

Advanced Course

ADVANCES IN SMALL RUMINANT REPRODUCTION

Zaragoza (Spain), 3-7 April 2017

1. Objective of the course

Small ruminant productions are of particular relevance in Mediterranean countries, covering a significant part of the demand of animal foodstuffs and playing an important role in socioeconomic development and landscape preservation. Animal production is facing increasingly challenging conditions due to climate change, socio-economic constraints and evolving consumer's needs and regulations. Under this increasing pressure, the mastering of reproductive functions becomes critical for breeding industry sustainability. This requires a precise knowledge of reproductive physiology at different levels (flock, animal, tissue, molecules). Besides, well established reproductive technologies are now available in different livestock production systems and will allow some of the impact of upcoming constraints on small ruminant breeding to be overcome. In addition, emerging biotechnologies may pave the way for further progress over new unexpected challenges.

Accordingly, the objectives of this course are to provide professionals and researchers with the most advanced knowledge in reproductive physiology, focused on sheep and goat, and with strategies using reproductive biotechnologies for flock management.

The control of the fine-tuning of male and female reproductive functions will be described in detail, including methods, efficiency control and expected results under different application conditions. Different goals specific to small ruminants will be highlighted, such as improving reproductive management, reducing non-productive periods, increasing productive efficiency, and developing hormone-free strategies. Future applications of emerging biotechnologies and how they can impact new breeding systems will be discussed. This wide theoretical knowledge will be prolonged by hands-on practicals and demonstrations.

At the end of the course, participants will have gained:

- Advanced knowledge on small ruminant reproductive physiology.
- Up-to-date information on new reproductive biotechnologies in females and males.
- Applied knowledge on reproductive management in different small ruminant systems.
- Decision-making ability to incorporate new procedures and technologies in reproductive management.
- Practical experience on some new technologies currently used.
- Exchange of experiences and points of view with experts in small ruminant reproduction from different countries.

2. Organization

The course is organized by the **International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM)**, through the

Mediterranean Agronomic Institute of Zaragoza (IAMZ), with the collaboration of the **Agrifood Research and Technology Centre of Aragón (CITA-GA)**, through the **Animal Production and Health Unit**. The course will take place at IAMZ and CITA-GA and will be given by well qualified lecturers from international institutions and from research centres, universities, government departments and private companies in different countries.

The course will be held over a period of 1 week, from 3 to 7 April 2017, in morning and afternoon sessions.

3. Admission

The course is designed for 25 participants with a university degree. It is intended for professionals from public institutions and the private sector involved in the improvement of small ruminant reproduction, such as livestock managers, development agents, technical advisors and researchers.

Given the diverse nationalities of the lecturers, knowledge of English, French or Spanish will be valued in the selection of candidates, since they will be the working languages of the course. IAMZ will provide simultaneous interpretation of the lectures in these three languages.

4. Registration

Application forms may be obtained from:

Instituto Agronómico Mediterráneo de Zaragoza
Avenida de Montañana 1005, 50059 Zaragoza (Spain)
Tel.: +34 976 716000 - Fax: +34 976 716001
e-mail: iamz@iamz.ciheam.org
Web: www.iamz.ciheam.org

Candidates should send the completed application form to the above address, accompanied by a detailed *curriculum vitae*, stating degree, diplomas, experience, professional activities, language knowledge and reasons for applying to the course. Copies of certificates should be enclosed with the application.

The deadline for the submission of applications is **27 January 2017**.

Applications from those candidates who cannot present their complete records when applying, or those requiring authorization to attend the course, may be accepted provisionally.

Registration fees for the course amount to 500 euro. This sum covers tuition fees only.

5. Scholarships

Candidates from CIHEAM member countries (Albania, Algeria, Egypt, France, Greece, Italy, Lebanon, Malta, Morocco, Portugal, Spain,



Tunisia and Turkey) may apply for scholarships covering registration fees, and for scholarships covering the cost of travel and full board accommodation in the Hall of Residence on the Aula Dei Campus.

Candidates from other countries who require financial support should apply directly to other national or international institutions.

6. Insurance

It is compulsory for participants to have medical insurance valid for Spain. Proof of insurance cover must be given at the beginning of the course. Those who so wish may participate in a collective insurance policy taken out by the IAMZ upon payment of the stipulated sum.

7. Teaching organization

The course requires personal work and interaction among participants and with lecturers. The international characteristics of the course favour the exchange of experiences and points of view.

Formal lectures are complemented by applied examples, practicals, group exercises and a round table discussion gathering on-farm specialists, lecturers and participants.

Practical sessions will take place at the Animal Production and Health Unit of the Agrifood Research and Technology Centre of Aragón, consisting of hands-on training in cervical artificial insemination and assessment of male genital tract and pregnancy diagnosis by ultrasounds, and of demonstrations on intrauterine artificial insemination, ovarian observations by endoscopy and ultrasounds, and oocyte recovery by laparoscopic ovum pick-up.

To put theory into practice, participants will work in groups to propose solutions helping breeding systems to face major constraints and challenges. The group outputs will be shared and discussed with all participants and lecturers in a problem-solving approach.

