



**ICAR**  
2023  
TOLEDO  
**SPAIN**  
22<sup>nd</sup> to 26<sup>th</sup> May 2023



Breeding for resilience:  
transitioning diverse livestock farming systems into the future

**PROGRAM**



## Join us in Toledo for the 2023 ICAR Conference

May 21<sup>st</sup> to May 26<sup>th</sup>, 2023

**“BREEDING FOR RESILIENCE: TRANSITIONING DIVERSE LIVESTOCK FARMING SYSTEMS INTO THE FUTURE”**

We invite you to visit the Program and Call for Abstracts pages for more details. The Royal Spanish Federation of Purebred Associations (RFEAGAS), is honoured to be your host for the 2023 ICAR Conference. This world-class event will be held in the old and historical city of Toledo, in the region of Castilla La Mancha in Spain. Toledo is 1h south from Madrid and can be reached by bus, train or car. We provide all the information needed to move from the airport to the hotels in Toledo on the Information tab.

It will be a unique opportunity to share our expertise, connect with international collaborators and transform animal production by linking science, data and farming practices.

We invite you to join us and we can't wait to see you in person!

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Autonomous University of Barcelona (UAB)

# PROGRAM

Wednesday 24<sup>th</sup> May 2023

08:30 AUDITORIUM  
GENERAL ASSEMBLY

10:00 – 10:30 COFFEE BREAK

10:30 AUDITORIUM  
PLENARY SESSION  
Chair: **Clara Díaz**

**THE DIVERSITY OF SPANISH PRODUCTIONS SYSTEMS**

**Pablo Bernardos**

*Ministry of Agriculture, Fisheries and Food*

**RESILIENCE: FROM SCIENCE TO THE LIVESTOCK INDUSTRY**

**Nicholas Friggens<sup>1</sup> and Peter Amer<sup>2</sup>**

*<sup>1</sup>AgroParis Tech, <sup>2</sup>Abacus Bio.*

13:00 – 14:00 LUNCH

14:00 AUDITORIUM  
MANUFACTURERS' SHOWCAS.  
Chair: **Steven Sievert**

14:00 ROOM B  
SESSION 13: BREED ASSOCIATIONS & QUALITY CERTIFICATION  
Chairs: **Suzanne Harding and Juho Kyntäjä**

S13.O-01

**VALUING THE CERTIFICATE OF QUALITY AT HOLSTEIN UK**

Darren Todd

*Holstein UK, Telford, United Kingdom.*

S13.O-02

**THE USEFULNESS OF THE COQ FOR A LOCAL BEEF CATTLE BREED: THE CASE OF AVILEÑA-NEGRA IBÉRICA.**

M. Mar González<sup>1</sup>, Javier López-Cordero<sup>1</sup>, Cristina Meneses<sup>2</sup>, Clara Díaz<sup>2</sup>, Pedro L. Herraiz<sup>1</sup>.

<sup>1</sup>RAEANI, Ávila, Spain; <sup>2</sup>INIA, CSIC, Madrid, Spain.

S13.O-03

**“WE ARE WHAT WE REPEATEDLY DO” THE EXPERIENCE OF ASSAF BREEDERS ASSOCIATION WITH ICAR CERTIFICATION OF QUALITY**

Fernando Freire Fernández<sup>1</sup>, Noelia Domínguez Merino<sup>1</sup>, Laura Casas Álvarez<sup>1</sup>, María Ángeles Jimenez Hernando<sup>2</sup>, Tarsicio Merino Barby<sup>3</sup>.

<sup>1</sup>ASSAFE, Toro, Spain; <sup>2</sup>INIA-CSIC, Madrid, Spain; <sup>3</sup>Almanor, Madrid, Spain.

S13.O-04

**SPANISH DAIRY SHEEP BREED ASSOCIATIONS WERE GRANTED WITH THE ICAR CERTIFICATE OF QUALITY**

Jean-Michel Astruc<sup>1</sup>, Fernando Freire<sup>2</sup>, Roberto Gallego<sup>3</sup>, Teodoro Lopez<sup>4</sup>, Lourdes Mintegi<sup>5</sup>, Elena Couto<sup>6</sup>, Fernando Tejerina<sup>7</sup>, Clara Diaz<sup>8</sup>.

<sup>1</sup>IDELE, Toulouse, France; <sup>2</sup>ASSAFE, Zamora, Spain; <sup>3</sup>AGRAMA, Albacete, Spain; <sup>4</sup>ANCHE, Palencia, Spain; <sup>5</sup>CONFELAC, Vitoria - Arkaute, Spain; <sup>6</sup>ICAR, Utrecht, Netherlands; <sup>7</sup>Ministry of Agriculture, Madrid, Spain; <sup>8</sup>INIA-CSIS, Madrid, Spain.

S13.O-05

**AUDITING FIVE SPANISH BEEF CATTLE BREEDERS’ ASSOCIATIONS FOR THE ICAR CERTIFICATE OF QUALITY; EXPERIENCES OF AN AUDITOR.**

Japie Van Der Westhuizen.

SA Stud Book, Pretoria, South Africa.

**14:00** ROOM C1

**SESSION 7: LATEST TOOLS USING MIR-SPECTRA IN THE ICAR WORL.**

Chairs: **Christian F. Baumgartner** and **Aser García González**

S07.O-01

**INFRARED MODELS FOR THE PREDICTION OF COW COLOSTRUM IMMUNOGLOBULINS G CONCENTRATION: PHENOTYPIC VARIABILITY AND RELATIONSHIP WITH COLOSTRUM YIELD**

Massimo De Marchi<sup>1</sup>, Arianna Goi<sup>1</sup>, Marta Pozza<sup>1</sup>, Elena Chiarin<sup>1</sup>, Angela Costa<sup>2</sup>.

<sup>1</sup>University of Padova, Legnaro, Italy; <sup>2</sup>University of Bologna, Bologna, Italy.

S07.O-02

**CORTISOL DETERMINATION IN DAIRY COWS HAIRS BY NEAR-INFRARED (NIR), MID-INFRARED (MIR) AND RAMAN SPECTROSCOPY.**

Octave Christophe<sup>1</sup>, Clément Grelet<sup>1</sup>, Huzaifa Simon<sup>1</sup>, José Wavreile<sup>1</sup>, Julie Leblois<sup>2</sup>, Vincent Baeten<sup>1</sup>, Frédéric Dehareng<sup>1</sup>.

<sup>1</sup>Walloon Agricultural Research Center (CRA-W), Gembloux, Belgium;

<sup>2</sup>Elevéo asbl, AWE groupe, Ciney, Belgium.

S07.O-03

**NEAR INFRA-RED SPECTRUM OF RAW MILK, RAW OR HOMOGENISED?**

Hafiz Muhammad Hussain Khan<sup>1</sup>, Ultan Mccarthy<sup>2</sup>, Norah O'shea<sup>1</sup>.

<sup>1</sup>Food Chemistry & Technology Department, Food Research Center, Teagasc Moorepark, Fermoy, Republic of Ireland; <sup>2</sup>South East Technological University, Waterford, Republic of Ireland.

S07.O-04

**CONSIDERATION OF FECAL NEAR-INFRARED SPECTRA TO ESTIMATE METHANE ERUCTED BY DAIRY OR BEEF CATTLE**

Amélie Vanlierde<sup>1</sup>, Frédéric Dehareng<sup>1</sup>, Alexandre Mertens<sup>1</sup>, Michaël Mathot<sup>1</sup>, Adeline Lefèvre<sup>1</sup>, Isabelle Morel<sup>2</sup>, Gilles Renand<sup>3</sup>, Yvanne Rochette<sup>4</sup>, Fabienne Picard<sup>4</sup>, Cécile Martin<sup>4</sup>, Donato Andueza<sup>4</sup>.

<sup>1</sup>CRA-W, Gembloux, Belgium; <sup>2</sup>Agroscope, Posieux, Switzerland; <sup>3</sup>INRAE, Jouy-en-Josas, France; <sup>4</sup>INRAE, Saint-Genès-Champagnelle, France.

S07.O-05

**IN-LINE REAL-TIME MILK COMPOSITION ANALYSIS BY TUNABLE LASER SPECTROSCOPY FOR DAIRY FARMS**

Tadas Bučiūnas, Benediktas Bilinskas, Ieva Šimonytė, Tomas Žukauskas, Arūnas Miasojedovas, Vladislavas Čerkasovas, Augustas Baltrėnas, Augustinas Vizbaras, Kristijonas Vizbaras, Dominykas Vizbaras.

*Brolis Sensor technology, Vilnius, Lithuania.*

S07.O-06

**DEVELOPMENT OF A PORTABLE MIR INSTRUMENT FOR IN-FARM MILK ANALYSIS - WHAT ARE THE NEEDS AND EXPECTATIONS OF THE DAIRY SECTOR**

Clément Grelet<sup>1</sup>, Maxime Joissains<sup>1</sup>, Quentin Arlould<sup>1</sup>, Delphine Delhotte<sup>1</sup>, Frédéric Dehareng<sup>1</sup>, Vincent Baeten<sup>1</sup>, Alessandro Giusti<sup>2</sup>, Panayiota Demosthenous<sup>2</sup>, Consortium Bromedir<sup>2</sup>, Juan Antonio Fernández Pierna<sup>1</sup>.

<sup>1</sup>Walloon Agricultural Research Center (CRA-W), Gembloux, Belgium;

<sup>2</sup>Cyprus Research & Innovation Center Ltd (CyRIC), Nicosia, Cyprus.



