LowInputBreeds

Issue 7 December 2012

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

Dear Readers,

With this newsletter we are informing you about progress in subprojects of LowInputBreeds. Our thematic article in this issue, from Alexandros Stefanakis and Nikolaos Voutzourakis, explains breeding values for selective traits of Skafiano sheep.

We would particularly like to draw your attention to the **third Symposium of the LowInputBreeds project**, which will take place in Nantes, France, from the 26th to the 30th of August 2013. LowInputBreeds will manage a session **"Breeding and Management in Low Input Production Systems"** as a contribution to the 64th Annual Meeting of the European Federation of Animal Science (EAAP) meeting. This is an ideal opportunity to share findings from the project and we would like to encourage all to submit abstracts by March 1, 2013. For more information see page 16 of this newsletter and our website at www.lowinputbreeds.org.

On the advice of a group of independent assessors we have invited **3 new partners to join our LowInputBreeds consortium** to bring in additional expertise and data to subproject 1 on cattle. The following institutions are admitted: The Department of Veterinary Science and Public Health (DIVET) of the Faculty of Veterinary Medicine at Milan University, Italy, the Department of Animal Breeding and Product Quality, Animal Production Research Centre, Nitra, Slovakia and the Irish Agriculture and Food Development Authority – Teagasc. We welcome these partners to our group and look forward to their contribution to LowInputBreeds.

Veronika Maurer, scientific coordinator and

Gillian Butler, coordinator

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Breeding values for selective traits in Skafiano sheep

Alexandros Stefanakis[1] and Nikolaos Voutzourakis[2]

Sheep and goat rearing has always been a very important sector of the Greek economy. Those animal species are well adapted to the local climate and landscape offering a high variety of animal products and at the same time contributing to the preservation of the natural semiarid landscape.

A discrete characteristic of Greek small ruminant farming is the presence of different local breeds. These animals started off by mixing genetic material from different origins and evolved mainly through natural selection rather than strategic breeding schemes. The observed differences between the Greek breeds reflect not only the diverse genotypes but also the different agro-climatic conditions, seasonal feed availability, reproduction and sanitary characteristics of the animals.

The different mountainous and lowland sheep breeds of the Greek mainland and islands represent wide-ranging genetic diversity. By applying selective breeding, this can be used to improve productivity, optimize the use of local resources such as pasture and create products with distinct quality characteristics.

Cretan sheep breeds

"Sfakiano"," Anogiano" and "Asterousiano" are the 3 native sheep breeds on Crete. The breed with the greatest population on the island is Sfakiano, while the other two are mostly located in areas from which their name originates (i.e. Anogia village on the Psiloritis Mountain and the Asterousia mountains respectively).

Ram of the "Anogiano" breed

The Sfakiano breed

Sfakiano takes its name from its region of origin. From there it spread to the rest of Crete, with farmers selecting for its special characteristics; with minimal needs and resistant to harsh conditions. The skin and wool colour and productive traits are similar to Italian breeds thought to have been brought to the island during its occupation by the Venetians during Medieval times, as in other regions of Greece.

Ewes have a medium-sized head with a roman nose. The ears are mid-sized, horizontally placed on the head and covered by short fleece. Other naked parts of the sheep covered with small hair are the head, neck, chest, belly and legs. The dominant color on these is white, although black spots may be present. Head characteristics are more intense for rams and the hair covering the naked parts is slightly thicker than in females. The wool is characterized as carpet wool type, mixed-haired and thin-tailed; hairs of spiral or wave shape. Mean ewe body weight is around 40 kg with height and length around 57 and 65 cm respectively. Morphologically, udders are characterized mainly as type 3 which makes them suitable for machine milking.

Regarding productive traits, Sfakiano sheep show early maturation initiating reproduction life at 8 to 9 months and can continue being productive until the age of 8 years. Seasonal anestrous is very short as to be considered absent and on average ewes carry 1.2 to 1.3 lambs per lambing or up to 1.7 lambs in more intense production systems. Sfakiano sheep is considered to be the best yielding of the mountainous Greek breeds with the ewe producing 120 to 150 kg of milk per season, although this can be doubled with intensification and increasing inputs. Although meat yield from lambs is low, its sensory and quality characteristics are highly desired among Greeks consumers.

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Sheep of "Sfakiano" breed

Targeted traits for selective breeding

Modern perspectives on small ruminant genetic improvement ought to include establishing targeted selective traits based on local characteristics and could aim to produce high quality PDO (protected designation of origin) products without disrupting the equilibrium of the local ecosystem. With this in mind, sheep genetic improvement should be accomplished without negatively affecting the existent genetic diversity of local breeds and their long term adaption to their environment. Therefore, in order to advance animal husbandry on Crete and other islands the establishment of the targeted selective traits ought to:

- be in accordance to the content and aims of the European Union's Common Agricultural Policy, which prioritizes social dimension of agriculture production and the overall social benefit, production of local products of high quality, while protecting the environment and preventing climatic change;
- take into consideration factors that contribute to production cost, as they exist in the given structure and organization; and
- reflect on expected demands of today's markets and consumers.