8. Programme

- 1. Interests for understanding and controlling reproduction in small ruminants (1 hour)**
 - 1.1. Overview of the small ruminant sector in the Mediterranean countries: figures and facts
 - 1.2. Importance of reproduction to increase production, product quality and profitability
 - 1.3. Crucial role of reproduction control in genetic improvement
- 2. Physiological basics of small ruminant reproduction (4 hours)**
 - 2.1. Neuroendocrine events controlling oestrous cycle, sexual behaviour, sperm production and seasonality
 - 2.2. Gametogenesis in males and females: puberty, ovarian activity, spermatogenesis
 - 2.3. Fertilization and early development
 - 2.4. Implantation, pregnancy and delivery
 - 2.5. Post-partum, offspring mortality and mother-young relationships
 - 2.6. Interactions between nutrition and reproduction
- 3. Main reproductive differences between sheep and goats (1 hour)**
- 4. Managing female reproduction (5 hours)**
 - 4.1. Male effect
 - 4.2. Hormonal control of ovarian function
 - 4.2.1. Follicular dynamics
 - 4.2.2. Ovulation time and rate

- 4.2.3. Corpus luteum quality
- 4.3. Genetic improvement of ovarian function and prolificacy**
- 4.4. Embryo technologies**
 - 4.4.1. Superovulation and embryo production
 - 4.4.2. Embryo evaluation
 - 4.4.3. Cryopreservation and transfer
- 5. Managing male reproduction (3 hours)**
 - 5.1. Control of sperm production and sexual activity: husbandry, photoperiod, temperature and mating conditions
 - 5.2. Sperm evaluation and storage
 - 5.3. Artificial insemination
- 6. Reproductive management (4 hours)**
 - 6.1. Choice of strategies for improving reproductive management
 - 6.1.1. Critical points for reproductive control in different production systems: biological, technical, sanitary and socioeconomic constraints
 - 6.1.2. Technologies applicable: why, where, when, which?
 - 6.1.3. How to master sustainability?
 - 6.2. Reduction of non-productive periods
 - 6.2.1. Advancing puberty and first mating
 - 6.2.2. Alleviating seasonal anoestrus
 - 6.2.3. Reducing postpartum
 - 6.2.4. Performing pregnancy and litter size diagnoses
 - 6.2.5. Identifying pathologies
 - 6.3. Increase of productive efficiency
 - 6.3.1. Oestrus synchronization and artificial insemination
 - 6.3.2. Feeding strategies
 - 6.3.3. Genetic improvement
 - 6.4. Towards hormone free reproductive control
 - 6.4.1. Replacement of steroids
 - 6.4.2. Replacement of gonadotropins
 - 6.4.3. Precision livestock farming for reproduction control
- 7. Advances in diagnosis and control of reproductive diseases (1 hour)**
- 8. Advanced biotechnologies (5 hours)**
 - 8.1. Imaging of reproductive parameters
 - 8.2. Semen sexing
 - 8.3. Embryo genotyping
 - 8.4. Embryo manipulation, cloning, and genome editing
 - 8.5. Ovum pick-up (OPU) and *in vitro* embryo production in adults and juveniles
 - 8.6. Future prospects: female and male genetic conservation, stem cells, new preservation techniques, etc.
- 9. Practical work (9 hours)**
 - 9.1. Hands-on practical
 - 9.1.1. Cervical artificial insemination
 - 9.1.2. Pregnancy diagnosis by ultrasounds
 - 9.1.3. Assessment of male genital tract by ultrasounds
 - 9.2. Demonstrations
 - 9.2.1. Intrauterine artificial insemination
 - 9.2.2. Ovarian observations by endoscopy and ultrasounds
 - 9.2.3. Oocyte recovery by OPU
 - 9.3. Group work: design of strategies to improve reproduction under different assumptions
 - 9.3.1. Free hormone systems
 - 9.3.2. Climate change
 - 9.3.3. Triplicating milk production per female
 - 9.3.4. Production for continuous market supply
 - 9.3.5. Maintaining biodiversity
- 10. Round table discussion: are new technologies matching the sector needs? (2 hours)**

GUEST LECTURERS

A. ABECIA, Univ. Zaragoza (Spain)
J.L. ALABART, CITA-GA, Zaragoza (Spain)
R. ARIAS, Censyra, Valdepeñas (Spain)
J.M. BLASCO, CITA-GA, Zaragoza (Spain)
P. CHEMINEAU, INRA, Nouzilly (France)
X. DRUART, INRA, Nouzilly (France)
E. ECHEGOYEN, CITA-GA, Zaragoza (Spain)
S. FABRE, INRA, Toulouse (France)
A. FALAGÁN, Univ. Politécnica Cartagena (Spain)

E. FANTOVA, UPRA Grupo Pastores, Zaragoza (Spain)
J. FOLCH, CITA-GA, Zaragoza (Spain)
A. GONZÁLEZ-BULNES, INIA, Madrid (Spain)
F. HERNÁNDEZ, Cerromonte SL, Ávila (Spain)
B. LAHOZ, CITA-GA, Zaragoza (Spain)
S. LEDDA, Univ. degli Studi di Sassari (Italy)
P. MERMILLOD, INRA, Nouzilly (France)
M. REKIK, ICARDA, Amman (Jordan)
J.M. VÁZQUEZ, Ovigén, Toro (Spain)