LowInputBreeds

Issue 8 July 2013

**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

This has been a busy time for partners of the project, although much of the recent work has involved preparing reports rather than activities that might be of interest to a wider audience. We would like to thank all partners for their co-operation in submitting reports and responding to queries – more or less on time, despite the relatively short notice given for these tasks.

Partners have also been preparing technical notes; presenting findings from some of our research to give guidance directly to the industry – more can be read about these on page 14 of this newsletter. Again thank you to all contributors.

At the time of writing, we are approaching our 3rd Symposium (see page 14 for details) held in August in conjunction with the 64th Annual Meeting of the European Federation of Animal Science (EAAP, www.eaap2013.org), giving us the opportunity to present findings and make our work accessible to a much wider audience than in the past. Other FP7 projects are also holding satellite meetings at the conference - hence an excellent opportunity to accommodate other findings as we approach the later stages of our project.

*Veronika Maurer, scientific coordinator and*
*Gillian Butler, coordinator*

## Contents



**Third symposium of the LowInputBreeds project**

The third symposium of the LowInputBreeds project will take place in the framework of the 64th Annual Meeting of the European Federation of Animal Science (EAAP) in Nantes, France, August 26 to 30. The LowInputBreeds session "Breeding in Low Input Production Systems" (session no 42) will take place in the afternoon of August 28 and will be followed by the General Assembly of the LowInputBreeds project.

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NEWSLETTER of the LowInputBreeds project

# Lamb meat quality and low input systems: restriction of the daily access to pasture

Giuseppe Luciano & Alessandro Priolo[1]

## Background

Different situations may lead farmers to restrict the daily access to pasture for ruminants. For instance, in temperate climate conditions, the restriction of the daily grazing duration can allow to extend the grazing season in periods characterized by low herbage allowance. In Mediterranean areas, pasture availability is limited to short seasons, and the restriction of the daily grazing duration could represent an interesting strategy to preserve the swards by limiting the grazing pressure and to reduce the costs arising from attending the flock at pasture. Certainly, such strategies should not compromise animal performances and product quality. Therefore, there is a need of further research aiming at better understanding the effects of the daily restriction of the pasture availability on the performances of growing lambs and on the quality of their meat.

**Feeding of ruminants with forages at pasture according to their nature consistently improves the nutritional quality of their products. (Photo: Giuseppe Luciano)**

In the frame of the Low Input Breeds project, the research group of the University of Catania (UCat) has evaluated the possibility of reducing the daily access to pasture for growing lambs to the sole morning or afternoon, instead of the conventional whole-day pasture availability. The focus was to assess the effect of this restriction on some nutritional and technological meat quality traits and on the main animal performance parameters. Details of this study are published (Luciano et al., 2012; Vasta et al., 2012a; 2012b).

## Materials and methods

In brief, from March to May 2010, one group of lambs (group 8h) grazed on a ryegrass pasture for 8 hours (from 9 am to 5 pm). Other two groups of lambs grazed in other parcels of the same pasture for 4 hours either in the morning (9 am to 1 pm; group 4h-AM) or in the afternoon (1 pm to 5 pm; group 4h-PM). An additional group of lambs (group S) was used as negative control and was kept indoors with animals being fed exclusively concentrate feeds. Samples of pasture were collected for chemical analyses. At the end of the trial, lambs were slaughtered and muscle samples collected for the evaluation of meat quality (fatty acid composition and oxidative stability).

## Results

### Fatty acid composition of herbage and meat

Linolenic acid (LNA n-3) accounts for almost 70% of the total fatty acids in fresh herbage, and it is the precursor of all the desirable polyunsaturated fatty acids in meat. In our study, the content of LNA n-3 in the herbage was higher in the sward grazed in the afternoon than in the morning as shown in Figure 1. Although it is known that herbage chemical composition varies along the day, there is scarce information regarding the evolution of fatty acid profile in plants during the day. Previous studies demonstrated that LNA plays important roles on the photosynthetic metabolism, which might explain the variation of its concentration in leaves along the day.

