Issue 2 April 2010

NEWSLETTER of the LowInputBreeds project

Development of integrated livestock breeding and management strategies to improve animal health, product quality and performance in European organic and 'low input' milk, meat and egg production

Editorial

This edition of the LowInputBreeds Newsletter provides brief state-of-the-arts reports on two themes within the project: the concept of flower breeding in pigs and the state and alternative breeding approaches in laying hens. There are also brief progress reports for the four subprojects which focus on the major livestock production systems.

We would also like to draw your attention to the LowInputBreeds workshop 'Economic, Environmental and Food Quality Assessment of LowInput Production Schemes – Consumer Standards and Demands' to take place on May 26, 2010, in Brussels.

Veronika Maurer and Carlo Leifert

Contents

The 'flower pig breeding concept' and participatory breeding system for laying hens – two concepts to be developed further in the LowInputBreeds project

Veronika Maurer[1]

Organic and low input pig and poultry farmers usually use genotypes selected for performance under intensive production systems. However, these animals may not be the best under more extensive organic and free-range conditions. On-farm breeding would be an option to overcome the gap between genetic potential and site-specific performance. But, in contrast to other livestock species, on-farm breeding of pigs and poultry is not widely practiced. The following reports present two alternative approaches. Both use information on the animal's performance under extensive conditions and knowledge of experienced farmers and combine this information with the advantages of a larger breeding population and specialist knowledge from industry partners.

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The 'flower pig breeding concept'

Jascha Leenhouwers[2] and Jan Merks[3]

The genetic material used in organic and low input pig production systems nowadays usually originates from conventional breeding programmes. Within these breeding programmes, pure breeds/lines are improved and crossed to produce parent sows. These crossbred sows are purchased by organic herds and mated to purebred parent boars via AI to produce slaughter pigs.

Crossbreeding programmes as shown in Figure 1 do benefit from hybrid vigour, but also require an extensive breeding infrastructure based on specialist crossbred

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sow production units and the use of relatively large populations for selection. Using this structure and with (nucleus) breeding populations of 4000 to 5000 sows/population, these breeding programs realize adequate genetic improvement in reproduction and health traits for commercial (crossbred) populations of more than 80'000 sows.

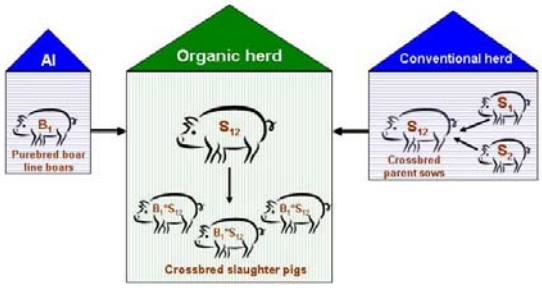

Figure 1: Current breeding practice where organic herds use crossbred parent sows (S_{12}) from conventional herds, which are mated by AI to purebred boar line boars (B_1) to produce crossbred slaughter pigs (B_1*S_{12})

Unfortunately, the current population of organic and low input production together does not justify such investment into dedicated breeding programs using several breeds and crossbreeding infrastructures. On the other hand, the use of conventional genetics in organic and low input environment has major disadvantages, such as high mortality rates and large variation in production performance. Moreover, EU regulations on organic livestock farming limit the use of replacement breeding stock from conventional origin and promote a closed herd policy.

The 'Flower Pig Breeding' concept is specifically designed to overcome the main limitations of using genetics from conventional breeding programmes in low input or organic pig production systems. (In the next lines 'organic herds' may also be read as 'low input herds' as the concept is similar for both situations).

Within the 'Flower Pig Breeding' concept, organic herds use one purebred organic sow breed (BIO, Figure 2) and NOT crossbred sows. Crossbred slaughter pigs are produced by mating this purebred sow by artificial insemination (AI) to another purebred boar line boars that meet the carcass and meat quality requirements of the organic sector. Organic herds provide their own replacement stock by occasionally mating the BIO sow by AI to the best purebred BIO sow line boars.