Taking this into account, Sfakiano sheep characteristics that present high value for selective breeding are:

a) high resistance and adaption ability to semi-arid climate;
b) ability to exploit low -quality pastures of the rough mountainous terrain;
c) absence (nearly) of an anestrous season, which could allow development of year round production (targeting milk and meat to be available when the prices are higher);
d) high fertility rate during the main breeding period (over 90%) but also during anestrous which allows production optimization;
e) Udder morphology with a very good adaptation to machine milking, which helps in mastitis prevention and favours their use in semi-intensive and intensive production systems;
f) excellent behaviour and temperament of ewes regarding lamb protection and raising;
g) the milk yield potential of ewes, which is of the highest among breeds of similar size and allows their use in production systems of differing intensity and also in genetic improvement of other mountainous sheep breeds.

Pictures: Anogiano and Asterousion sheep in typical production systems

Pictures: Smaro Sotiraki, Hellenic Agricultural Organisation - Demeter

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Pictures of Sfakiano sheep

Pictures: Smaro Sotiraki, Hellenic Agricultural Organisation - Demeter

Background and progress reports from the subprojects

Subproject 1: Dairy cow and beef cattle production systems[1]

Michael Kramer[2], Gillian Butler[3], Sven König[4], Sokratis Stergiadis[5], Anna Bieber[6] and Henner Simianer[7]

Analysing phenotypic and genomic data of the Brown Swiss population (work package 1.1)

Within our LowInputBreeds subproject, we estimated genetic parameters for some new functional traits in a first complex. Based on phenotypes of 1,800 cows from 40 Swiss dairy herds we estimated relatively high heritabilities for the behavior traits *rank order in herd, general temperament, aggressiveness* and *milking temperament* of 0.186, 0.387, 0.107 and 0.038, respectively. The high heritabilities lead to reasonably high accuracies of breeding values, and differences in accuracies between phenotyped cows and bulls with more than 10 daughters are small. This is a promising result since these breeding values will be used in a genomic selection scheme based on 700k genotypes and a mixed dataset of proven bulls and phenotyped cows. We also estimated a heritability of 0.283 for the novel conformation trait *position of labia*, which is highly correlated with urovagina (a diagnosis with high influence on fertility) but is easier to observe and so can help to improve fertility of dairy cows. To our knowledge we are the first to estimate genetic parameters for this trait. Based on an exact measurement of udder depth (cm above hock) we estimated a heritability of 0.420, which is also distinctly higher than heritabilities based on routinely used subjective scores normally used for breeding value estimation.

As a second trait complex we estimated heritabilities for milk composition (at the udder quarter level) on basis of milk samples taken close to drying off. Our results showed that content of fat and protein in milk from front quarters is significantly ($p < 0.05$) higher than in milk from rear quarters, whereas lactose content is significantly ($p < 0.05$) higher in rear quarter milk. No differences were found for urea content and somatic cell score (SCS) between quarters. As to the heritabilities, we estimated higher heritability of fat content, for rear compared to front quarters ($\approx$ 0.10 vs. 0.13) whereas the heritability of protein content and SCS is higher for front quarters ($\approx$ 0.27 vs. 0.16 and 0.26 vs. 0.16). No differences between the udder quarters were observed for heritability of lactose content and urea content ($\approx$ 0.12 and 0.14). From these results we conclude that SCS, fat and protein content from front and rear udder quarters can be treated as different traits, whereas lactose and urea content of milk from different quarters should be treated as the same traits. To set up a genomic selection scheme for these new traits based on the cow phenotypes, we obtained 700k SNP data from 3,908 animals (proven bulls and phenotyped cows). The SNP data are partly imputed from 54k (n = 3,114) to 700k (n = 794) and one challenge to overcome is that the genotyped population appears as 2 distinct groups or stratified –see figure X with Original Braunvieh

[1] The work packages of subproject 1 "Dairy and beef cattle production systems" are:

Work package 1.1 Development of within breed selection systems to improve animal health, product quality and performance traits; comparing genome-wide and traditional quantitative-genetic selection

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

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

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shown as blue and Brown Swiss animals as red. This stratification was found to cause a bias in the first attempts to estimate a genomic breeding value, and next we will develop and test solutions for this problem.

In addition, fatty acid analysis of approximately 1800 milk samples collected from genotyped cows in 40 low input farms has been completed. Findings will allow the comparison of milk quality with differing proportions of Brown Swiss, season, grazing intake and altitude, management and season. Results have been statistically analysed and a paper is in progress towards submission to Journal of Dairy Science.