**14:00** ROOM C2

**SESSION 1: DRIVERS AND CHALLENGES FOR NEW UPTAKES OF NEW SOURCES AND USES OF DATA RECORDING**

Chairs: **Isabel Casasús and Noureddine Charfeddine**

S01.O-01

**LIVESTOCK RECORDING AND IMPROVEMENT IN SOUTH AFRICA: CHALLENGES AND MAJOR DRIVERS**

Japie Van Der Westhuizen<sup>1</sup>, Bobbie Van Der Westhuizen<sup>2</sup>.

<sup>1</sup>*South African Stud Book & Animal Improvement Association, Bloemfontein, South Africa;* <sup>2</sup>*SA Stud Book, Pretoria, South Africa.*

S01.O-02

**PRACTICAL LESSONS FROM DATA HUB IMPLEMENTATION**

Johannes Frandsen<sup>1</sup>, Chris Murphy<sup>2</sup>.

<sup>1</sup>*Seges Innovation, Aarhus, Denmark;* <sup>2</sup>*Chris Murphy Advisory, Richmond, Australia.*

S01.O-03

**PERFORMANCE RECORDING IN BOVINES UNDER THE SMALLHOLDERS DAIRY PRODUCTION SYSTEM IN INDIA: CHALLENGES AND SUITABLE INTERVENTIONS**

Sujit Saha, Nilesh Nayee, A Sudhakar, Swapnil Gajjar, Atul Mahajan, Kishore G, Rajesh O Gupta.

*National Dairy Development Board, Anand, India.*

S01.O-04

**DEVELOPMENT OF AN AUTOMATED QUALITY CONTROL PIPELINE TO FACILITATE THE REPORTING OF MAJOR GENE GENOTYPES**

Katie Quigley<sup>1</sup>, Thomas Browne<sup>1</sup>, Karl O' Connell<sup>1</sup>, Paul Flynn<sup>2</sup>, Ross D Evans<sup>3</sup>, Michael P Mullen<sup>4</sup>.

<sup>1</sup>*Irish Cattle Breeding Federation, Link Rd, Ballincollig, Co. Cork. P31 D452, Republic of Ireland;* <sup>2</sup>*Weatherbys Scientific, Unit F1 M7 Business Park Newhall, Naas Co. Kildare W91 VX86, Republic of Ireland;* <sup>3</sup>*Irish Cattle Breeding Federation, Link Rd, Ballincollig, Co. Cork. P31 D452, Afghanistan;*

<sup>4</sup>*AgriGenomics Ltd., Cloonmweelaun, Menlough, Ballinasloe, Co. Galway, Republic of Ireland.*

S01.O-05

**AGRI-FOOD DATA CANADA: A DATA ECOSYSTEM SERVING AGRI-FOOD SUSTAINABILITY**

Lucas M. Alcantara, Carly Huitema, A. Michelle Edwards.

*University of Guelph, Guelph, Canada.*

S01.O-06

**DATA INVESTMENT STRATEGY - THE CORE ISSUE FOR GENETICS ORGANISATIONS IN THE GENOMICS ERA**

Robert Banks<sup>1</sup>, Siobhan Ring<sup>2</sup>, Ross Evans<sup>2</sup>.

<sup>1</sup>AGBU, Armidale, Australia; <sup>2</sup>ICBF, Cork, Republic of Ireland.

14:00 ROOM D1

**SESSION 10: BRIAN WICKHAM YOUNG PERSONS EXCHANGE PROGRAM (BWYPEX) “BEEF ON DAIRY, SENSORS IN WELFARE MONITORING; EXTRAMIR, SUSTAINABILITY TRAITS”**

Chairs: **Martín Burke and Andrew Cromie**

S10.O-01

**THE STATE OF THE ART ABOUT THE DEVELOPMENT OF MID-INFRARED BASED FATTY ACIDS PREDICTIONS AND THEIR APPLICATIONS ALONG THE DAIRY FOOD CHAIN.**

Michael Whittaker<sup>1</sup>, Silvia Orlandini<sup>2</sup>, Christian Baumgartner<sup>2</sup>, Steve Holroyd<sup>3</sup>, Gavin Scott<sup>3</sup>, Paul Jamieson<sup>3</sup>, Débora Santschi<sup>4</sup>, Mazen Bahadi<sup>4</sup>, Bevin Harris<sup>5</sup>, Kathryn Sanders<sup>5</sup>, Hélène Soyeurt<sup>6</sup>.

<sup>1</sup>The Cattle Information Service, Telford, United Kingdom; <sup>2</sup>ICAR, Utrecht, Netherlands; <sup>3</sup>Fonterra Co-Operative Group limited, Ruakura, New Zealand; <sup>4</sup>Lactanet, Quebec, Canada; <sup>5</sup>Livestock Improvement Corporation, Newstead, New Zealand; <sup>6</sup>University of Liège, Gembloux, Belgium.

S10.O-02

**BEEF FROM DAIRY: THE ROLE OF GENETIC IMPROVEMENT IN CREATING GREATER INTEGRATION BETWEEN OUR DAIRY AND BEEF INDUSTRIES.**

Jo Newton<sup>1</sup>, Matthew Shaffer<sup>2</sup>, Andrew Cromie<sup>3</sup>.

<sup>1</sup>Agriculture Victoria, Bundoora, Australia; <sup>2</sup>DataGene Limited, Bundoora, Australia; <sup>3</sup>ST Genetics, Cork, Republic of Ireland.

S10.O-03

**SENSOR DATA FOR ANIMAL HEALTH AND WELFARE – ICAR MEMBERS’ PRESENT PERSPECTIVES AND FUTURE APPLICATIONS**

Katharina Schodl<sup>1</sup>, Martin Burke<sup>2</sup>, René Van Der Linde<sup>3</sup>, Christa Egger-Danner<sup>1</sup>.

<sup>1</sup>ZuchtData EDV-Dienstleistungen GmbH, Vienna, Austria; <sup>2</sup>ICAR, Utrecht, Netherlands; <sup>3</sup>ICAR, Utrecht, Netherlands.

S10.O-04

**CONNECTING INDUSTRY, RESEARCH AND FARMERS TO TACKLE SUSTAINABILITY: FEED EFFICIENCY AND METHANE IN THE SPOTLIGHT**

Caeli Richardson<sup>1</sup>, Peter Amer<sup>2</sup>, Filippo Miglior<sup>3</sup>, Michael Aldridge<sup>4</sup>, Oscar Gonzalez-Recio<sup>5</sup>, Ross Evans<sup>6</sup>, Jan Lassen<sup>7</sup>, Jennie Pryce<sup>8</sup>, Amélie Vanlierde Vanlierde<sup>9</sup>, Birgit Gredler-Grandl<sup>4</sup>.

<sup>1</sup>AbacusBio International Ltd, Edinburgh, United Kingdom; <sup>2</sup>AbacusBio Ltd, Dunedin, New Zealand; <sup>3</sup>Lactanet Canada, Guelph, Canada; <sup>4</sup>Wageningen University and Research, Wageningen, Netherlands; <sup>5</sup>Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria, Madrid, Spain; <sup>6</sup>Irish Cattle Breeding Federation, Ballinacollig, Republic of Ireland; <sup>7</sup>Aarhus University, Aarhus, Denmark; <sup>8</sup>Agriculture Victoria, Bunboora, Australia; <sup>9</sup>Walloon Agricultural Research Centre CRA-W, Gembloux, Belgium.

**14:00** SALA D 2

**SESSION 5.1: PLF TECHNOLOGY DEVELOPMENT AND DATA ACCESSIBILITY**

Chairs: **Bert Van't Land** and **Daniel Villalba**

S05.O-01

**PREDICTION OF PERSISTENCY AT DAY 305 IN LACTATION AT THE MOMENT OF THE INSEMINATION DECISION**

Yongyan Chen, Wilma Steeneveld, Mirjam Nielen, Miel Hostens.  
*Utrecht University, Utrecht, Netherlands.*

S05.O-02

**PROTOTYPING A REMOTE SENSING DECISION SUPPORT TOOL FOR GRASSLAND MONITORING IN SOUTHERN BELGIUM : VERSATILE FEATURES TO MEET THE DIVERSITY OF FARMERS' PRACTICES.**

Killian Dichou<sup>1</sup>, David Mathy<sup>2</sup>, Charles Nickmilder<sup>1</sup>, Olivier Debauche<sup>3</sup>, Amine Roukh<sup>3</sup>, Astrid Bughin<sup>1</sup>, Théo Lefèvre<sup>1</sup>, Loïs Penasse<sup>1</sup>, Sébastien Van Laeken<sup>2</sup>, Viviane Planchon<sup>2</sup>, Cozmin Lucau-Danila<sup>2</sup>, Hélène Soyeurt<sup>1</sup>.

<sup>1</sup>ULiège - Gembloux Agro-Bio Tech, Liège, Belgium; <sup>2</sup>Walloon Agricultural Research Centre, Gembloux, Belgium; <sup>3</sup>University of Mons, Faculty of engineering, Computer Science, Software and Artificial Intelligence Service, Mons, Belgium.

S05.O-03

**FARM-TO-TABLE SCIENCE: DAIRY DATA MINING FOR FUTURE RESILIENCE**

Ingemar Ohlsson, Tomas Klingström.