A single herd may fulfil this concept, but the competitive strength of selection on performance under organic conditions must come from collaboration between a large number of farms: the population used to improve the purebred BIO sows approximates 4000 to 5000 sows. This collaborative structure is presented in Figure 3 (next page). As with a flower, the flower petals together form the beauty and strength of the flower.

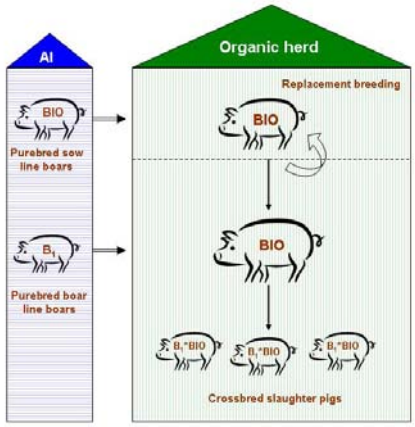

Figure 2: Organic herds use a purebred organic sow breed (BIO) which is mated by AI to purebred boar line boars (B_1) to produce crossbred slaughter pigs (B_1*BIO). At the same time they provide their own replacement stock by mating the purebred sows (BIO) to purebred sow line boars (BIO).

In this concept, the purebred BIO sow breed is selected on the basis of collective 'on farm' data registration of traits within the organic breeding goal (e.g. piglet survival, heat stress resistance). A central AI station is part of the system to distribute the semen of the best purebred boars safely across all the participating herds. The 'Flower Pig Breeding' concept does not require specialised breeding populations as it uses the sow on the participating herds. Consequently, in this 'Flower Pig Breeding' concept only 5000 BIO sows are required for a strong breeding program instead of supporting two breeding populations of each 5000 sows and a commercial population of more than 80'000 sows.

More information

› Work package 3.1. 'Development of a 'FLOWER' BREEDING system to improve pig survival and robustness related traits in small populations; comparing the performance of breeds from 'flower' and conventional breeding systems' at http://www.lowinputbreeds.org/sp3-wp1.html