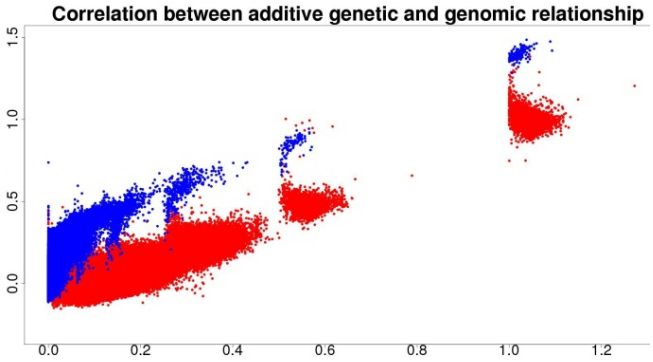

Figure: Additive genetic (x axis) vs. genomic (y axis) relationship of animals with available genotypes. Blue: relationships with involvement of Original Braunvieh; red: pure Brown Swiss animals.

Development of improved cross breeding strategies to optimise the balance between "robustness" and performance traits (work package 1.2)

In work package 1.2 (development of improved cross breeding strategies to optimise the balance between "robustness" and performance traits) approximately 1000 cows were selected from 17 low input dairy farms representing a wide range of cross breeding types in UK. Cows were mainly crossbreds between black & white dairy cows (Holstein, British Friesian, New Zealand Friesian) and alternative breeds covering Jersey, Ayrshire, Scandinavian Red, Brown Swiss, Montbelliarde and Shorthorn. Milk samples have been collected on 4 occasions throughout 2011 and 2012 representing both grazing and housed periods. Milk fatty acid analysis and collection of records of nutrition, health, fertility and breeding are in progress.

In addition, the statistical analysis of data from the 1st oilseed supplementation trial is now finished, and a paper discussing its results is under review on Journal of Dairy Science. A follow up feeding trial was performed in winter 2012, investigating the impact of naked oats and full fat rapeseed supplementation of organic and conventional diets on cow health and milk quality, including fatty acid profiles. Milk samples from 80 cows on 5 occasions and blood samples were collected and analysed for fatty acid composition. Results are under statistical analysis.

In the remaining project time, in work package 1.2 fatty acid analysis of milk samples from the UK crossbreeding dairy survey will go on while collection of records of nutrition, health, fertility and breeding is due to finish in December 2012. Statistical analysis and dissemination of the results through scientific journals, conferences and other public meetings will be performed.

Evaluation of low input breeding program designs (work package 1.3)

In comparison to conventional breeding programs, dairy cattle breeding for organic or low input production systems reveals three major differences:

1.) the small population size,

2.) the definition of alternative breeding goals with an emphasis on 'new phenotypes' linked to functional traits like animal health and welfare, and

3.) utilization of natural service sires as well as artificial insemination.

In realizing their objectives, organic breeders have two options: Selecting sires from conventional breeding programs, or to establish their own organic breeding program. In order to evaluate these breeding strategies, a *stochastic simulation* was performed using true breeding values of selected sires and their inbreeding coefficients as the main evaluation. The original simulation program was developed by partner University of Guelph , subsequently modified to consider questions specific for low input farming like: genotype by environment interactions, and the distribution of cows and bulls to organic farms in order to mimicking within herds selection strategies. In brief, a large conventional population of 148,800 cows in 2,976 herds

(averaging 50 cows per herd), and a small low input population of 1,200 cows in 60 herds, were simulated for a low heritability functional trait ($h^2 = 0.05$), and for a production trait of moderate heritability ($h^2 = 0.30$). Selection criteria of young bulls in the low-input production system were considered either 'conventional' breeding values, or genomic breeding values. In selecting young bulls from the conventional population, genotype by environment interactions were accounted for by altering genetic correlations between both production systems (conventional and organic/low-input) in increments of 0.1, from 0.5 to 1.0. The crucial parameter for the success of genomic breeding program is the accuracy of genomic breeding values; these were studied with values ranging between 0.5 and 1.0.

Results suggest 'true breeding values' are only better using the genomic breeding values from the larger conventional population (rather than the low-input population) by neglecting G x E interactions, and assuming a genetic correlation of both systems is close to one. This is especially relevant for 'new health traits'; with which we expect genetic correlations between conventional and organic environments to be below the critical threshold of 0.80, indicating a genotype by environment interaction. A breeding concept based on genotyped sires used for natural service is competitive with a conventional AI breeding program for sufficiently reliable genomic breeding values (accuracy > 0.80), and genetic correlations of $r_g < 0.80$ between production systems.

We observed minor differences in inbreeding coefficients when comparing the selection strategies in both production systems. The observed trend of less inbreeding when applying genomic selection suggests additional opportunities offered by genomic breeding. To summarize, we have generated a simulation tool to analyse breeding strategies for dairy cattle which can address questions relevant to low input and organic systems of production including economic modeling or optimization of a calibration group for genomic selection.