*Swedish University of Agricultural Sciences, Uppsala, Sweden.*

S05.O-04

**PREDICTION OF BODY CONDITION IN JERSEY DAIRY CATTLE FROM 3D IMAGES USING MACHINE LEARNING TECHNIQUES.**

Rasmus Bak Stephansen<sup>1</sup>, Coralia I. V. Manzanilla-Pech<sup>1</sup>, Grum Gebreyesus<sup>1</sup>, Goutam Sahana<sup>1</sup>, Jan Lassen<sup>2</sup>.

<sup>1</sup>Aarhus University, Aarhus, Denmark; <sup>2</sup>VikingGenetics, Randers, Denmark.

S05.O-05

**PHENO3D : VALIDATION OF A HIGH-THROUGHPUT MOVABLE 3D DEVICE FOR THE ACQUISITION OF THE WHOLE CATTLE BODY**

Maxence Bruyas<sup>1</sup>, Adrien Lebreton<sup>2</sup>, Laurent Griffon<sup>3</sup>, Laurent Delattre<sup>4</sup>, Clement Allain<sup>2</sup>.

<sup>1</sup>ELIANCE, Paris, France; <sup>2</sup>IDELE, Paris, France; <sup>3</sup>Races de France, PARIS, France; <sup>4</sup>3D Ouest, Lannion, France.

S05.O-06

**FAT AND PROTEIN CORRECTION - ESTIMATING DAILY FAT PERCENTAGE FROM SINGLE SAMPLE IN AMS HERDS USING A REGRESSION MODEL**

Julia Sophia Gerke, Florian Grandl, Jürgen Duda.

LKV Bayern, Munich, Germany.

15:30 - 16:00 COFFEE BREAK

16:00 AUDITORIUM

**ROUND TABLE: DATA OWNERSHIP AND DATA ACCESSIBILITY**

Chairs: **Fernando Estellés and Reinhart Reents**

## Thursday 25th May 2023

**08:30** ROOM C1

**OPEN WORKSHOP: USING SENSOR DATA FOR ANIMAL HEALTH AND WELFARE IMPROVEMENT ALONG THE DAIRY VALUE CHAIN: MERITS AND REQUIREMENT**

**08:30** ROOM D1

**SESSION 6: CHALLENGES AND DEVELOPMENTS IN RECORDING AND SAMPLING FOR SHEEP AND GOATS**

Chairs: **Jean Michel Astruc and Steven Sievert**

S06.O-01

**MILK RECORDING IN SHEEP AND GOATS: STATE OF THE ART AND MATERIALS USED FOR RECORDING AND SAMPLING**

Jean-Michel Astruc<sup>1</sup>, Antonello Carta<sup>2</sup>, Mojca Simcic<sup>3</sup>, Marija Spehar<sup>4</sup>, Eva Ugarte<sup>5</sup>, Cesare Mosconi<sup>6</sup>.

<sup>1</sup>IDELE, Toulouse, France; <sup>2</sup>Agris Sardegna, Sassari, Italy; <sup>3</sup>University of Ljubljana, Ljubljana, Slovenia; <sup>4</sup>Centre for Livestock Breeding, Zagreb, Croatia; <sup>5</sup>NEIKER, Vitoria, Spain; <sup>6</sup>ICAR, Utrecht, Netherlands.

S06.O-02

**CHALLENGES ON MILK RECORDING AND SAMPLING IN THE LATXA DAIRY SHEEP BREEDING PROGRAM**

Maite Lasarte<sup>1</sup>, Lourdes Mintegi<sup>2</sup>, Jon Bizkarralegorra<sup>3</sup>, Aiora Cenitagoya<sup>4</sup>, Ana Díez<sup>5</sup>.

<sup>1</sup>ASLANA, Iza, Spain; <sup>2</sup>CONFELAC, Arkaute, Spain; <sup>3</sup>ACOL, Durango, Spain; <sup>4</sup>ELE, Azpeitia, Spain; <sup>5</sup>AGORALA, Arkaute, Spain.

S06.O-03

**CERTIFICATION OF MILK METERS FOR SMALL RUMINANTS: CHALLENGES AND POSSIBILITIES**

Guillaume Hamon, Clément Allain, Jean-Louis Poulet.  
Institut de l'Élevage, Le Rheu, France.

S06.O-04

**OVERVIEWS OF MILK RECORDING AND RECORDING DEVICES IN SHEEP AND GOATS IN ITALY**

Mauro Fioretti<sup>1</sup>, Lorenzo Pascarella<sup>1</sup>, Riccardo Negrini<sup>2</sup>, Giulio Malvezzi<sup>3</sup>.

<sup>1</sup>Associazione Italiana Allevatori (A.I.A.), Roma, Italy; <sup>2</sup>Associazione Italiana Allevatori (A.I.A.)/ Università Cattolica del Sacro Cuore, Roma/Piacenza, Italy; <sup>3</sup>Associazione Regionale Allevatori della Toscana (A.R.A.T.), Sesto Fiorentino, Italy.

S06.O-05

**ICAR PERSPECTIVES ON DEVICES IN SMALL RUMINANTS**

Steven Sievert<sup>1</sup>, René Van Der Linde<sup>2</sup>, Jean-Michel Astruc<sup>3</sup>.

<sup>1</sup>National DHIA USA, Red Wing, MN, United States; <sup>2</sup>ICAR, Utrecht, Netherlands; <sup>3</sup>IDELE, Toulouse, France.

S06.O-06

**RELIABLE MILK PERFORMANCE TESTING USING MILK FLOW METERS EQUIPPED WITH A REPRESENTATIVE ONLINE SAMPLER DURING TIMESENSITIVE MILKING OF SMALL RUMINANTS**

Tilman Hoefelmayr, Axel Prediger, Ansgar Adriany, Sabine Büchel.

WMB, Balgach, Switzerland.

08:30 ROOM D2

**SESSION 4.1: CLIMATE CHANGE MITIGATION STRATEGIES**

Chairs: **Birgit Gredler-Grandl and David R. Yáñez-Ruiz**

S04.O-01

**THE SPANISH STRATEGY TO REDUCE METHANE EMISSIONS THROUGH BREEDING IN DAIRY CATTLE**

Oscar Gonzalez-Recio<sup>1</sup>, Javier López-Paredes<sup>2</sup>, Aser García-Rodríguez<sup>3</sup>.

<sup>1</sup>INIA, Madrid, Spain; <sup>2</sup>CONAFE, Valdemoro, Spain; <sup>3</sup>NEIKER, Arkaute, Spain.

S04.O-02

**THE SUSTAINABILITY INDEX: A NEW TOOL TO BREED FOR REDUCED GREENHOUSE GAS EMISSIONS INTENSITY IN AUSTRALIAN DAIRY CATTLE**

Thuy Nguyen<sup>1</sup>, Caeli Richardson<sup>2</sup>, Madeline Post<sup>3</sup>, Peter Amer<sup>3</sup>, Gert Nieuwhof<sup>1</sup>, Peter Thurn<sup>1</sup>, Matthew Shaffer<sup>1</sup>.

<sup>1</sup>DataGene, Bundoora, Australia; <sup>2</sup>AbacusBio, Edinburgh, United Kingdom;

<sup>3</sup>AbacusBio, Dunedin, New Zealand.

S04.O-03

**SUCKLER CARBON EFFICIENCY PROGRAMME**

Craig Vigors, Christopher Daly.

ICBF, Ballinacollig, Republic of Ireland.

S04.O-04

**A NOVEL FRAMEWORK FOR ESTIMATING THE CARBON FOOTPRINT OF BEEF ANIMALS IN A NATIONAL DATABASE BASED ON GENETIC AND PERFORMANCE DATA**

Colm O'Dwyer<sup>1</sup>, John Crowley<sup>2</sup>.

<sup>1</sup>ICBF, Cork, Republic of Ireland; <sup>2</sup>AbacusBio, Edinburgh, United Kingdom.

S04.O-05

**ESTIMATION OF ENTERIC METHANE EMISSION IN ITALIAN DAIRY HERDS: APPLICATION OF IPCC EQUATIONS USING DHI DATA.**

Federica Luisi<sup>1</sup>, Mesfin Mekonnen Moliso<sup>2</sup>, Mauro Fioretti<sup>3</sup>, Alessia Tondo<sup>3</sup>, Riccardo Negrini<sup>4</sup>.

<sup>1</sup>Associazione Italiana Allevatori (A.I.A.); Università Cattolica del Sacro Cuore, Roma/Piacenza, Italy; <sup>2</sup>Università Cattolica del Sacro Cuore; Associazione Italiana Allevatori, Piacenza/Roma, Italy; <sup>3</sup>Associazione Italiana Allevatori (A.I.A.), Roma, Italy; <sup>4</sup>Associazione Italiana Allevatori (A.I.A.); Università Cattolica del Sacro Cuore, Roma/Piacenza, Italy.

S04.O-06

**NEU.RIND - DIGITAL FARM ASSISTANT FOR ASSESSING SUSTAINABILITY, EFFICIENCY AND ENVIRONMENTAL IMPACT ON THE DAIRY FARM**

Franz Steininger<sup>1</sup>, Stefan Hörtenhuber<sup>2</sup>, Markus Herndl<sup>3</sup>, Kristina Linke<sup>1</sup>, Martin Stegfellner<sup>4</sup>, Johannes Schmid<sup>5</sup>, Marco Horn<sup>6</sup>, Franz-Josef Auer<sup>7</sup>, Christa Egger-Danner<sup>1</sup>.