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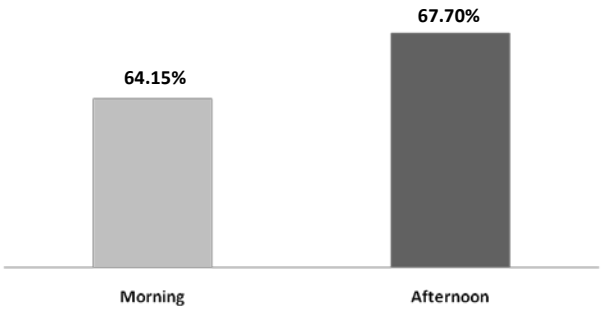


**Figure 1. Diurnal variation of linolenic acid (LNA) in pasture**

As a consequence of the variation of the fatty acid profile of the herbage during the day, meat fatty acid composition was affected by the grazing management. Compared to a morning-grazing or to a whole day-grazing management, allowing lambs to graze in the afternoon improved the fatty acid composition of meat. As shown in Figure 2, the afternoon grazing (4hPM) reduced the saturated fatty acids and increased the content of polyunsaturated fatty acids compared to the morning grazing (4h-AM) and to the 8-hours grazing system.

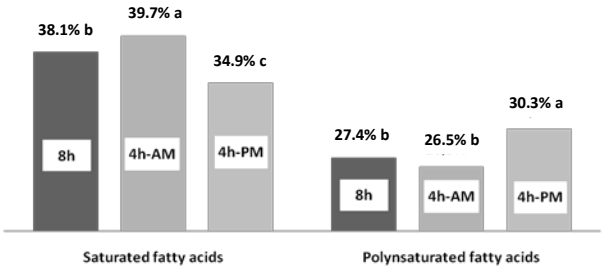


**Figure 2. Saturated and polyunsaturated fatty acids in lamb meat**

## Meat shelf life over storage duration at 4°C

Oxidative processes cause the deterioration of meat sensory and nutritional quality over time of storage and retail display. Meat shelf life can be delayed by the presence of antioxidants in muscle and some of these molecules are of dietary origin. For instance, pasture-based diets improve meat shelf life compared to diets based on concentrate feeds, because fresh herbage contains higher levels of antioxidants. However, feeding restrictions can negatively affect the antioxidant capacity of muscle.

Therefore, we have assessed whether, in lambs, a restriction of the daily access to pasture could have detrimental effects on meat shelf life.

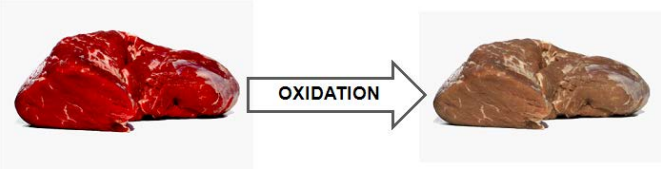


**Photo 2. Oxidative deterioration of meat**

Figure 3 shows the levels of lipid oxidation in meat over 10 days of storage. Not surprisingly, the meat from concentrate-fed lambs (group S) had the highest levels of lipid oxidation. Interestingly, lipid oxidation was low in meat from lambs grazing either for 8 hours or for 4 hours in the afternoon. These results demonstrated that a restriction of the daily access to pasture to the sole afternoon did not impair meat shelf life compared to a conventional system in which lambs grazed for 8 hours during the whole day.