Subproject 1: Three new partners bringing additional expertise

Gillian Butler[1]

On the advice of a group of independent assessors we have invited 3 new partners to join the LowInputBreeds consortia to bring in additional expertise and data to subproject 1 on cattle. We are completing paperwork necessary to admit:

- Rita Rizzi, The Department of Veterinary Science and Public Health (DIVET) of the Faculty of Veterinary Medicine at Milan University, Italy
- Peter Polák, Department of Animal Breeding and Product Quality, Animal Production Research Centre, Nitra, Slovakia
- Donagh Berry, Irish Agriculture and Food Development Authority – Teagasc

Department of Veterinary Science and Public Health (DIVET) of the Faculty of Veterinary Medicine at Milan University, Italy

Rita Rizzi will be working with Carora cattle in Venezuela, originating from Creole cattle crossed with Brown Swiss and raised mainly for milk production under intensive and extensive systems. Carora bulls are currently used in Holstein herds to obtain a productive crossbred cow adapted to the tropical climate or with *Bos indicus* cows to give *"doble proposito"* animals. The primary selection object has been milk quantity and quality although attention is also given to heat tolerance. Bulls are routinely evaluated visually for hair length since the ability to maintain body temperature in hot environment is associated with sleek, dense coats. Milk yield is positively associated with heifers' live weight at 18 months; however, as size increases nutrient requirements increase, leading to higher feed costs and reduced incomes especially for smallholders. This has resulted in a massive exploitation of pastures with negative environmental consequences for additional grazing and land conversion (e.g. forest clearing).

Pedigree records from 1992 are available for live weight at specified ages and throughout lactation

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both in purebred Carora and crosses with *B. taurus* and *B. indicus* breeds as well as test-day and 305d milk yields, mainly in purebred Carora. The Breed Association is going to modify breeding objectives, giving more emphasis to milk yield per unit of [metabolic] weight rather than to milk yield *per se*, in order to increase sustainability reducing grazing pressure maintaining the same productive level and also improve heat tolerance.

Department of Animal Breeding and Product Quality, Animal Production Research Centre, Nitra, Slovakia

Peter Polák will consider beef traits for Slovak Pinzgau (or Slovak Pinzgauer) cattle in Slovakia; a local mountain breed recognised as part of European animal genetic resources. The breed originated in Pinzgau region near Salzburg in Austria and bulls were first imported to Slovakia more than 250 years ago. Since this time autochthonous Carpathian Gray and Carpathian Red cattle from the North mountain regions of Slovakia have been continuously crossed with original purebred bulls. The breed Slovak Pinzgauer was established in 1950s from a local population of Pinzgauer cattle in Slovakia. Historically the breed was kept as triple purpose (milk, draught and meat) although providing power disappeared after mechanisation of field production. At present a reasonable proportion of breeders have stopped milking due to the competition of specialised dairy breeds. However over the last 50 years the breed has been improved almost equally in milk and meat production, although beef production traits were neglected in selection. Muscle development of hind-quarters is not sufficient to compete with foreign finishing cattle. However, because the breed is fully adapted to the harsh conditions of Carpathian Mountains by its excellent walking and grazing ability and robustness (health and fertility) it is popular in low input systems of suckler cow production (cow – calf unit). For cow – calf production schemes maternal traits are important, such as nursing ability, easy calving, milk ability etc. and meat production traits (growth intensity and body conformation). This subproject aims to design a new evaluation protocol for Slovak Pinzgauer cattle to support meat production traits while maintaining the excellent maternal traits and growth rates under the conditions of mountain low input and organic production.

Irish Agriculture and Food Development Authority – Teagasc

Donagh Berry and colleagues at Teagasc have been comparing breeds for grazing based systems in Ireland for many years, considering Holstein-Friesian, Jersey, Montbeliarde, Norwegian Red and their crosses. Extensive genotype and phenotype records have been collected on large populations of both purebred and cross-bed cows kept under low-input grazing systems. Data has accumulated under a range of national and EU projects, however, further useful information can be derived from these records. Phenotypic records will be used to derive previously un-quantified lactation profiles for alternative aspects of milk quality such as fat, protein, lactose, urea, casein and fatty acid content of milk from low-input grass-based dairy cows, evaluating breed, parity or experimental treatment differences and corresponding benefits of heterosis.

We welcome these partners to our group and look forward to their contribution to LowInputBreeds.

Subproject 2: Sheep production systems[1]

Smaro Sotiraki[2], Nikolaos Tzanidakis [3], Nikolaos Voutzourakis[4], Alekios Stefanakis[5], Veronika Maurer[6], Felix Heckendorn[7], Steffen Werne[8], Sophie Prache[9], Alessandro Priolo[10], Hervé Hoste[11]

Workpackage 2.1: Development of within breed selection systems

Phenotyping of Sfakiano sheep

For nearly 2 years (December 2009 to October 2011), the phenotypic performance of 800 Sfakiano ewes in Crete was monitored along with their responses to abiotic (temperature) and biotic (mastitis, parasitic infections of gastrointestinal nematodes) stress. Findings have been presented to the scientific and farming communities and can be summarized as follows:

- Influence of sheep management systems on animal health and product quality.
  In these last six months, the final microbiological examinations on milk collected from the main experiment in Crete were completed. Apart from the management system, the time of year also seems to play a role in subclinical mastitis cases; compared to semi-intensive reared ewes, those in extensive production showed less udder infection, especially in spring. The completion of the sample analyses and the statistical analyses of the collected data is expected for spring 2013.
- Genotyping of sheep in different macro climatic European zones to improve abiotic and biotic stress resistance.
  Blood samples have been collected from sheep in Greece (Sfakiano), in Switzerland (one rustic Engadine and one more intensive White Alpine) breed), and France (one rustic Limousine and one more intensive Romane). In spring 2013, a research assistant from the Hellenic Agricultural Organisation - Demeter (formerly NAGREF) will visit the University of Lincoln (New Zealand) to investigate the heterogenicity of preselected molecular markers for parasite resistance, cold resistance, product quality traits for these five sheep breeds in different European conditions (Greece, Switzerland, France).

Workpackage 2.2

Controlled studies

In France (INRA Toulouse), a 42-day experiment was performed in June and early July to examine the effects on lambs (experimentally infected at 'day 0' with *Haemonchus contortus)* from the inclusion of: 0, 33%, 66% or100 % sainfoin pellets in their concentrate feed between 21 and 42 days after infection. In addition, on the last week of the experiment, some animals receive hazel nut skins as a second source of tannins to potentially complement to sainfoin. Early results show reductions in parasite egg excretion in excess of 60 % in lambs consuming sainfoin pellets. However some pathophysiological measurements are still pending, and the statistical analyses of data have to be completed.

[1] The work packages of subproject 2, Improving performance, animal health, welfare and product quality in organic and 'low input' sheep production systems:

Work package 2.1 Development of within breed selection systems to improve abiotic and biotic stress resistance and performance traits; comparing marker assisted and traditional quantitative-genetic selection systems for functional traits.

Work package 2.2 Development of improved endoparasite management strategies based on integrating (a) feed supplementation with tanniniferous forages with (b) strategic use of clean pastures and/or (c) the use of parasite tolerant breeds.

Work package 2.3 Development of strategies to improve lamb meat quality based on optimising (a) TF feed supplements (b) grazing regimes and/or (c) the use of stress tolerant breeds

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[9] INRA, UR1213 - Unité de Recherches sur les Herbivores, 63122 Theix, France

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In autumn 2012, atrial of alternative lambs feeding is in progress in Crete, supervised by NAGREF. As in France, lambs were experimentally infected with gastrointestinal parasites (*Haemonchus* spp and *Trichostrongylus* spp this time) and separated into groups fed with or with-out a carob based concentrate feed, using polyethylene glycol to detect if tannins or non-tanniniferous components in carob have anthelminthic activity.

Flowering sainfoin in an experimental unit. Picture: Steffen Werne, FiBL

Field studies

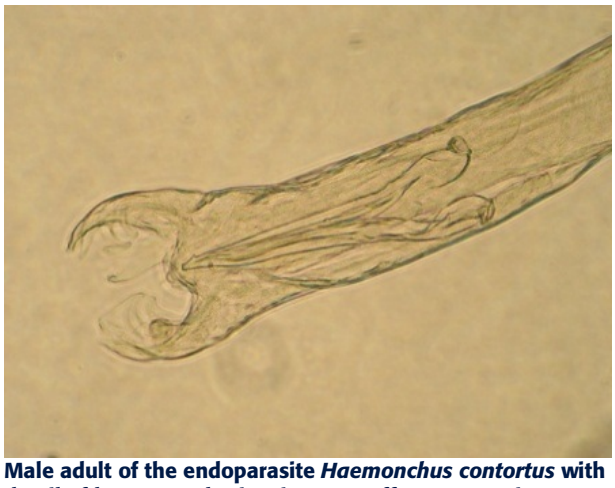
In Switzerland (FiBL) the main activities during the past 6 months have been:

(i) preparation of a manuscript for publication on the investigation into the use of sainfoin and faba bean seeds to reduce the periparturient parasite egg rise in ewes (task 1) and

(ii) identification and counting of gastro-intestinal nematodes originating from sheep in another major trial (task 2).

The manuscript on the periparturient ewes was submitted recently. The categorized nematodes will provide the fundament for the evaluation of the impact of sainfoin feeding, breed difference and pasture management on gastrointestinal nematodes of lambs for meat production. Initial results indicate a variable impact of sainfoin on the different nematode genera of the two breeds used, however, no conclusions can be drawn yet as statistical analysis is on-going.

In France (INRA Toulouse), the last year of the 3 year-study into the effects of feeding lambs sainfoin at weaning has now been completed but worm counts within the digestive tract are still in process. The results on egg excretion suggest a transient negative effect when sainfoin is eaten but followed by a return to values comparable to control when the consumption stops.