<sup>1</sup>ZuchtData, Vienna, Austria; <sup>2</sup>University of Natural Resources and Life Sciences, Vienna, Institute of Livestock Sciences, Vienna, Austria; <sup>3</sup>HBLFA Raumberg-Gumpenstein, Altrudning, Austria; <sup>4</sup>Rinderzucht Austria, Vienna, Austria; <sup>5</sup>Chamber of Agriculture Austria, Vienna, Austria; <sup>6</sup>Chamber of Agriculture Lower Austria, St. Pölten, Austria; <sup>7</sup>LKV-Austria, Vienna, Austria.

S04.O-07

**Implementation of Genomic Evaluation for Methane Efficiency in Holsteins**

Brian Van Doormaal<sup>1</sup>, Hinayah Oliveira<sup>2</sup>, Saranya Narayana<sup>1</sup>, Allison Fleming<sup>1</sup>, Hannah Sweett<sup>1</sup>, Saeed Shadpour<sup>3</sup>, Francesca Malchiodi<sup>4</sup>, Janusz Jamrozik<sup>1</sup>, Gerrit Kistemaker<sup>1</sup>, Peter Sullivan<sup>1</sup>, Flavio Schenkel<sup>3</sup>, Christine Baes<sup>5</sup>, Filippo Miglior<sup>6</sup>.

<sup>1</sup>Lactanet Canada, Guelph, Canada; <sup>2</sup>Lactanet Canada & Purdue University, Guelph, Canada; <sup>3</sup>University of Guelph, Guelph, Canada; <sup>4</sup>Semex, Guelph, Canada; <sup>5</sup>University of Guelph & University of Bern, Guelph, Canada; <sup>6</sup>Lactanet Canada & University of Guelph, Guelph, Canada.

**10:30 - 11:00 COFFEE BREAK**

**11:00 ROOM C1**

**OPEN WORKSHOP: USING SENSOR DATA FOR ANIMAL HEALTH AND WELFARE IMPROVEMENT ALONG THE DAIRY VALUE CHAIN: MERITS AND REQUIREMENT**

**Thursday 25<sup>th</sup> May 2023**

11:00 ROOM D1

**SESSION 11: RECENT DEVELOPMENTS IN GENOMIC EVALUATIONS: NEW TRAITS, NEW POPULATIONS**

Chairs: **M<sup>a</sup> Jesús Carabaño and Andrew Cromie**

S11.O-01

**THE APPLICATION OF GENOMIC SELECTION IN SOUTH AFRICA; IMPLEMENTATION, ADOPTION, CHALLENGES AND FUTURE PROSPECTS.**

Bobbie Van Der Westhuizen<sup>1</sup>, Japie Van Der Westhuizen<sup>2</sup>, Helena Theron<sup>1</sup>, Bernice Mostert<sup>1</sup>, Jason Reding<sup>1</sup>.

<sup>1</sup>SA Stud Book, Bloemfontein, South Africa; <sup>2</sup>SA Stud Book, Pretoria, South Africa.

S11.O-02

**GENOMIC SELECTION IN SPANISH DAIRY SHEEP BREEDS**

Eva Ugarte<sup>1</sup>, Itsasne Granado-Tajada<sup>1</sup>, Malena Serrano<sup>2</sup>.

<sup>1</sup>NEIKER, Vitoria-Gasteiz, Spain; <sup>2</sup>INIA-CSIC, Madrid, Spain.

S11.O-03

**INCORPORATING GENOMIC INFORMATION ON THE GENETIC EVALUATION OF SPANISH LOCAL BEEF CATTLE BREEDS.**

Clara Diaz<sup>1</sup>, Cristina Meneses<sup>1</sup>, Javier Cañon<sup>2</sup>, Carlos Carleos<sup>3</sup>, Rosa Morales<sup>4</sup>, Antonio Molina<sup>4</sup>, Daniel Villalba<sup>5</sup>, Juan Carlos Parejo<sup>6</sup>, Juan Altarriva<sup>7</sup>, Luis Varona<sup>7</sup>.

<sup>1</sup>INIA-CSIC, Madrid, Spain; <sup>2</sup>UCM, Madrid, Spain; <sup>3</sup>UNIOvi, Oviedo, Spain; <sup>4</sup>UCO, Cordoba, Spain; <sup>5</sup>UdLe, Lerida, Spain; <sup>6</sup>UEX, Cáceres, Spain; <sup>7</sup>UNIZAR, Zaragoza, Spain.

S11.O-04

**GENETIC PARAMETERS AND SINGLE STEP EVALUATION OF SEXUAL PRECOCITY TRAITS IN CHAROLAIS BEEF CATTLE**

Romain Saintilan<sup>1</sup>, Manon Gicquel<sup>2</sup>, Aurelia Baur<sup>1</sup>, Helene Leclerc<sup>1</sup>, François Guillaume<sup>2</sup>.

<sup>1</sup>Eliance - INRAE, Paris, France; <sup>2</sup>Synetics - Charolais Univers, Noyal sur Vilaine, France.

S11.O-05

**GENETIC CORRELATIONS BETWEEN PRODUCTIVE AND REPRODUCTIVE COW-SISTERS PERFORMANCE AND FEED EFFICIENCY AND GREENHOUSE GASSES EMISSIONS IN GROWING BROTHERS-BULLS**

Francesco Tiezzi<sup>1</sup>, Raffaella Finocchiaro<sup>2</sup>, Jan-Thijs Van Kaam<sup>2</sup>, Lorenzo Benzoni<sup>2</sup>, Marcos Paulo G. Rezende<sup>2</sup>, Riccardo Bozzi<sup>1</sup>, Martino Cassandro<sup>2</sup>.

<sup>1</sup>Department of Agriculture, Food, Environment and Forestry (DAGRI), University of Florence, Firenze, Italy; <sup>2</sup>Anafibj, CREMONA, Italy.

S11.O-06



**EXPLORING OPPORTUNITIES TO EVALUATE GENOMICALLY MIR-PREDICTED RESIDUAL CH<sub>4</sub> EXPLOITING CORRELATIONS TO MACE TRAITS**

Hadi Atashi<sup>1</sup>, Amélie Vanlierde<sup>2</sup>, Frédéric Dehareng<sup>2</sup>, Hélène Soyeurt<sup>3</sup>, Nicolas Gengler<sup>3</sup>.

<sup>1</sup>Shiraz University, Shiraz, Iran; <sup>2</sup>CRA-W, Gembloux, Belgium; <sup>3</sup>ULiège-GxABT, Gembloux, Belgium.

**11:00** ROOM D2

**SESSION 4.2: CLIMATE CHANGE MITIGATION STRATEGIES**

Chairs: **Birgit Gredler-Grandl and David R. Yáñez-Ruiz**

S04.O-08

**GREENFEED AND SNIFFER STANDARD OPERATING PROCEDURE (SOP) IN DAIRY AND BEEF CATTLE**

Lorenzo Benzoni<sup>1</sup>, Donagh Berry<sup>2</sup>, Elizabeth Dressler<sup>3</sup>, Roger Hegarty<sup>4</sup>, Lisanne Koning<sup>5</sup>, Ciarán Mc Donnell<sup>6</sup>, Lorna Mcnaughton<sup>7</sup>, Gail Ritchie<sup>8</sup>, Raffaella Finocchiaro<sup>1</sup>, Anouk Van Breukelen<sup>5</sup>, Aser García-Rodríguez<sup>9</sup>, Oscar Gonzalez-Recio<sup>9</sup>, Caeli Richardson<sup>10</sup>, Trine Michelle Villumsen<sup>11</sup>, Birgit Gredler-Grandl<sup>5</sup>.

<sup>1</sup>ANAFIBJ, Cremona, Italy; <sup>2</sup>TEAGASC, Fermoy, Republic of Ireland; <sup>3</sup>Kansas State University, Manhattan, United States; <sup>4</sup>University of New England, Armidale, Australia; <sup>5</sup>Wageningen University & Research, Wageningen, Netherlands; <sup>6</sup>Irish Cattle Breeding Federation, Cork, Republic of Ireland; <sup>7</sup>Livestock Improvement Corporation (LIC), Hamilton, New Zealand; <sup>8</sup>University of Guelph, Guelph, Canada; <sup>9</sup>Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA), Madrid, Spain; <sup>10</sup>ICAR, Utrecht, Netherlands; <sup>11</sup>Aarhus University, Aarhus, Denmark.

S04.O-09

**RE-LIVESTOCK - FACILITATING INNOVATIONS FOR RESILIENT LIVESTOCK FARMING SYSTEMS**

Birgit Gredler-Grandl<sup>1</sup>, John Newbold<sup>2</sup>, Laurence Smith<sup>3</sup>, Hannah Van Zanten<sup>1</sup>, Carolina Ramos<sup>4</sup>, Fernando Estellés<sup>5</sup>, Elin Rööös<sup>6</sup>, Ignacio Fernández-Figares<sup>7</sup>, Rosa Nieto<sup>7</sup>, Catherine Pfeifer<sup>8</sup>, Alejandro Parodi Parodi<sup>1</sup>, Luca Fontanesi<sup>9</sup>, Michele Moretti<sup>10</sup>, Antonio Lopez Francos<sup>11</sup>, Anne Grete Kongsted<sup>12</sup>, Manuel Romero<sup>7</sup>, Andrés Schlageter-Tello<sup>11</sup>, Ines Rivelli<sup>7</sup>, David Yáñez-Ruiz<sup>7</sup>.