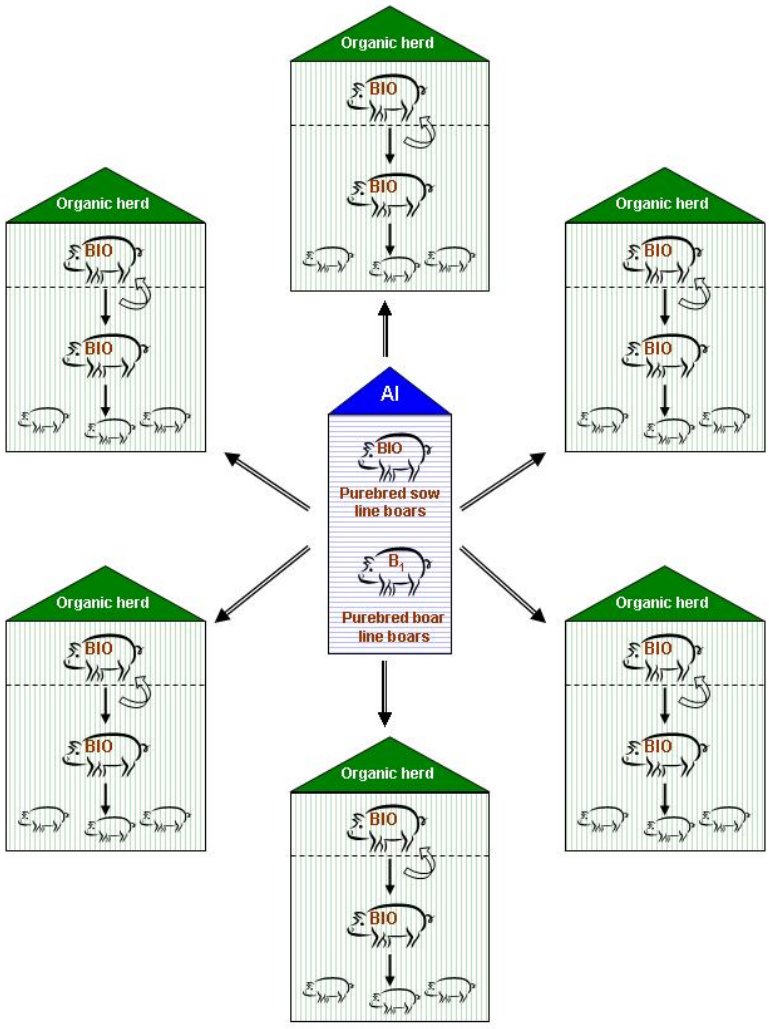

Figure 3: The basis of the Flower Breeding Concept: herds working together in genetic improvement of their BIO sow line by collection of data on the farm and jointly selecting the best boar(s) for replacement of these sows.

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Participatory breeding system for laying hens

Ferry Leenstra[1]

Livestock breeds (and breeding systems) developed for intensive production systems often do not perform as expected in organic and extensive systems. For these alternative systems animals need good social and ranging behaviour, which is in general not necessary in intensive systems with greater confinement for the animals. Although this is the case in all the livestock species (e.g. dairy cows, pigs and sheep), in poultry, the differences between organic/free range and conventional systems are comparatively large.

Worldwide, only a few breeding companies provide laying hens since internationally production systems are rather uniform, however there are differences between these companies concerning traits and breeding methods used. This consolidation in poultry breeding is further facilitated by the high reproduction rate of poultry. One grandmother might have about 80 daughters in one year and each of which can deliver about 80 commercial laying hens the following year. Consequently a granddam might produce over 6000 laying hens; for one grandsire this might be over 60'000. Almost all hens in commercial systems (organic production included) result from crosses between four (grand)parent lines. Laying hens are crossbreds and, combined with the common bio-security systems for layers, breeding of laying hens is completely separated from commercial production of eggs. Producers of eggs buy hens of a specific 'brand' from one of the internationally operating breeding companies; it is virtually unknown for them to breed their own hens using an original local breed.

Laying hens are selected for a high egg output with good shell quality for a minimum amount of feed. The carbon footprint of eggs produced in conventional systems is quite favourable compared with other animal products. However, keeping hens in close confinement, without outside access is debated in a number of countries. Systems with more freedom for laying hens, such as organic or free range, might require a different type of layer, however it is unlikely that a completely separate breeding program for layers in free range systems will be feasible.

Figure 4: Specialized poultry farmers can indicate and articulate which specific traits are essential for a layer in a free range system. © FiBL

The question is, how to utilize the positive aspects of current layer breeding stock with the demands of free range systems. In LowInputBreeds we want to explore this by a participatory breeding system. We want to combine the knowledge of poultry farmers, specialized in free range systems, with the knowledge of the breeding company. Specialized poultry farmers can indicate essential traits for layers in a free range systems and, in structured discussions with the breeding company, a 'design' of an ideal free range hen can be identified. It is likely that some aspects of this ideal free range hen are novel to existing breeding programs but their evaluation will be essential.

The next step is for the breeding company to compare basic lines for these items or traits and decided if either new combinations of existing lines or an adapted selection program for one or more lines is necessary to provide the improved free range hen.

Within the project, this is carried out by characterizing approximately 100 commercial organic and/or free range farms in each of 3 countries (NL, CH, F) using a quantitative survey/questionnaire. Data collected includes information on farm and flock size, the genetic background of birds (current and previous flocks), housing system, type of outdoor area, diet, feeding systems, climatic conditions, health management (e.g. vaccinations, anthelmintic treatments), whether farms are mixed or specialized on egg production, information on the rearing system of the hens and the number of years experience of the farm manager and staff.

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Figure 5: Plumage quality will be an important parameter recorded on farms within the farmer-participatory performance recording network. © FiBL

With these data we get indications how different breeds ('brands') perform in different systems.

Approximately 40 of the 100 farms profiled in each of the three countries are asked to participate in the 'farmer participatory performance recording network' (FP-PRN) with continued recording.