Male adult of the endoparasite *Haemonchus contortus* with detail of bursa copulatrix. Picture: Steffen Werne, FiBL

Gathering lambs for the weekly health check. Picture: Steffen Werne, FiBL

Work package 2.3

In year 4 of the LowInputBreeds project, INRA Theix (France) has performed two experiments:

› the fourth year of the experiment on "Effect of management practices on lamb meat quality" according to the schedule proposed in the Technical Annex (WP2.3.1., TASK 1) has been performed between March and October 2012.
› Two levels of mineral nitrogen fertilisation and two levels of concentrate supplementation were compared for finishing lambs in a 2 x 2 factorial design. Mineral nitrogen fertiliser was applied at 0 (organic) and 100 kg N/ha (non organic) and concentrate feed offered at 0 or 300 g barley per lamb per day. Forty-eight Limousine male lambs were classified into 12 *blocks* and assigned to 1 of 4 treatments.

An experiment to determine the dose-response relationships between the proportion of legumes in lamb diets and the sensory and nutritional quality of meat (WP2.3.1., task 3) took place between June and September 2012.

Fresh lucerne (mown daily) was fed at 0, 20%, 40% or 60% of the diets of 36 male Romane lambs grazing a monoculture of cocksfoot. The data are currently analysed.

And finally, the partner in Italy at University of Catania, is currently preparing articles for publication based on results from experiments described in the previous Newsletters[1] of the LowInputBreeds project.

Dissemination of results

› FAO-CIHEAM Network on Sheep and Goats. 14th International Seminar & 2nd Symposium of LowInputBreeds, Hammamet, Tunisia 15th to 18th May, 2012.[2]
› One day workshop, organized by NAGREF in Rethymno, Crete, with the participation of the farmers involved in the project and representatives of the local authorities, 5th of August 2012. See also report from the workshop on page 15 of this Newsletter.

[1] The Newsletters of the LowInputBreeds project are available at http://www.lowinputbreeds.org/newsletter-archive.html

[2] The abstracts of the LowInputBreeds papers presented at this seminar are available at the project website: http://www.lowinputbreeds.org/symposium-2012.html

Subproject 3: Pig production systems[3]

Jascha Leenhouwers[4]

Review of the past six months

The breeding of a new robust sow line has started on several nucleus farms in Southern Europe, including Spain and Portugal. The breeding goal of this line is characterized by greater emphasis on robustness traits, such as vitality, longevity, and ease of use. The line will be part of a commercial cross, specifically to be used in challenging environments, such as low-input and organic production systems.

Previous results confirmed that genetic variation exists for heat stress resistance and can be used to breed sows better able to withstand high temperatures. Recent results have identified the most sensitive periods (in terms of farrowing rate and litter size) during the sow reproduction cycle and this information will be used to optimize breeding for heat stress resistance. In Brazil, research is being conducted to find genes involved in heat stress resistance.

Preliminary results on the effects of rearing environment on mothering ability of sows show maternal behaviour is affected by genetics of the sow (high *vs.* low genetic merit for pig survival) and lactation environment (conventional *vs.* organic rearing). More specifically, organically reared sows of high genetic merit more frequently lie with their heads towards the piglet nest, which results in more frequent and intensive contacts with piglets - this could lead to higher piglet survival.

[3] The work packages of subproject 3, Improving performance, animal health & welfare and product quality in organic and 'low input' PIG production systems:

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.

Work package 3.2 Effect of management innovations (gilt rearing and lactation systems) on mothering ability of sows as well as pre- and post-weaning diarrhoea and losses of piglets.

Work package 3.3 Effect of traditional, improved and standard hybrid pig genotypes and feeding regimes on carcass, meat and fat quality in heavy pigs used for premium, regional pork products.

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Outlook for the next period

With regard to heat stress, research will focus on the effects of early life experiences on subsequent reproductive performance of sows. For example, sows conceived in a non-heat stress foetal environment may be better adapted to heat stress later in life compared with sows conceived during time of heat stress by their mothers. Accounting for early life experiences will lead to a more efficient breeding strategy for heat stress resistance. The scope of heat stress will be widened to a more general *robustness* concept (i.e. 'problem-free piglet production') with the objective to breed pigs with enhanced ability to withstand challenges of disease, climate, management or feed changes.

In 2013, large amounts of data will be collected on the effects of rearing environment and sow genotype on maternal behaviour and piglet health.

Fatty acid composition in fresh meat and boar taint hormones will be assessed by a large scale survey covering three countries (UK, Netherlands, Spain); three seasons (spring, summer and winter); two genders (male/female) and two low input system types (pasture/indoor). Sampling will commence in December 2012 and will continue throughout 2013.

The effects of pig genotypes (Angeln Saddleback vs. Piétrain*Angeln Saddleback vs. Modern hybrid genotype) and roughage type (straw vs grass clover silage) on meat quality of air-dried sausages will be analysed. Lastly, calculations will be performed on the economic performance of heavy pig production systems.

Farrowing pens with and without additional pasture with mobile fences. Picture: Herman Vermeer, WUR.

From the first hour after access to the pasture at one week of age the piglets start to root. Picture: Herman Vermeer, WUR.

The pasture area is only accessible for the piglets, the sows stays at the concrete part of the outdoor run. Picture: Herman Vermeer, WUR.