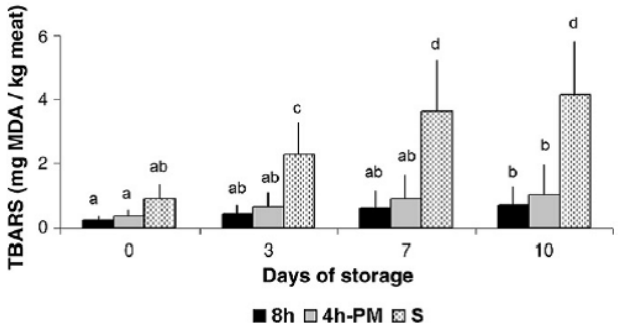


**Figure 3. Lipid oxidation measured in meat during 10 days of storage**

1) a, b, c, d: different letters indicate statistically significant differences between values
2) Lipid oxidation was measured as TBARS values expressed as mg of malonaldehyde (MDA) / kg of meat

## Lamb growth and production performances

Figure 4 shows that the daily weight gain was higher for the lambs allowed to graze for 8 hours compared to those grazing for 4 hours in the afternoon. However, interestingly, there was no difference in the carcass weight and carcass yield between the two groups. A possible adaptation of the grazing behaviour consequent to the restriction of the time at pasture could have allowed lambs to minimize

detrimental effects of such feeding restriction. Indeed, for the 4h-PM group, the restriction of the grazing duration by 50% of that allowed to the 8h lambs caused a reduction of the herbage intake of only 22.6%. This, together with the lower physical activity of the 4h-PM lambs compared to the 8h lambs, might partially explain the comparable carcass weight and yield between the groups.

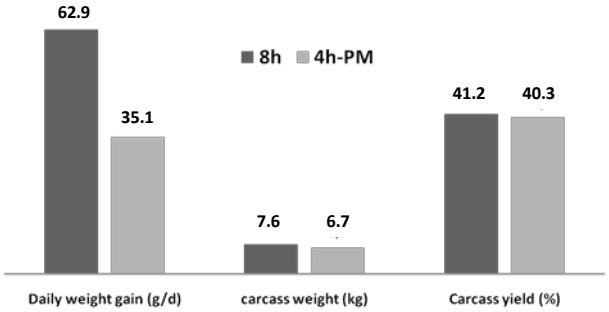


**Figure 4. Lamb growth and production performances**

Our results motivate further research aiming at better understanding the adaptation of lambs to a reduction of grazing allowance. At the moment, we conclude that grazing in the afternoon is preferable over the morning from a "meat quality" perspective.

## References

Luciano G, Biondi L, Pagano RI, et al. (2012). The restriction of grazing duration does not compromise lamb meat colour and oxidative stability. *Meat Science,* 92, 30-35

Vasta V, Pagano RI, Luciano G, et al. (2012a). Effect of morning vs. afternoon grazing on intramuscular fatty acid composition in lamb. *Meat Science,* 90, 93-98

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# 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] and Henner Simianer[6]

### First genomic breeding values for novel functional traits in the Brown Swiss population

As reported in earlier newsletters, 1,800 cows from 40 Swiss low input dairy herds have been extensively phenotyped for a wide range of novel functional traits. All these cows and most of their sires were also genotyped with single nucleotide polymorphism (SNP) arrays, where the majority of animals was genotyped with an array comprising more than 777k SNPs, while the other animals were genotyped with an array comprising more than 54k SNPs. By statistical means, the genotypes for 627k informative SNPs on all chromosomes was obtained for 1,126 animals: 930 cows with phenotype information for the novel traits observed and 196 bulls with performance records of at least one daughter.

For all genotyped animals, conventional breeding values were calculated for all traits and reliabilities were derived for cows and bulls separately. As can be seen in Table 1, there is a considerable variation of reliabilities both between traits and between sexes. Reliabilities range from 0.04 for days to first heat to 0.54 for milking speed in cows. In all cases, breeding values of cows have a comparable or slightly higher reliability than breeding values of bulls.

