. The objective of this experiment was to investigate the effect of omitting teat preparation prior to milking on bacterial levels in milk directly after milking and after a period of milk storage.
Methods: Eighty Holstein-Friesian dairy cows from the Moorepark Research Farm (Fermoy, Co Cork, Ireland) were assigned to two pre-milking teat preparation treatments; (i) washing of teats, drawing of foremilk, application of an iodine-based disinfectant followed by drying with paper towels, (ii) no teat preparation. All cows were managed as one herd outdoors on pasture for the duration of the study (220 days). Individual cow measurements included; individual quarter somatic cell count (SCC) and teat swabs for the presence of Bacillus cereus. On seven occasions all milk produced over a 24 h period from each treatment group was segregated into a separate bulk milk tank and sampled. Sub-samples of this milk were stored at 4 °C for 0, 24, 48 and 72 h and the milk analysed for total bacterial count (TBC), thermoduric bacterial count, and presence of B. cereus and sulphite-reducing Clostridia (SRC). The analysis of the data was carried out with linear models (SAS, 2011) with log transformation as appropriate.
Results: Individual quarter SCC tended to be higher for unprepared teats (159,000 cells/mL) compared with prepared teats (133,000 cells/mL; $P<0.09$). A similar trend was observed for bulk tank SCC with the unprepared teat treatment tending to have a higher SCC (156,000 cells/mL) compared to the prepared teat treatment (102,000 cells/mL; $P<0.09$). The number of clinical and sub-clinical cases of mastitis did not differ between treatments. Staphylococcus aureus was the single most common contagious pathogen isolated from both clinical and subclinical cases.
The TBC was not significantly different between milks from unprepared teats (3,152 cfu/mL) compared with milk from prepared teats (1,678 cfu/mL) ($P=0.10$). TBC levels doubled from 48 to 72 h and were three times higher compared to the initial counts regardless of treatment. While TBC levels were significantly higher at 72 h compared with 0, 24 and 48 h ($P<0.01$), they were well within the EU regulatory limit of 100,000 cfu/mL (EEC, 1992) and the processor limit of 50,000 cfu/mL required in Ireland and differences observed between treatments were not considered biologically important. The thermoduric bacterial count in milk was higher when teat preparation was omitted ($P<0.01$) and this effect was also observed after 72 h storage ($P<0.05$). However, counts were not biologically important as the thermoduric levels reported in this study were well within the limits considered satisfactory for good quality milk. B. cereus and SRC in milk samples did not differ between treatments. However, unprepared teats had significantly higher colony counts of B. cereus present on teat skin ($P<0.001$).
Conclusion: The results of this study indicate that, in an outdoor grazing situation where good equipment hygiene is implemented; the omission of pre-milking teat preparation has a minimal effect on milk quality. However, these results may not extrapolate to the early spring period where cows spend a greater proportion of time in a housed environment.

Notes

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