<sup>1</sup>Wageningen University & Research, Wageningen, Netherlands; <sup>2</sup>SRUC, Dumfries, United Kingdom; <sup>3</sup>University of Reading, Reading, United Kingdom; <sup>4</sup>CONSULAI, Lisbon, Portugal; <sup>5</sup>Universitat Politècnica de València, Valencia, Spain; <sup>6</sup>Swedish University of Agricultural Sciences, Uppsala, Sweden; <sup>7</sup>Estación Experimental del Zaidín, CSIC, Granada, Spain; <sup>8</sup>Forschungsinstitut für biologische Landwirtschaft, Frick, Switzerland; <sup>9</sup>University of Bologna, Bologna, Italy; <sup>10</sup>University of Pisa, Pisa, Italy; <sup>11</sup>CIHEAM Zaragoza, Zaragoza, Spain; <sup>12</sup>Aarhus University, Tiele, Denmark.

S04.O-10

**INTEGRATING GENETICS AND NUTRITION STRATEGIES TO DEVELOP A ROADMAP FOR GREENHOUSE GAS MANAGEMENT IN RUMINANT SPECIES**

Christine Baes<sup>1</sup>, Rachel Gervais<sup>2</sup>, Paul Stothard<sup>3</sup>, Flavio Schenkel<sup>1</sup>, Ermias Kebreab<sup>4</sup>, Jennifer Ellis<sup>1</sup>, Debora Santschi<sup>5</sup>, Michael Von Massow<sup>1</sup>, Caeli Richardson<sup>6</sup>, Graham Plastow<sup>3</sup>, Leluo Guan<sup>3</sup>, Katherine Wood<sup>1</sup>, Francesca Malchiodi<sup>7</sup>, Angela Canovas<sup>1</sup>, Tom Wright<sup>8</sup>, Kent Weigel<sup>9</sup>, Francisco Peñagaricano<sup>9</sup>, Oscar Gonzales-Recio<sup>10</sup>, Jan Lassen<sup>11</sup>, Donagh Berry<sup>12</sup>, Raffaella Finocchiaro<sup>13</sup>, Adrien Butty<sup>14</sup>, Steven Miller<sup>15</sup>, Sam Clark<sup>15</sup>, Reinhardt Reents<sup>16</sup>, Douglas Macdonald<sup>17</sup>, Filippo Miglior<sup>1</sup>.

<sup>1</sup>University of Guelph, Guelph, Canada; <sup>2</sup>Université Laval, Montreal, Canada;

<sup>3</sup>University of Alberta, Edmonton, Canada; <sup>4</sup>University of California Davis, Davis, United States; <sup>5</sup>Lactanet, Montreal, Canada; <sup>6</sup>Abacus Bio, Edinburgh, United Kingdom; <sup>7</sup>Semex, Guelph, Canada; <sup>8</sup>OMAFRA, Guelph, Canada;

<sup>9</sup>University of Wisconsin, Madison, United States; <sup>10</sup>INIA, Madrid, Spain;

<sup>11</sup>Aarhus University, Tjele, Denmark; <sup>12</sup>Teagasc, Moorepark, Republic of Ireland;

<sup>13</sup>ANAFIBJ, Cremona, Italy; <sup>14</sup>Qualitas AG, Zug, Switzerland; <sup>15</sup>University of New England, Armidale, Australia; <sup>16</sup>VIT, Verden, Germany; <sup>17</sup>Environment and Climate Change Canada, Ottawa, Canada.

S04.O-11

**ICAR HARMONISATION OF SUSTAINABILITY RELATED MILK TRAITS**

Tone Roalkvam<sup>1</sup>, Birgit Gredler-Grandl<sup>2</sup>, Christa Egger-Danner<sup>3</sup>, Robert Fourdraine<sup>4</sup>, Debora Santschi<sup>5</sup>, Fabian Bernal<sup>6</sup>, Caeli Richardson<sup>7</sup>, Martin Burke<sup>8</sup>, Rene Van Der Linde<sup>8</sup>.

<sup>1</sup>TINE, Oslo, Norway; <sup>2</sup>WUR, Wageningen, Netherlands; <sup>3</sup>Zuchtdata, Vienna, Austria; <sup>4</sup>DRMS, Madison, United States; <sup>5</sup>Lactanet, Montreal, Canada;

<sup>6</sup>DeLaval Group, Tumba, Sweden; <sup>7</sup>AbacusBio, Hamilton, New Zealand;

<sup>8</sup>ICAR, Utrecht, Netherlands.

S04.O-12

**IS THE DIGITAL TRANSITION OF FARM A KEY FOR SUSTAINABILITY? THE PARMALAT LACTALIS ITALIA SCENARIO**

Paolo Bulgarelli, Alice Comparelli.

*Parmalat Lactalis Italia, Collecchio, Italy.*

13:00 - 14:00 LUNCH

**14:00** ROOM B

**SESSION 9: IMPLEMENTING RFID INTO NATIONAL IDENTIFICATION PROGRAMS**

Chairs: **Ken Evers and Andie Dimitriadou**

S09.O-01

**THE IMPLEMENTATION OF NATIONAL ANIMAL IDENTIFICATION SYSTEMS IN DEVELOPING COUNTRIES**

Alexander Toto.

*SATOTO Livestock Projects, Windhoek, Namibia.*

S09.O-02

**CHALLENGES FACED IN THE IMPLEMENTATION OF A LIVESTOCK IDENTIFICATION SYSTEM - CANADA'S EXPERIENCE**

Heather Brown.

*Canadian Food Inspection Agency / Government of Canada, Canada.*

S09.O-03

**AUSTRALIA'S NATIONAL LIVESTOCK IDENTIFICATION SYSTEM (NLIS) - VICTORIA'S EXPERIENCE**

Tony Britt.

*Agriculture Victoria, Victoria, Australia.*

**14:00** ROOM C1

**SESSION 5.2: PLF TECHNOLOGY DEVELOPMENT AND DATA ACCESSIBILITY**

Chairs: **Bert Van't Land and Daniel Villalba**

S05.O-07

**HOW TO OPTIMIZE FEED EFFICIENCY BY AUTOMATIC DATA EXCHANGE**

Johannes Frandsen.

*SEGES Innovation PS, Aarhus, Denmark.*

S05.O-08

**SYSTEM AND BIOLOGICAL EFFECTS ON QUANTITATIVE MILKING SPEED PHENOTYPES FROM INLINE MILK METERS**

Asha Miles<sup>1</sup>, Jana Hutchison<sup>1</sup>, Robert Fourdraine<sup>2</sup>, Steven Sievert<sup>3</sup>, Sophie Eaglen<sup>4</sup>, Kristen Gaddis<sup>5</sup>, Jeffrey Bewley<sup>6</sup>, Joao Durr<sup>5</sup>, Jay Weiker<sup>4</sup>.

<sup>1</sup>USDA-ARS, Beltsville, United States; <sup>2</sup>DRMS, Raleigh, United States; <sup>3</sup>NDHIA QCS, Verona, United States; <sup>4</sup>NAAB, Madison, United States; <sup>5</sup>CDCB, Bowie, United States; <sup>6</sup>Holstein Association USA, Brattleboro, United States.

S05.O-09

**FRENCH EXPERIENCE OF USING ICAR APPROVED METHOD FOR PREDICTING 24-HOUR FAT PERCENTAGE AND YIELD FROM ONE SAMPLED MILKINGS IN AUTOMATIC MILKING SYSTEMS**

Xavier Bourrigan<sup>1</sup>, Gabriel Augier<sup>2</sup>, Roxane Vallee<sup>1</sup>.

<sup>1</sup>Institut de l'Elevage, Paris, France; <sup>2</sup>Eliance, Paris, France.

S05.O-10

**COMPARING PEAK OF LACTATION FROM AUTOMATIC MILKING SYSTEMS AND CONVENTIONAL MILKING SYSTEMS**

Liliana Fadul, Gervais Bisson, Débora Santschi.

Lactanet, Montreal, Canada.

S05.O-11

**360 INNOVATIVE SOLUTIONS FOR THE SUSTAINABILITY OF AMS DAIRY FARMS IN SPAIN**

Noureddine Charfeddine.

CONAFE, Valdemoro, Spain.

S05.O-12

**MIGRATING ICAR'S GUIDELINES TO A WIKI**

Bruce Golden<sup>1</sup>, Robert Banks<sup>2</sup>, Andrew Cromie<sup>3</sup>, Martin Burke<sup>4</sup>.

<sup>1</sup>Retired, Lacey, WA, United States; <sup>2</sup>Retired, Tasmania, Australia; <sup>3</sup>Sexing Technologies, Gouda, Netherlands; <sup>4</sup>ICAR, Utrecht, Netherlands.

14:00 ROOM C2

**OPEN WORKSHOP: EXTRA-MIR**

**CREATING A WORLD REPRESENTATIVE MILK MID-INFRARED SPECTRAL DATABASE TO LIMIT THE SPECTRAL EXTRAPOLATION WHEN A PREDICTION IS REALIZED**

Hélène Soyeurt<sup>1</sup>, Charles Nickmilder<sup>1</sup>, Sébastien Franceschini<sup>1</sup>, Michael Whittaker<sup>2</sup>, Frédéric Dehareng<sup>3</sup>, Mazen Bahadi<sup>4</sup>, Julie Leblois<sup>5</sup>, Clément Grelet<sup>3</sup>.

<sup>1</sup>University of Liège - Gembloux Agro-Bio Tech, Gembloux, Belgium; <sup>2</sup>The Cattle Information Service, Telfort, United Kingdom; <sup>3</sup>Walloon Research Centre, Gembloux, Belgium; <sup>4</sup>Lactanet, Sainte-Anne-de-Bellevue, Canada; <sup>5</sup>European Milk Recording, Ciney, Belgium.