**Table 1: Mean reliabilities ± standard error of estimated conventional breeding values for cows (n = 930) and bulls (n = 196) for the traits observed.**

| Trait | abbreviation | cows | bulls |
|---|---|---|---|
| General temperament | GT | 0.46 ± 0.06 | 0.36 ± 0.15 |
| Milking temperament | MT | 0.09 ± 0.03 | 0.09 ± 0.06 |
| Aggressiveness | AG | 0.12 ± 0.05 | 0.12 ± 0.08 |
| Rank order in herd | RO | 0.27 ± 0.05 | 0.23 ± 0.12 |
| Milking speed | MS | 0.54 ± 0.06 | 0.40 ± 0.16 |
| Udder depth | UD | 0.46 ± 0.07 | 0.35 ± 0.16 |
| Position of labia | PL | 0.39 ± 0.07 | 0.31 ± 0.15 |
| Days to first heat | DH | 0.04 ± 0.01 | 0.04 ± 0.03 |

In the next step, estimated breeding values were used as quasi-phenotypes in combination with genotype information to derive genomic breeding values for all animals and all traits. The accuracy of these genomic breeding values was assessed via a random cross-validation.

[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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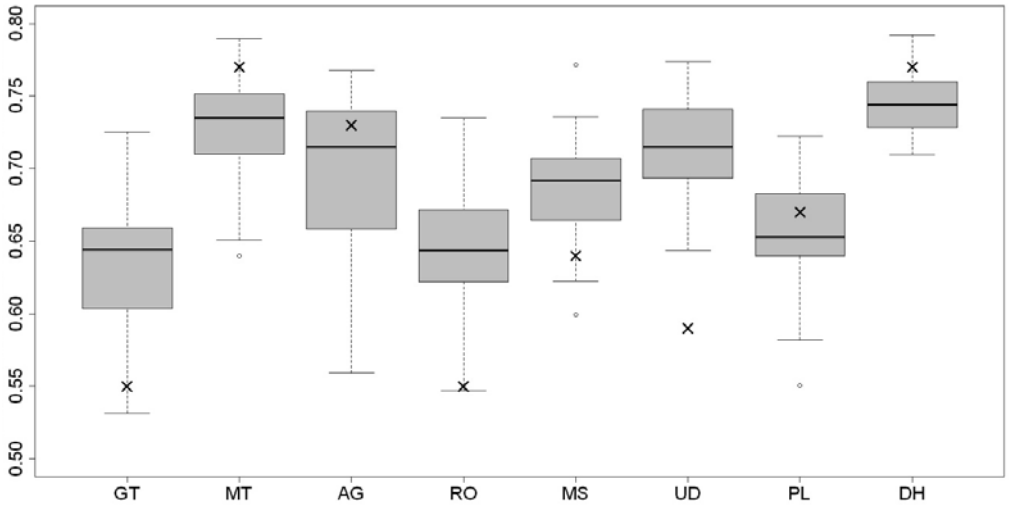


**Figure 1: Correlations between direct genomic and conventional breeding values in a random cross-validation (box-plots) and for the 20% youngest animals (×). For trait abbreviations see Table 1.**

Mean accuracies (the horizontal lines in the boxes) vary between 0.64 for general temperament and 0.74 for days to first heat. Overall, the observed accuracies are surprisingly high, in view of the relatively small sample size and the moderate reliabilities of conventional breeding values used as quasi-phenotypes.

In breeding applications, genomic breeding values are especially relevant for the youngest group of animals, since for them genotypes are available directly at birth, while performance data only become available much later. Therefore we also tried to predict the 20% youngest animals. The correlation for this prediction is given in Figure 1 by a cross. While in most cases these correlations lie in the range of values obtained with a random cross-validation, we found substantially smaller values for some traits like *rank order in herd* or *udder depth*. This means, that at random 20% of the phenotypes was neglected, and these phenotypes were predicted using the remaining 80% of the phenotypes and the genomic information. The accuracy then was assessed as the correlation between predicted and true phenotypes. This procedure was repeated 50 times, so that for each trait a distribution of correlations was obtained. These values are depicted in Figure 1.