In workshops in each country involving farmers, egg traders and the breeding company the 'ideal' hen for a specific system will be discussed, generating ideas for new genotypes suited to specific systems (or countries). The breeding company will try to produce the crosses and make them available to participating farms. Experiences with the new crosses will be shared and evaluated testing this participatory system, with direct feed back from farmers to the breeding company, for added value to farmers and the breeding company.

More information

› Work package 4.1 'Development of 'FARMER PARTICIPATORY' breeding systems to improve productivity, health and welfare and egg quality related traits; comparing standard with farmer participatory breeding systems' at http://www.lowinputbreeds.org/sp4-wp4-1.html

Reports from the subprojects

> Report from subproject 1: 'Dairy cow and cattle production systems'

Henner Simianer[1]

Review of the past six months

In work package 1.1 'Expanded phenotyping of Swiss Brown Cattle and parameter estimation for traits required in organic and 'low input' systems' the first and second data sampling tour visiting 40 low input dairy farms in Switzerland have taken place.

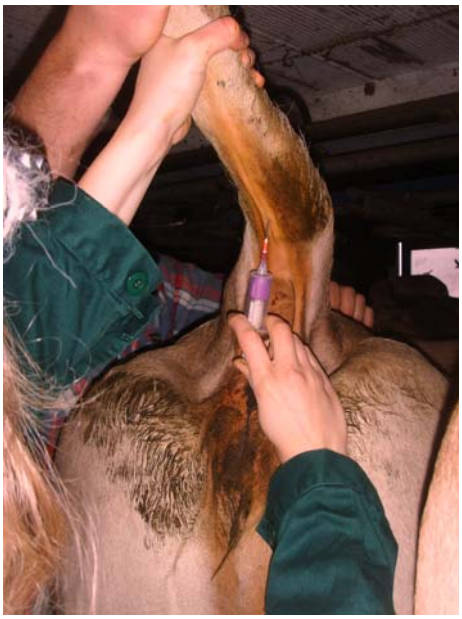

Figure 6: Taking blood samples on Swiss dairy farms

Photo: Anna Bieber, FiBL, Switzerland

Approximately 1200 Swiss Brown dairy cows have been evaluated for several phenotypic characteristic, blood samples have been taken (Figure 6) and their DNA has been extracted. Data transfer from the breeder's organisation to the database at the Research Institute of Organic Agriculture FiBL has been established and the first genetic parameters are estimated at the University of Göttingen. Moreover, the first of two milk samplings

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to study the effect of contrasting feeding regimes on fatty acid composition has been organized.

In work package 1.2 **'Development of improved CROSS-BREEDING strategies to optimise the Balance between 'robustness' and performance traits; comparing cross-breeds with pure-bred Holstein Friesian genotypes',** the Nafferton Ecological Farming Group NEFG has just completed a 6 week feeding trial to improve the fat profile of winter milk in their parallel organic and conventional managed herds (Figure 7).

Figure 7: Feeding trial at Nafferton farm: The aim of the trial is to improve the fat profile of winter milk in their parallel organic and conventional managed herds

Photo: Gillian Butler, NEFG, Newcastle, UK

We had 20 cows in each herd receiving 2 kg of rolled linseed per head per day to mimic the supply of α linolenic acid consumed from fresh grazing in the summer months. Sampling only finished in mid March, so it is too early to know how milk composition or cow health has altered.

The overall aim of work package 1.3 **'Design of optimised breeding and management systems for different macro-climatic regions of Europe; model-based MULTI-CRITERIA EVALUATION with respect to performance, animal health and welfare, product quality and environmental impact'** is to simulate the day-by-day operations in low input dairy cattle farms based on random regression coefficients. Such a strategy implies the estimation of (co)variance components for a multitude of traits, which so far has been done for production traits, somatic cell score, and milk urea nitrogen. Results for additive genetic and permanent environmental effects, as well as solutions for fixed effects can be used in the next step to generate phenotypic records by applying the framework of the recently developed simulation program.