Subproject 4: Laying hen production systems[1]

Ferry Leenstra[2]

The poultry activities in the LowInputBreeds project focus on free range and organic laying hens. In France, Switzerland and The Netherlands a large number of different commercial types and brands of layers is used for free range and organic egg production. Average production data generally is lower than that for laying hens kept inside. The general idea of farmers is, for a production system with outside access, a hen is required to eat more than and handle greater variability in environmental conditions than in house production. In 2012 farmers with organic laying hen in The Netherlands tested two alternative genotypes, here identified as A and B, that are expected to have this higher eating capacity and might be suitable for outside systems. Both genotypes were reared with a standard commercial genotype, here indicated as C. During rearing both novel genotypes performed well, although body weights of A and B pullets were slightly lower (instead of higher) than C pullets. The results in the laying period were not all as expected. Genotype A was tested on 10, mostly small, organic farms (60 – 750 animals per flock). The flock of 750 A hens was compared on a farm which also kept C hens. Genotype B is still being tested in one flock of 120 and one flock of 3000 animals where they are compared with C hens from the same rearing. Egg production of A and B lines was below that of more usual genotypes in organic systems, while genotype A suffered from loss of feathers in all cases and showed naked areas. When tested in cages and on a conventional diet, hens of genotype A had an egg production slightly below more usual genotypes, but also a lower mortality. Genotype B is performing very well in the flock of 120 hens, but feather pecking and mortality is higher in the flock of 3000 hens, when compared to C. We have no clear indications for the undesirable results of the A and B genotypes in non-cage systems. The roles of rearing, housing, and dietary composition in relation to genotype might be something for further exploration.

To get more insight in management and dietary factors important for hens with outside access, farm visits have been carried out in participating countries. These consider the hens themselves: genotype, diet and supplements (grains, forage, minerals, stones, supplements to drinking water) provided and laying out and use of the range area. Also keel bone deformation, foot condition and feather condition are assessed using a common protocol. The first results show foot pad problems and abnormalities in the keel bone are quite common, and thus a point of attention.

Some results of the project were discussed at the 2nd IFOAM Animal Husbandry Conference in Hamburg, Germany (September 2012) where there was enthusiasm for the approach and comparisons between organic and free range egg production and discussion on the magnitude of differences between genotypes.

During the farm visits information on egg quality are recorded from the farmers and, where possible, feedback from egg traders. In this way data on egg weight, percentage of second grade eggs (dirty eggs, eggs with shell cracks, etc.), haugh units (an indicator for freshness of eggs) and yolk colour are collected. We try to get an impression of differences between genotypes and management measures in relation to egg quality.

Besides, samples are taken to determine fatty acid composition of the eggs. We will try to compare eggs from flocks with access to green pasture or getting green material or silage in addition to their feed, with flocks receiving less vegetation. We are interested in differences between these groups as well as variation in egg composition within the same farm and throughout the year.

[1] The work packages of subproject 4, laying hen production systems:

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

Work package 4.2 Effect of, and interactions between, laying hen genotypes, feeding regimes, 'welfare-friendly' moulting protocols and prolonged use of layers on performance, and animal health and welfare

Work package 4.3 Effect of, and interaction between, laying hen genotypes and management innovations on egg quality

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Report from a meeting about the Sfakiano sheep in Crete in Summer 2012

Smaragda Sotiraki[1]

To meet the expectations and targets of work package 2.1.1 (Phenotyping of Sfakiano sheep for biotic and abiotic stress resistance), the Greek LowInputBreeds partner NAGREF has been monitoring in 20 flocks of sheep in Crete for mastitis and parasites under different management and environmental conditions. This recording, over 2 years, was completed in January 2012 and relied on full support of participating farmers.

To show our gratitude, we organize a get-together between us (the researchers group) and the 20 farmers to thank them and present results on their animals, in an effort to explain how targeted research can find solutions.

A one-day workshop followed by lunch was held in the relaxed atmosphere of a restaurant in the village of Spili in the Rethymno district of Crete on 5th of August 2012. The audience was a mix of local regional authorities and the farmers and researchers participating in the project. The main presentations with results were given by the two PhD students (Mr Nikolaos Tzanidakis and Mr Nikolaos Voutzourakis), who performed the sampling procedure and gathered the data. Moreover, Professor Carlo Leifert from Newcastle University gave great insights on the future of agriculture in Europe.

The presentations were followed by a long vivid discussion and our *take home message* was that: farmers were more than satisfied to be a part of such a research effort and appreciated all the information collected to develop strategies to support them. The great benefit was the support we got from all those farmers who volunteer to participate in all our future research efforts.