Using the information of the 54k SNP array instead of the 777k SNP array only led to minor ($\leq 0.01$) deviations in accuracy, suggesting that in Brown Swiss it is completely sufficient to use the smaller and cheaper 54k SNP array for genotyping.

The results suggest that genomic approaches can be used for novel traits, which are especially relevant for dairy production in low input systems, and that early selection based on genomic breeding values that are more accurate than phenotypes or pedigree-based breeding values appears promising.

## Crossbreeding dairy survey

In the crossbreeding dairy survey in UK, 17 farms have been monitored over 15 months (August 2011-October 2012) for their breeding, reproduction and husbandry and milk yield and quality. Data collection has nearly finished, and information has been gathered for 1078 milking cows regarding animal genetics (crossbred types), nutrition (estimated forage intake, conserved forages, concentrate feeds), mastitis, lameness and other health treatments,

fertility performance (calving intervals, calving-1st service interval, number of services) and treatments as well as culling rates. All is almost ready for statistical analysis. Background data from three remaining farms will be collected this summer to finalise datasets. A total of 2850 milk samples have been collected during routine milking from individual cows at regular intervals over the study.

**Typical crossbred cow making the most of grazed grass (Photo: Acorn Dairy)**

Basic milk composition has been collected in collaboration with National Milk Recording, the leading organisation for routine milk analysis for UK dairy farms. Milk fatty acid profiling is in progress with 1400 samples analysed by gas chromatography already. Newcastle University has also developed a collaboration with Northumbria University to extend its analytical capacity thus reassuring faster delivery of research outputs; fatty acid analysis of all milk samples for this survey is due in December 2013 when all data will be combined to assess the impact of crossbreeding strategies and animal nutrition on animal health and fertility and milk nutritional quality.

## 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]

### 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.

The use of cross-breeding for improving low-input (traditional/extensive) and organic sheep productivity is not always a favorable strategy. There are important reasons for this relating to the attitude

[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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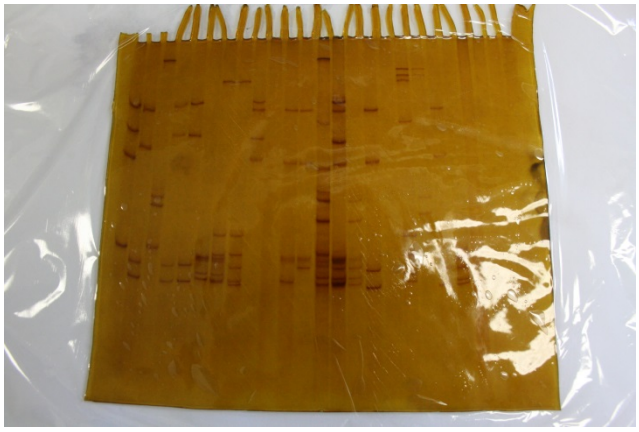
of both farmers and consumers. Regarding farm owners, when different sheep breeds are bred, traits such as robustness and adaptability can be lost and veterinary medicine and/or feed supplements are increasingly used. From the consumers' point of view, tasty values of sheep products are downgraded and concerns are raised regarding drug residues. So, in order to optimize sheep farm productivity and also preserve the above conditions, a within breed selection strategy should be applied.

A main task of the LowInputBreeds project is to investigate the possibility of improving certain productivity traits, within the same sheep breed, using molecular methods. To achieve such an intervention for a measurable productivity trait, some prerequisites have to exist. Firstly, genes that are relevant to this phenotype (productivity trait) have to be identified. Secondly, a genetic diversity (polymorphism) for that specific gene has to exist. Finally, these different gene variants (alleles) need to be correlated to the phenotype. In this way a genotype – phenotype correlation may be established, so that a molecular prediction for a sire's or ewe's trait can be made. It is also planned in the LowInputBreeds project, to use the same model to identify possible existence of genetically based resistance to some diseases.