Outlook

The next major step in work package 1.1.1 will be to genotype all relevant animals with a high density SNP chip, which will be the basis for the development of a genomic selection strategy to improve performance, fitness and product quality under low input conditions. In Work package 1.1.3 an open call will be issued to recruit additional partners and widening the data basis especially with respect to growth and beef traits.

More information

› Information about subproject 1 is available at the LowInputBreeds project homepage at www.lowinputbreeds.org/lib-research-dairy-cows.html

> Report from subproject 2: 'Sheep production systems'

Hervé Hoste[1]

Review of the past six months

During the past 6 months, some of the main experiments started within subproject 2 of the LowInputBreeds project.

Work package 2.1: Within breed selection to improve abiotic and biotic stress resistance

From May to October 2009 several farmer consultation meetings were organized in Crete to present the project to the farmers and enroll the 20 flocks scheduled in the future studies.

Since December 2009, the sheep monthly sampling scheme has begun and continues. Faecal and milk samples are collected and milk yield, FAMACHA® category and body condition score (BCS) are recorded for each ewe. Milk samples are analyzed in collaboration with ELOGAK (Hellenic Organization for Milk and Meat) in the accredited laboratory in Rethymno.

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Work package 2.2: Management strategies of endoparasites

In spring 2009 the preparations of two extensive experiments with (i) ewes and (ii) lambs were initiated. A total of 300 ewes were hormonally synchronized in order to allow for controlled tupping in late August 2009. 50 percent of the ewes were of the Engadiner race, which is an endangered, old and robust breed with reduced susceptibility against gastro intestinal nematodes (GIN). The other ewes were of the white Alpine breed which is the dominant breeds in Switzerland and known to be less resistant to GIN. Synchronisation assured an equal period of gestation in ewes and consequently lambs born within approximately 10 days. This was an important precondition for both experiments to be performed within work package 2.2

Lambs were born in late January 2010 and concurrently with the lambing period the first experiment with ewes of the Engadiner breed was performed. Four groups of 22 ewes were fed as described earlier with either (a) a sainfoin hay/silage mixture, (b) a silage/faba bean mixture, (c) a clover/grass mixture (silage and hay) with faba beans or (d) a clover/grass mixture (silage and hay) without faba beans. All feeds were balanced with regard to energy and protein contents and all groups had comparable infections with GIN. Different parasitological examinations in faeces and blood were performed in order to identify the antiparasitic effect of the different feeding regimes.

The experiment is completed and all samples have been collected. Within the next months blood samples and data will be analysed.

Lambs are currently being raised and will be weaned in late April. Experiment number 2 of work package 2.2 will start in May 2010.

Work package 2.3: Development of strategies to improve lamb meat

A first experiment was completed by INRA (partner 3) comparing the impact of three factors (organic versus conventional systems, high or low grass level, use of sainfoin to control endoparasites) on the carcass and meat, quality and level of parasite infections.

The first 2-month field experiment aiming at comparing the effect of morning versus afternoon feeding started in March at the University Catania (Partner 6).

Finally, overall information on the LowInputBreeds project was presented by Otto Schmid (FiBL) and Dr Hervé Hoste (INRA) to more than 60 R&D colleagues in France, during the RMT DEVAB[1] meeting held in Paris, 25-26th March 2010.

Relevant meetings of the subproject

- Thessaloniki, October 7 to 9, 2009: Meeting between Partners 3 (INRA) and 7 (National Agricultural research Foundation NAGREF) to prepare the overall PhD design of Mr Ilias Chaligiannis (NAGREF)
- Leon, Spain, October 14 to 16, 2009. Participation of Partners 2 and 3 at the FAO CIHEAM meeting,[2] especially at the session on the interactions between nutrition and parasitism. Meeting between Partners 2 and 3 to discuss the PhD design of Mr Stephen Werne (FiBL)
- Frick, Switzerland, March 2 and 3, 2010. Meeting between Partners 2 (FiBL), 3 (INRA) and 6 (University of Catania) aiming at i) discussing the design of experiments assessing the impact on meat quality ; ii) harmonizing the measurements and iii) preparing the exchanges of samples collected by the three partners. Cross participation of the University of Catania to the slaughtering of animals in the experiment performed by FiBL in October 2010 has been planned.