**WHAT IS THE BEST MODELLING APPROACH TO PREDICT SKEWED DISTRIBUTED HEALTH BIOMARKERS FROM MIR, A CASE STUDY WITH THE HAPTOGLOBIN IN MILK?**

Sebastien Franceschini<sup>1</sup>, Marion Calmels<sup>2</sup>, Clement Grelet<sup>3</sup>, Julie Leblois<sup>4</sup>, Yves Brostaux<sup>1</sup>, Happymoo Consortium<sup>5</sup>, Nicolas Gengler<sup>1</sup>, Helene Soyeurt<sup>1</sup>.  
<sup>1</sup>ULiège - Gembloux Agro-Bio Tech, Liège, Belgium; <sup>2</sup>Seenovia, Saint-Berthevin, France; <sup>3</sup>Walloon Agricultural Research Center, Gembloux, Belgium; <sup>4</sup>Wallon Breeders Association Group, Ciney, Belgium; <sup>5</sup>Consortium, Ciney, Belgium.

**14:00** ROOM D1

**SESSION 2.1: ADVANCES ON MONITORING WELFARE AT GROUP AND INDIVIDUAL LEVEL**

Chairs: **Katharina Friederike Stock and Pol Llonch Obiols**

S02.O-01

**EXPLORATION OF USING ANIMAL-BASED PARAMETERS (ACTIVITY LEVEL AND RESPIRATORY HEALTH STATUS) COLLECTED BY SENSORS TO MONITOR PIG WELFARE ON FARM**

Heng-Lun Ko<sup>1</sup>, Damián Escribano<sup>2</sup>, Marina López-Arjona<sup>1</sup>, María Botia<sup>2</sup>, Alba Ortín-Bustillo<sup>2</sup>, Fernando Tecles<sup>2</sup>, Pablo Fuentes Pardo<sup>3</sup>, José Cerón<sup>2</sup>, Xavier Manteca<sup>1</sup>, Pol Llonch<sup>1</sup>.

<sup>1</sup>Universitat Autònoma de Barcelona, Cerdanyola del Vallès, Spain;

<sup>2</sup>Universidad de Murcia, Murcia, Spain; <sup>3</sup>CEFU, S.A., Murcia, Spain.

S02.O-02

**IDENTIFICATION OF BEHAVIORAL PATTERNS ASSOCIATED WITH ACIDOSIS IN DAIRY COWS**

Lucile Herve<sup>1</sup>, Yaneth Gómez<sup>2</sup>, Kevin Chow<sup>3</sup>, Anna H. Stygar<sup>4</sup>, Greta V. Berteselli<sup>5</sup>, Emanuela Dalla Costa<sup>5</sup>, Elisabetta Canali<sup>5</sup>, Xavier Manteca<sup>2</sup>, Pol Llonch<sup>6</sup>.

<sup>1</sup>PEGASE, INRAE, Institut Agro, Saint-Gilles, France; <sup>2</sup>Department of Animal and Food Science, Universitat Autònoma de Barcelona, Cerdanyola del Vallès, Spain; <sup>3</sup>Department of Information and Communications Engineering, Universitat Autònoma de Barcelona, Cerdanyola del Vallès, Spain; <sup>4</sup>Natural Resources Institute Finland (Luke), Helsinki, Finland; <sup>5</sup>Università degli Studi di Milano, Dipartimento di Medicina Veterinaria e Scienze Animali, Lodi, Italy; <sup>6</sup>Department of Animal and Food Science, Universitat Autònoma de Barcelona, Cerdanyola del Vallès, France.

S02.O-03

**A PREDICTIVE MODEL FOR HYPOCALCEMIA IN DAIRY COWS UTILIZING BEHAVIOURAL SENSOR DATA COMBINED WITH DEEP LEARNING**

Meike Van Leerdam<sup>1</sup>, Arno Liseune<sup>2</sup>, Peter Hut<sup>1</sup>, Elena Slavco<sup>1</sup>, Jan Hulsen<sup>3</sup>, Miel Hostens<sup>4</sup>.

<sup>1</sup>*Utrecht University, Utrecht, Netherlands;* <sup>2</sup>*Ghent University, Ghent, Belgium;* <sup>3</sup>*Vetvice/Cowsignals, Bergen op Zoom, Netherlands;* <sup>4</sup>*Utrecht University and Ghent University, Utrecht and Ghent, Netherlands.*

S02.O-04

**AUXILIARY TRAITS FOR LAMENESS IN AUSTRIAN FLECKVIEH COWS**

Astrid Köck<sup>1</sup>, Katharina Schodl<sup>1</sup>, Birgit Fuerst-Waltl<sup>2</sup>, Marlene Suntinger<sup>1</sup>, Kristina Linke<sup>1</sup>, Johann Kofler<sup>3</sup>, Franz Steiniger<sup>1</sup>, Hermann Schwarzenbacher<sup>1</sup>, Lena Lemmens<sup>3</sup>, Franz-Josef Auer<sup>4</sup>, Christa Egger-Danner<sup>1</sup>.

<sup>1</sup>*ZuchtData EDV-Dienstleistungen GmbH, Vienna, Austria;* <sup>2</sup>*University of Natural Resources and Life Sciences, Vienna, Institute of Livestock Sciences, Vienna, Austria;* <sup>3</sup>*University of Veterinary Medicine, Vienna, Austria;* <sup>4</sup>*LKV Austria, Vienna, Austria.*

S02.O-05

**EVALUATION OF CAMERA-BASED DAIRY CATTLE LAMENESS DETECTION TECHNOLOGY PAIRED WITH ARTIFICIAL INTELLIGENCE**

Drew Swartz<sup>1</sup>, Elise Shepley<sup>1</sup>, Duane Norman<sup>2</sup>, Javier Burchard<sup>2</sup>, Asha Miles<sup>3</sup>, Xiao-Lin Wu<sup>2</sup>, Kristen P. Gaddis<sup>2</sup>, Gerard Cramer<sup>1</sup>.

<sup>1</sup>*College of Veterinary Medicine, University of Minnesota, St. Paul, MN, United States;* <sup>2</sup>*Council on Dairy Cattle Breeding, Bowie, MD, United States;* <sup>3</sup>*Animal Genomics and Improvement Laboratory (AGIL) USDA, USA, Beltsville, MD, United States.*

14:00 ROOM D2

**SESSION 3: BREEDING FOR RESILIENCE TO CLIMATE CHANGE: ADAPTATION STRATEGIES**

Chairs: **Manuel Ramón Fernández and Thuy Nguyen**

S03.O-01

**TOWARDS NEW BREEDING TOOLS IN A CONTEXT OF CLIMATE CHANGE: FERTILITY RESULTS OF THE RUMIGEN PROJECT ON NEW PHENOTYPES FOR HEAT TOLERANCE TRAITS**

Maria Carabaño<sup>1</sup>, Aurelie Vinet<sup>2</sup>, Hans Mulder<sup>3</sup>, Mario Calus<sup>3</sup>, Jeremie Vandenplas<sup>3</sup>, Manuel Ramón<sup>4</sup>, Clara Díaz<sup>1</sup>, Beatriz Cuyabano<sup>2</sup>, Didier Boichard<sup>2</sup>, Eric Pailhoux<sup>2</sup>, Sophie Mattalia<sup>2</sup>.

<sup>1</sup>*INIA-CSIC, Madrid, Spain;* <sup>2</sup>*INRAE, Jouy-en-Josas, France;* <sup>3</sup>*Wageningen University & Research, Wageningen, Netherlands;* <sup>4</sup>*IRIAF, Valdepeñas, Spain.*

S03.O-02

**DEVELOPMENT OF A GLOBAL HEAT STRESS ASSESSMENT FOR GENETIC EVALUATION OF HEAT STRESS IN DAIRY CATTLE**

Pauline Lema<sup>1</sup>, Marie-Nguyet Tran<sup>2</sup>, Martine Schroyen<sup>1</sup>, Nicolas Gengler<sup>1</sup>.

<sup>1</sup>Gembloux Agro-Bio Tech / University of Liège, Gembloux, Belgium; <sup>2</sup>Elevéo / Association Wallonne des Eleveurs, Ciney, Belgium.

S03.O-03

**MODELLING OF GENETIC HEAT TOLERANCE IN ITALIAN HOLSTEIN COWS**

Raffaella Finocchiaro, Jan-Thijs Van Kaam, Ferdinando Galluzzo, Maurizio Marusi, Martino Cassandro.

Anafibj, Cremona, Italy.

S03.O-04

**GENETIC ANALYSIS OF LACTATION CONSISTENCY USING DAILY MILK WEIGHTS IN U.S. HOLSTEINS**

Fiona Louise Guinan<sup>1</sup>, Robert Fourdraine<sup>2</sup>, Francisco Peñagaricano<sup>1</sup>, Kent Weigel<sup>1</sup>.

<sup>1</sup>University of Wisconsin-Madison, Madison, United States; <sup>2</sup>Dairy Records Management Systems, Raleigh, United States.

S03.O-05

**PREDICTION OF HEAT STRESS STATUS BY INFRARED SPECTROSCOPY IN DAIRY SHEEP**

Manuel Ramon<sup>1</sup>, Clara Diaz<sup>2</sup>, María Jesús Carabaño<sup>3</sup>.

<sup>1</sup>CERSYRA-IRIAF, Valdepeñas, Spain; <sup>2</sup>INIA-CSIC, Madrid, Spain; <sup>3</sup>CSIC-INIA, Madrid, Spain.