One of these objectives of the LowInputBreeds project is to investigate the possible presence of genetic resistance to parasite infections. To achieve this, parasite – genotype correlation has to be determined. To measure the parasite level (phenotype data) individual faecal samples were collected from almost 800 ewes in Greece and 300 lambs in Switzerland and screened using a modified McMaster technique. The egg output of gastrointestinal parasites per gram of faeces (epg) was recorded as phenotypic data. Additionally, blood samples were collected from the same ewes and lambs to perform genotype analysis for this disease, in the Gene Marker Laboratory of Lincoln University, in New Zealand (supervision: Prof. Jonathan Hickford). In this second phase which lasted from 18 February to 17 April 2013, all samples were processed with DNA Extraction and PCR for the target gene (DQA2). The Single-strand conformation polymorphism method (SSCP) and gel electrophoresis were used to reveal different alleles of this gene per sample. The alleles have been identified in all these samples, revealing high heterogeneity (see photo). So, the next step will be to correlate these allele frequencies with the faecal egg counts of these sheep.



**SSCP* gel with different alleles per sample (column)**
***Single-strand conformation polymorphism method (SSCP).**
**Photo: Nikolaos Tzanidakis**

In order to be trained and apply these gene methods for LowInputBreeds samples, a research assistant from Greece (Mr. N. Tzanidakis) visited the Gene Marker Lab. Additionally to the DQA2 gene, approximately 1100 sheep samples were genotyped for the 'cold stress' gene, which may be associated with milk fat content and live body weight gain traits. These results have to be further analyzed, but at a first glance, a valuable potential seems to exist in improving product quality traits of dairy sheep. These innovative molecular methods can lead to molecular marker assisted selection (MAS) breeding programmes. Thus, we can anticipate improvement of productivity, product quality, but also sheep welfare if we implement MAS in organic and low-input dairy sheep production.

From November 2012 to February 2013 all the remaining microbiological examinations of the sheep milk samples of the LowInputBreeds project were finalized (see previous newsletter).

**Correlating phenotypical and genotypical measurements: Collection of milk samples for quantitative / qualitative assessment on Greek Sfakiano breed before genotyping of the animals in collaboration with Lincoln University in New Zealand**

### 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.

Two main questions have been addressed since the last newsletter, which can have direct practical consequences

*Are the in vivo anthelmintic effects of tanniniferous forage (sainfoin) related to the proportion in the sheep diet?*

After verifying anthelmintic (AH) activity of sainfoin pellets based on *in vitro* assays , an experiment with sainfoin vs non tannin legume pellets was performed in experimentally infected sheep to evaluate the anthelmintic (AH) activity of different proportions of sainfoin pellets in the diet.

Some reductions in FEC in the sainfoin treated groups when compared to the control group were observed, reaching a maximum value of 60 % reduction. These differences between the treated and the control groups showed a trend for statistical significance ($P < 0.09$) in FEC when the lambs were fed on sainfoin pellets. However, no dose dependent effect was measured. No differences in worm counts were measured between groups. These results suggest that the consumption of sainfoin pellets can contribute to reduce FEC in lambs infected with the abomasal species *H. contortus* but with no direct reduction of worm populations.

*Integrative aspects: What are the combined effects of integrating tannin-rich forages with the use of parasite tolerant breeds and the strategic use of clean pastures?*

In Switzerland, a high performing breed (White Alpine Sheep) and a native and potentially tolerant breed (Red Engadine Sheep= RES), both naturally infected with GIN, were subjected to two sainfoin feeding periods. Furthermore, lambs of the two breeds were grazed on natural mountainous pastures with low stocking density or intensively grazed lowland pastures for 2.5 months.

At the end of the study, it was concluded that the local tolerant breed (RES) may be preferred over the White Alpine Sheep (WAS) based on parasitological data. By the integration of sainfoin and/or the strategic use of mountainous pastures, this advantage could be used to implement further a reduced input of synthetic anthelmintics.