Outlook

- April to October 2010 is the period when the four main field experiments will be performed in Greece (work package 2.1), Switzerland (work package 2.2), Italy (work package 2.3) and France (work packages 2.2 and 2.3).

More information

- Information about subproject 2 is available at the LowInputBreeds project homepage at www.lowinputbreeds.org/sheep.html

[1] RMT DevAB is a French technological network, 'Development of Organic Farming'. It was founded in 2008. Its aims are to identify development strategies for organic farming and to organise knowledge transfer with the wider agricultural sector. More information is available at www.devab.org.

[2] The Seminar 'Challenging strategies to promote the sheep' took place from October 14-16, 2009 in Leon, Spain. It constituted the 13th Seminar of the FAO-CIHEAM Sub-Network on Sheep and Goat Nutrition. CIHEAM is the Mediterranean Agronomic Institute.

> Report from subproject 3: 'Pig production systems'

Jascha Leenhouwers[1]

Review of the past six months

During the period October 2009 – April 2010, the pig breeding research in subproject 3 made adequate progress. Some of the advancements made are:

› Results of a Dutch study on breeding replacement gilts for organic farms were submitted to a peer reviewed scientific journal.
› In order to identify the most suitable breeds for organic and low input pig production systems, a large body of literature was collected on performance of traditional vs conventional breeds. Additionally, local breed performance data are being collected as part of a survey in different climatic zones in Europe.
› Sample collection for DNA profiling has been prepared for two large (outdoor) farms in Spain and UK. These data will be used to develop and implement an effective selection strategy to reduce pig mortality between birth and slaughter.
› Since heat tolerance is generally accepted as a robustness trait, the objective of another part of SP3 is to identify genetic differences within and between sow lines. During the last 6 months the model to analyse data has been developed further and an abstract has been submitted and accepted for the upcoming ASAS conference in Denver, Colorado, USA.[2]
› By the end of 2009 the first sows were inseminated with either semen from boars with average or high piglet survival records to test different gilt rearing and lactation systems.

Outlook with regard to next period

› On June 10th, the second progress meeting of subproject 3 (pig production systems) will take place in Amsterdam.
› Later in 2010, results of the literature study and technical survey of traditional versus conventional breeds will be combined in a scientific publication to be submitted to a peer reviewed scientific journal.
› Two papers on the effects of heat stress on farrowing rate and litter size, respectively, will be submitted to peer reviewed scientific journals.
› In the spring of 2010 the first litters will be born and the first step of the trial will be that these piglets will be reared organically or conventionally and mated in the end of 2010.

More information

› Information about subproject 3 is available at the LowInputBreeds project homepage at www.lowinputbreeds.org/sp3.html

> Report from subproject 4: 'Laying hens'

Thea van Niekerk[3]

Review of the past six months

In the past six month much effort has been put in collecting information from 100 commercial farms with laying hens in Switzerland, The Netherlands and France for work package 4.1.1, task 1 (questionnaire survey in Netherlands, Switzerland and France).

On the 15th of February 2010, the preliminary results of this inventory were discussed by the project team during a meeting in The Netherlands. In general two third of the Swiss farms and a little more than half of the Dutch farms were organic with the others keeping free range poultry.

Outlook with regard to next period

As soon as the French data are added, publications will be prepared with farm information. Also a selection of 40 farms per country will be made for ongoing recording, based on record quality but representative of farming system, type of birds and farm size. Feedback on the findings from the questionnaires will be discussed in small workshops and further participation in the project will be outlined to them.