N Christodoulakis, T. Patenas – two of the farmers involved in the project

N. Tzanidakis and N. Voutzourakis of NAGREF discussing with the farmers

Carlo Leifert of Newcastle University

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Call for papers: Third LowInputBreeds Symposium/64th Annual EAAP Meeting

The third symposium of the European-funded research project LowInputBreeds project will take place in Nantes, France, from the **26th to the 30th of August 2013**. It will be held in the framework of the 64th Annual Meeting of the European Federation of Animal Science (EAAP). Abstracts need to be submitted by March 1, 2013

The main theme of the EAAP meeting will be "New challenges facing animal production for diversified territories, market demands and social expectations". The programme will cover all aspects of scientific achievements within animal production, including genetics, physiology, nutrition, management and health.

At the meeting, a number of selected oral presentations and study posters from a great number of scientists from Europe and world-wide will be presented, and workshops and discussions of the latest and most relevant research in the field of animal science will take place.

Participants will see good examples of successful partnerships of international teams bringing scientists and stakeholders together. Particular attention will be paid to efficient and faster transfer of knowledge and life education of professionals in the livestock sector. This is a unique occasion for updating knowledge and acquiring new ideas, and the organizers especially encourage young scientists and students to attend.

The LowInputBreeds project will contribute the session "Breeding and Management in Low Input Production Systems" to the EAAP meeting.

Previous symposia of the LowInputBreeds project took place in 2011 in Wageningen, The Netherlands, and in 2012 in Hammamet, Tunisia.

Venue

The venue is the La Cité Nantes Events Centre, 5 Rue de Valmy, 44000 Nantes, France.

Abstract submission

Abstracts can be submitted by March 1, 2013.

Organisers

The national organiser of the 64th EAAP annual meeting is the French National Institute of Agronomic Research INRA.

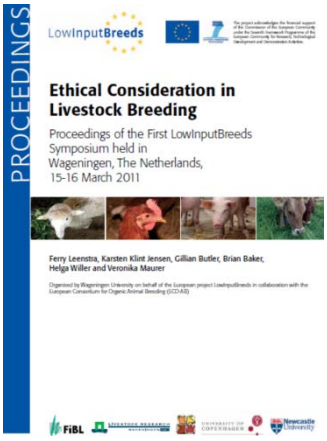
Links

www.eaap2013.org: Website of the 64th EAAP meeting with detailed information

www.lowinputbreeds.org/symposium-2013.html: 3rd LowInputBreeds symposium

Proceedings of the first LowInputBreeds Symposium now available

The first LowInputBreeds Symposium was organised by the LowInputBreeds project partners Wageningen UR Livestock Research and the Danish Centre for Bioethics and Risk Assessment of the University (CeBRA) of Copenhagen in cooperation with ECO AB, the European Consortium for Organic Animal Breeding.



The aim of the symposium was to discuss the plans and progress in LowInputBreeds in an early stage of the EU-project with stakeholders. For the symposium farmers and policy workers from governmental and non-governmental organisations were invited. Special attention was paid to possible ethical issues in organic and free range systems of livestock production as considered by the LowInputBreeds project. CeBRA had arranged for facilitators and a structure to discuss in species specific workshops these ethical issues.

The proceedings of the symposium can now be downloaded from the project website. They contain abstracts of the plenary and species specific presentations, links to the presentations and reports on the workshops per species.

Publications of the LowInputBreeds project

Publications of the LowInputBreeds project can be downloaded at the project website www.lowinputbreeds.org > Publications.

Partner list of the LowInputBreeds project

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Partner 2: Research Institute of Organic Agriculture FiBL, Switzerland, Scientific coordinator
Partner 3: Institut National de la Recherche Agronomique INRA, France
Partner 4: Wageningen UR, Livestock Research, The Netherlands
Partner 5: University of Göttingen / Georg-August-University Göttingen UGöt, Animal Breeding and Genetics Group, Germany
Partner 6: University of Catania UCat, Department of Animal Sciences, Italy
Partner 7: National Agricultural Research Foundation NAGREF, Greece
Partner 8: Federal Research Institute for Rural Areas, Forestry and Fisheries vTI, Institute of Organic Farming, Germany
Partner 9: Danish Centre for Bioethics and Risk Assessment, University of Copenhagen, UCPH-CeBRA, Denmark
Partner 10: University of Ljubljana ULju, Animal Science Department, Slovenia
Partner 11: University of Louvain UCLou, Centre for Philosophy of Law, Belgium
Partner 12: Swissgenetics, Switzerland
Partner 13: Swiss Brown Cattle Breeders' Federation SBZV, Switzerland
Partner 14: Applied Genetics Network an, Switzerland
Partner 15: Institute for Pig Genetics IPG, The Netherlands
Partner 16: TOPIGS Iberica / Pigture Ibérica, Spain
Partner 17: Institut de Sélection Animale BV ISA, a Hendrix Genetics company, The Netherlands
Partner 18: Institut National de la Recherche Agronomique de Tunisie INRAT, Tunisia
Partner 19: Lincoln University UL-NZ, Faculty of Agriculture and Life Sciences, New Zealand
Partner 20: University of Guelph UG-CAN, Centre for Genetic Improvement of Livestock, Canada
Partner 21: Federal University of Vicosa UVF, Animal Science Department, Brazil
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