**15:30 - 16:00 COFFEE BREAK**

**16:00** ROOM C2

**OPEN WORKSHOP: EXTRA-MIR**

**Thursday 25<sup>th</sup> May 2023**

16:00 ROOM D1

**SESSION 2.2: ADVANCES ON MONITORING WELFARE AT GROUP AND INDIVIDUAL LEVEL.**

Chairs: **Katharina Friederike Stock and Pol Llonch Obiols**

S02.O-06

**ASSESSING THE IMPACT OF BODY CONDITION SCORE DYNAMICS FROM DRY-OFF TO CALVING ON THE INCIDENCE OF EARLY LACTATION DISEASE IN HOLSTEIN COWS**

Pablo Pinedo<sup>1</sup>, Diego Manriquez<sup>2</sup>, Joaquin Azocar<sup>3</sup>, Albert De Vries<sup>4</sup>.

<sup>1</sup>Colorado State University, Fort Collins, CO, United States; <sup>2</sup>Colorado State University, Fort Collins, United States; <sup>3</sup>DeLaval Inc, Bannockburn, United States; <sup>4</sup>University of Florida, Gainesville, FL, United States.

S02.O-07

**USE OF VOCALIZATIONS TO DETECT PAIN AND DISCOMFORT IN DAIRY COWS AT DRY-OFF**

Joana Miranda<sup>1</sup>, Cristian Larrondo<sup>2</sup>, Raúl Guevara<sup>2</sup>, Ester Vidaña-Vila<sup>3</sup>, Jordi Malé<sup>3</sup>, Marc Freixes<sup>3</sup>, Rosa M. Alsina-Pagès<sup>3</sup>, Leticia Duboc<sup>3</sup>, Eva Mainau<sup>2</sup>, Pol Llonch<sup>4</sup>.

<sup>1</sup>AWEC Advisors S. L., Cerdanyola del Valles, Spain; <sup>2</sup>AWEC Advisors S.L., Cerdanyola del Valles, Spain; <sup>3</sup>Human-Environment Research (HER) - La Salle - Universitat Ramon Llull, Barcelona, Spain; <sup>4</sup>Universitat Autònoma de Barcelona, Cerdanyola del Valles, Spain.

S02.O-08

**A NEW MEASURE TO RANK COW PRODUCTION PERFORMANCE USING LIFETIME INCOME VALUES.**

Mario Séguin, Robert Moore, René Lacroix, Débora Santschi.

*Lactanet, Ste-Anne-de-Bellevue, Canada.*

S02.O-09

**SEARCHING FOR PHENOTYPES TO IMPROVE WELFARE IN AVILEÑA-NEGRA IBÉRICA BEEF CATTLE BREED: PRELIMINARY RESULTS**

Carmen Giné<sup>1</sup>, Cristina Meneses<sup>1</sup>, M. Jesús Carabaño<sup>1</sup>, M. Mar González<sup>2</sup>, Alba Hernández<sup>2</sup>, Carmen González<sup>1</sup>, Fátima Vicente<sup>1</sup>, Marta Álvarez<sup>3</sup>, Jesús De La Fuente<sup>4</sup>, Clara Díaz<sup>1</sup>.

<sup>1</sup>INIA, CSIC, Madrid, Spain; <sup>2</sup>RAEANI, Ávila, Spain; <sup>3</sup>ULE, León, Spain; <sup>4</sup>UCM, Madrid, Spain.



16:00 ROOM D2

**SESSION 8: ADAPTATION, RESILIENCE AND AGROECOLOGICAL TRANSITION IN SMALL RUMINANTS AND CAMELIDS.**

Chairs: **Jean Michel Astruc and Eva Ugarte**

S08.O-01

**DTREO, A FLEXIBLE CLOUD-BASED DATA-RECORDING PLATFORM FOR DATA-DRIVEN DECISIONS IN SHEEP AND GOAT INDUSTRIES**

Simone Savoia<sup>1</sup>, Bruno Santos<sup>2</sup>, Mark Teviotdale<sup>2</sup>, Sharl Liebergreen<sup>2</sup>, Peter Amer<sup>2</sup>, Tim Byrne<sup>1</sup>.

<sup>1</sup>AbacusBio Int. Limited, Edinburgh, United Kingdom; <sup>2</sup>AbacusBio Limited, Dunedin, New Zealand.

S08.O-02

**A TIME-SERIES ANALYSIS OF ALPINE AND SAANEN GOAT MILK PRODUCTIVITY TRENDS IN TAIWAN**

Po-An Tu<sup>1</sup>, Jen-Wen Shiau<sup>1</sup>, Shui-Tsai Chen<sup>2</sup>, Ming-Che Wu<sup>2</sup>, Jih-Tay Hsu<sup>3</sup>, Ming-Kuei Yang<sup>1</sup>, Jen-Fang Huang<sup>2</sup>.

<sup>1</sup>Hsinchu Branch, Livestock Research Institute, Miaoli, Taiwan; <sup>2</sup>Livestock Research Institute, Tainan, Taiwan; <sup>3</sup>National Taiwan University, Taipei, Taiwan.

S08.O-03

**GENOCELLS FOR DAIRY GOATS: IDENTIFICATION OF THE MOST CONTRIBUTING GOATS TO THE BULK TANK SOMATIC CELL COUNT BY GENOTYPING TANK MILK.**

Jean-Bernard Daviere<sup>1</sup>, Antoine Vivier<sup>1</sup>, Pierre Lenormand<sup>1</sup>, Tanguy Lallemand<sup>1</sup>, Florent Perrin<sup>2</sup>, Marion Calmels<sup>1</sup>, Magali Foucher<sup>2</sup>.

<sup>1</sup>Seenovia, Saint Berthevin, France; <sup>2</sup>Agranis, Saint Berthevin, France.

S08.O-04

**SELECTIVE PEDIGREE BREEDING EFFICIENCY OF IMPORTED BREEDS OF DAIRY GOAT IN TROPICAL TAIWAN**

Mingche Wu<sup>1</sup>, Yungyu Lai<sup>1</sup>, Shuitsai Chen<sup>1</sup>, Deryuh Lin<sup>1</sup>, Hsiuluan Chang<sup>2</sup>.

<sup>1</sup>Taiwan Livestock Research Institute, Tainan, Taiwan; <sup>2</sup>National Pingtung University of Science and Technology, Pingtung, Taiwan.

S08.O-05

**VALORIZATION OF EXTENSIVE BREEDING OF THE SPANISH MERINO SHEEP THROUGH THE QUALITY WOOL IMPROVEMENT: PRELIMINARY RESULTS OF GWAS OF FIBER DIAMETER FROM WHOLE GENOME SEQUENCES**

Gabriel Anaya Calvo-Rubio<sup>1</sup>, Nora Laseca<sup>1</sup>, Andrés Domingo<sup>2</sup>, Antonio Granero<sup>3</sup>, Francisco Arrebola<sup>4</sup>, Chiraz Ziadi<sup>1</sup>, Antonio Molina<sup>1</sup>.

<sup>1</sup>University of Córdoba, Córdoba, Spain; <sup>2</sup>Center of Selection and Reproduction Animals (CENSYRA), Badajoz, Spain; <sup>3</sup>National Association of Merino Sheep Breeders (ACME), Madrid, Spain; <sup>4</sup>Agriculture, Livestock and Fisheries Research Institute (IFAPA), Córdoba, Spain.

S08.O-06

**THE POTENTIAL OF BREEDING CASHMERE GOATS IN EUROPE**

Nora Kravis<sup>1</sup>, Lapo Tardelli<sup>2</sup>, Cristina Nocelli<sup>3</sup>.

<sup>1</sup>Azienda Agricola la Penisola, Radda in Chianti, Italy; <sup>2</sup>Universita di Firenze, Firenze, Italy; <sup>3</sup>Universita di Camerino, Camerino, Italy.

# E-POSTERS

## S01.P-01

### **EXPANDING THE RECORDING OF REFERENCE WEIGHT AND IMPROVING RELIABILITY: NEW RULES FOR THE FRENCH BEEF CATTLE RECORDING AND IBOVAL GENETIC EVALUATION**

Arnaud Delpuch<sup>1</sup>, Marie-Noëlle Fouilloux<sup>1</sup>, Gabriel Augier<sup>2</sup>, Philippe Boulesteix<sup>1</sup>, Marine Barbat<sup>3</sup>, Arnaud Tranier<sup>1</sup>, Laurent Griffon<sup>4</sup>.

<sup>1</sup>Institut de l'Élevage, Paris, France; <sup>2</sup>Eliance, Paris, France; <sup>3</sup>GenEval, Paris, France;

<sup>4</sup>Races de France, Paris, France.

## S01.P-02

### **CHALLENGES AND OPPORTUNITIES OF MILK RECORDING METHODS IN IRISH DAIRY FARMS: A COMPARISON OF TEST DAY MILK RECORDINGS AND DAILY BULK COLLECTIONS**

Matthew Thompson.

ICBF, Cork, Republic of Ireland.

## S01.P-03

### **DEVELOPMENT OF GENOMIC EVALUATION OF BREEDING VALUE SYSTEM FOR MILK PRODUCTION TRAITS WITH ON-LABORATORY QUALITY CONTROL OF PHENOTYPIC DATA**

Iliia Rukin<sup>1</sup>, Mariia Krutkina<sup>1</sup>, Kateryna Pantiukh<sup>1</sup>, Evgeniy Kamaldinov<sup>2</sup>.