More information

Further information about subproject 4 is available at www.lowinputbreeds.org/sp4.html

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[2] The 2010 Annual Meetings of the American Dairy Science Association (ADSA), Poultry Science Association (PSA), Asociación Mexicana de Producción Animal (AMPA), Canadian Society of Animal Science (CSAS), American Society of Animal Science (ASAS), and ASAS Western Section (WSASAS) will be held together July 11-15, 2010, in Denver, Colorado. More information is available at http://adsa.psa.ampa.csas.asas.org/meetings/2010/index.asp

[3] Thea van Niekerk, Scientific researcher (laying hens and poultry welfare), Wageningen UR Livestock Research, 8200 AB Lelystad, The Netherlands, Tel. +31 320-293549, Thea.vanNiekerk@wur.nl, www.asg.wur.nl

Forthcoming events

> Project event

May 26, 2010: Workshop Economic, Environmental and Food Quality Assessment of LowInput Production Schemes – Consumer Standards and Demands, Academie Royale des Sciences, Brussels

This workshop constitutes the first workshop of work package 5.1: Economic and multi-criteria impact assessment.

9 to 10 am: Welcome and Overview by Tom Dedeurwaerdere ; first round of discussion with the participants

10 to 11.30 am Environmental, Animal Welfare, Food Quality and Public Health Assessment of Low-input Livestock Production Schemes. Presentations of each species under study, validation and comparison of quantitative data sets for the sustainability indicators relevant to the four livestock production schemes:

- Low-input Dairy Cows production: Prof. H. Simianer (University of Göttingen, Germany) and B. Bapst and Peter Klocke (FiBL, Switzerland);
- Low-input Sheep production: Marc Benoit (INRA, France) and Dr. S. Sotiraki (Nagref Greece);
- Low-input Pig production: Prof. S. Edwards (UNEW, UK) and Jan Merks (IPG, The Netherlands)
- Low-input Laying Hens production: F. Leenstra (WUR, The Netherlands) and Dr. V. Maurer (FiBL, Switzerland).

12 to 1 pm: Governmental Intervention Options

- Governmental Intervention Options, Instruments and Measures to Deliver Public Goods in Agriculture: Irene Hoffmann (FAO).
- Civil Society Perspective on Standards for Labelling and Direct Consumer Markets: Lord Peter Melchett (Policy Director of the Soil Association, UK).

2.30 to 4 pm: Standards for Labelling and Direct Consumer Markets. Presentations on existing labelling initiatives and on direct farmer/consumer standards (identification of consumer related food quality and environmental demands)

- Speaker from IFOAM Participatory Guarantee System: Jordy Van Akker (Nature et Progrès, France)
- Speaker from European Producers' Association: Christophe Derrien(Copa-Cogeca)

4 to 5.15 pm General Roundtable Discussion

The workshop is public and without registration fee.

- Workshop contact

Fulya Batur, Université catholique de Louvain, Belgium, fulya.batur@uclouvain.be
For updates please check http://www.lowinputbreeds.org/events-lib.html

> Further events

July 11-15, 2010: 2010 Annual Meetings of the American Dairy Science Association (ADSA), Poultry Science Association (PSA), Asociación Mexicana de Producción Animal (AMPA), Canadian Society of Animal Science (CSAS), American Society of Animal Science (ASAS), and ASAS Western Section (WSASAS)

Location: Denver, Colorado, USA

More information is available at the Conference homepage at adsa.psa.ampa.csas.asas.org/meetings/2010/

August 1-6, 2010: 9th World Congress on Genetics Applied to Livestock Production

Location: Leipzig, Germany

The 9th World Congress on Genetics Applied to Livestock Production will take place from August 1-6, 2010 in Leipzig, Germany. For more information see the conference homepage at www.WCGALP2010.org

August 23-27, 2010: 61st Annual Meeting of the European Association for Animal Production in Crete

Location: Heraklion, Greece

The 61st Annual Meeting of the European Association for Animal Production in Crete will take place in Heraklion, Crete Island, Greece. For more information see the conference homepage at www.erasmus.gr/en/congresses/athens/2010/eaap_2010/invitation/

Imprint
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This newsletter is available at project website www.lowinputbreeds.org. The newsletter is published every six months.