<sup>1</sup>JSC «Agroplem», Moscow, Russian Federation; <sup>2</sup>Novosibirsk State Agrarian University, Novosibirsk, Russian Federation.

## S03.P-01

### **GROWTH DIFFERENTIATION FACTOR 9 MRNA EXPRESSION IN OVARIAN FOLLICLES OF POTCHEFSTROOM KOEKOEK CHICKEN BREED**

Thobela Louis Tyasi<sup>1</sup>, Victoria Rankotsoane Hlokwe<sup>1</sup>, Monnye Mabelebele<sup>2</sup>.

<sup>1</sup>University of Limpopo, Mankweng, South Africa; <sup>2</sup>University of South Africa, Florida, South Africa.

## S04.P-01

### **ONGOING RESEARCH TO INVESTIGATE THE GENETIC BACKGROUND OF NITROGEN USE EFFICIENCY AND METHANE EMISSIONS OF SWISS DAIRY COWS**

Claudia Kasper, Fredy Schori, Silvia Ampuero Kragten.

Agroscope, Posieux, Switzerland.

## S05.P-01

### **ULTRASONIC MEAT QUALITY ANALYSIS IN MEAT YIELD CONTROLS AT THE CENSYRA BADAJOZ TESTING CENTER**

Isaac Torrado<sup>1</sup>, Gema Vara<sup>1</sup>, Olvido Blanco<sup>1</sup>, Sebastian Lopez Valiente<sup>2</sup>, Sebastian Maresca<sup>2</sup>, Andres Domingo<sup>1</sup>.

<sup>1</sup>CENSYRA, Badajoz, Spain; <sup>2</sup>INTA, Cuenca del Salado, Argentina.

**S05.P-02**

**PROGENY PRODUCTIVE PERFORMANCE OF CROSSBREED BETWEEN BRANGUS AND ANGUS**

Sebastian López Valiente<sup>1</sup>, Alejandro Rodriguez<sup>2</sup>, F Perea Muñoz<sup>3</sup>, J. Bedatou<sup>4</sup>, F. Rainieri<sup>5</sup>, Gema Vara<sup>6</sup>, Andres Domingo<sup>6</sup>, Sebastian Maresca<sup>2</sup>.

<sup>1</sup>INTA, Cuenca dell Salado, Argentina; <sup>2</sup>INTA, Cuenca del Salado, Argentina; <sup>3</sup>Privada, Cuenca del Salado, Argentina; <sup>4</sup>Particular, Cuenca del Salado, Argentina; <sup>5</sup>Particular, Cuenca del Salado, Argentina; <sup>6</sup>CENSYRA, Badajoz, Spain.

**S07.P-01**

**DEVELOPMENT OF A NEW EQUATION BASED ON MIR SPECTRA TO PREDICT LIPOLYSIS IN DAIRY GOATS**

Marine Gelé<sup>1</sup>, Sofia Meurisse<sup>1</sup>, Philippe Trossat<sup>2</sup>, Aurore Oudotte<sup>2</sup>, Thierry Fassier<sup>3</sup>, Hugues Caillat<sup>4</sup>, Philippe Lambertson<sup>5</sup>, Alexandra Eymard<sup>6</sup>, Hélène Larroque<sup>7</sup>, Laurence Bernard<sup>8</sup>, Catherine Hurtaud<sup>9</sup>, Christelle Cebo<sup>10</sup>.

<sup>1</sup>Institut de l'Élevage, PARIS, France; <sup>2</sup>Actalia-Cécalait, Poligny, France; <sup>3</sup>INRAE UEP3R, Osmoy, France; <sup>4</sup>INRAE FERLUS, Lusignan, France; <sup>5</sup>INRAE IEPL, Le Rheu, France; <sup>6</sup>INRAE MoSAR, Thiverval-Grignon, France; <sup>7</sup>GenPhySE, université de Toulouse, INRAE, ENVT, Castanet-Tolosan, France; <sup>8</sup>INRAE, Université Clermont Auvergne, VetAgroSup, UMR Herbivores, Saint-Genès-Champanelle, France; <sup>9</sup>PEGASE, INRAE, Institut Agro Rennes-Angers, Saint-Gilles, France; <sup>10</sup>Université Paris-Saclay, INRAE, AgroParisTech, GABI, Jouy-en-Josas, France.

**S07.P-02**

**LEVERAGING THE SPECTRAL DHI DATABASES TO ESTIMATE MISSING MILK FT-MIR SPECTRA: A STRATEGY TOWARD IMPROVING THE RELIABILITY OF BREEDING VALUES AND PREDICTIVE MODELS**

Hélène Soyeurt<sup>1</sup>, Xiao-Lin Wu<sup>2</sup>, Clément Grelet<sup>3</sup>, Mathijs Van Pelt<sup>4</sup>, Nicolas Gengler<sup>1</sup>, Frédéric Dehareng<sup>5</sup>, Carlo Bertozzi<sup>5</sup>, Javier Burchard<sup>6</sup>.

<sup>1</sup>University of Liège - Gembloux Agro-Bio Tech, Gembloux, Belgium; <sup>2</sup>Council of Dairy Cattle Breeding / University of Wisconsin, Bowie / Madison, United States; <sup>3</sup>Walloon Agricultural Research Centre, Gembloux, Belgium; <sup>4</sup>Cooperation CRV, Arnhem, Netherlands; <sup>5</sup>Walloon Breeders Association, Ciney, Belgium; <sup>6</sup>Council of Dairy Cattle Breeding, Bowie, United States.

**S08.P-01**

**EWES' MILK UREA CONCENTRATION METHODS' OPTIMIZATION, BY DIFFERENCE IN PH AND MID-INFRARED SPECTROSCOPY (MIRS)**

Fanny Albert<sup>1</sup>, Mohammed El Jabri<sup>2</sup>, Philippe Trossat<sup>3</sup>, Marine Gelé<sup>4</sup>, Jean-Michel Astruc<sup>1</sup>, Cécile Laithier<sup>5</sup>, Gilles Lagriffoul<sup>1</sup>.

<sup>1</sup>Institut de l'élevage, Toulouse, France; <sup>2</sup>Institut de l'élevage, Paris, France; <sup>3</sup>Actalia, Poligny, France; <sup>4</sup>Institut de l'élevage, Beaucauzé, France; <sup>5</sup>Institut de l'élevage, Lyon, France.

### **S08.P-02**

#### **PERCEPTIONS AND ADAPTATION STRATEGIES FOR CLIMATE CHANGE FROM SMALL RUMINANT FARMERS IN NORTH-WEST CAMEROON**

Tendonkeng Fernand<sup>1</sup>, Noubbissi Marie Noël Bertine<sup>1</sup>, Emile Miéguoué<sup>1</sup>, Awah Nelson Nde<sup>1</sup>, Etienne Pamo Tedonkeng<sup>1</sup>, Einar Vargas-Bello-Pérez<sup>2</sup>.

<sup>1</sup>University of Dschang, Dschang, Cameroon; <sup>2</sup>University of Copenhagen, Faculty of Health and Medical Sciences, Frederiksberg, Denmark.

### **S11.P-01**

#### **VALIDATION OF US GENOMIC PREDICTION FOR MILK AND FAT YIELD FOR HOLSTEIN CATTLE IN SUBTROPICAL TAIWAN**

Chun-Hsuan Chao<sup>1</sup>, Jen-Wen Shiau<sup>1</sup>, Jih-Yi Chen<sup>1</sup>, Po-An Tu<sup>1</sup>, Szu-Han Wang<sup>1</sup>, Jeng-Fang Huang<sup>2</sup>.

<sup>1</sup>Hsinchu Branch, Livestock Research Institute, Council of Agriculture, Miaoli, Taiwan;

<sup>2</sup>Livestock Research Institute, Council of Agriculture, Tainan, Taiwan.

### **S11.P-02**

#### **BEEF CATTLE BREEDING IN LATVIA**

Evija Skujina, Irina Pilvere.

Latvia University of Life Sciences and Technologies, Jelgava, Latvia.

### **S11.P-03**

#### **GENOMIC BREEDING STRATEGIES MAY LEAD TO HIGHER GENETIC PROGRESS IN BUFFALOES UNDER SMALL HOLDER PRODUCTION SYSTEM IN INDIA.**

Nilesh Kumar Nayee, Sujit Saha, A Sudhakar, Swapnil Gajjar, Atul Mahajan, Kamlesh Trivedi.

National Dairy Development Board, Anand, India.

### **S11.P-04**

#### **GENOMICS IMPROVES THE RELIABILITY OF BREEDING VALUE PREDICTION OF MORPHOLOGICAL AND REPRODUCTIVE TRAITS IN THE PURA RAZA ESPAÑOL HORSE: PRELIMINARY RESULTS**

Chiraz Ziadi<sup>1</sup>, Davinia Perdomo -González<sup>2</sup>, Mercedes Valera<sup>2</sup>, Nora Laseca<sup>1</sup>, Ana Encina<sup>3</sup>, Pedro Azor<sup>3</sup>, Arancha Rodríguez<sup>3</sup>, Sebastián Demyda-Peyrás<sup>1</sup>, Antonio Molina<sup>1</sup>.

<sup>1</sup>Departamento de Genética, Universidad de Córdoba, Córdoba, Spain; <sup>2</sup>Departamento de Agronomía, Universidad de Sevilla, Sevilla, Spain; <sup>3</sup>Real Asociación Nacional de Criadores de Caballos de Pura Raza Española, Sevilla, Spain.



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