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

The description of some of the main results obtained in the relationships between the grazing management depending on the day time and the quality of lamb meat has been the focus of the LowInputBreeds Newsletter 7[1].

For the last six months, studies aiming at addressing the two hereby questions have been performed

- What are the effects of management practices on the sensorial and nutritional quality of lamb meat and carcass?
- What are the dose-response relationships between (a) the proportion of legumes in the diet and (b) the carcass quality and sensory and nutritional quality of lamb?

These two questions still require studies and analyses before final conclusions can be drawn.

[1] Newsletter No. 7 of the LowInputBreeds project is available at http://www.lowinputbreeds.org/fileadmin/documents_organicresearch/lowinputbreeds/newsletter-no-7.pdf

## Subproject 3: Pig production systems[1]

Jascha Leenhouwers[2]

### Review of the past six months

The paper on suitability of traditional and modern pig breeds for low-input systems has been published in the peer-reviewed journal Animal Genetic Resources (Leenhouwers *et al.* 2013).

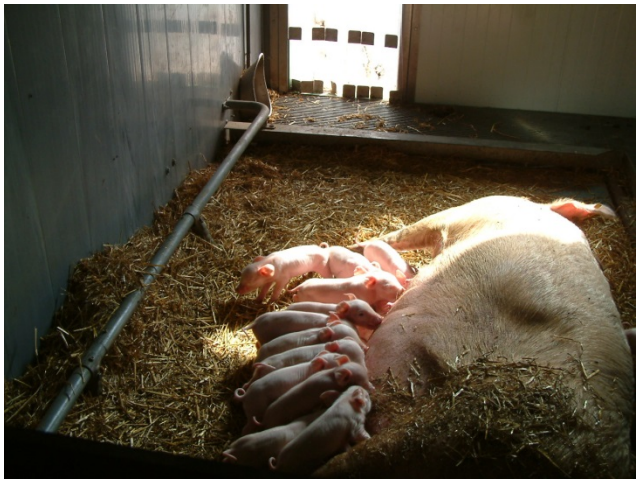
A new crossbred sow is currently being produced in Spain, Germany and South Africa This sow combines prolificacy with high robustness and longevity. Results of the research on heat stress resistance of sows are implemented in the breeding goal of this new sow; making them well-suited for hot climates and low-input production systems.

**Pigs on the São Marcelo Farm in Brazil. Photo: Jascha Leenhouwers, TOPIGS Research Center IPG**

DNA profiles have been analyzed on more than 1000 hair samples from dead pigs collected on a low-input farm in Brazil. DNA analysis will allow these dead pigs to be traced back to their respective fathers. Subsequently, fathers with large genetic effects on mortality can be excluded from the breeding program, which will lead to improvement of pig survival.

In trials investigating the effects of rearing environment on mothering ability of sows, data are being collected from the first two litters of the sows. These trials focus on neonatal mortality and gut health after weaning. The majority of the first litters are now born, but most of the second litters have still to be born.

**Gilts born in conventional farrowing pens and ....**



**.... gilts born in organic farrowing pens to see if maternal behaviour is affected later in life as an adult sow. Both photos by Herman Vermeer, Wageningen University**

[1] 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 d3iarrhoea 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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The main activities of the research concerning different pig genotypes and feed additives were

(a) complementary analyses of project data concerning performance, carcass quality, meat quality and product quality,
(b) research concerning manual realization and economic conditions of sausage production,
(c) extensive statistical evaluation,
(d) completion of the literature research for the planned reviewed publications & the final report, and
(e) start with the final report.

The project and some first results were presented at the 12th Scientific Conference on Organic Farming in the German Speaking Countries (12. Wissenschaftstagung Ökologischer Landbau in Bonn, Germany, March 5 to 8, 2013).

Additionally, several technical notes from the subproject area under preparation: on pig breeding, meat quality, old breeds, heat stress and piglet management.

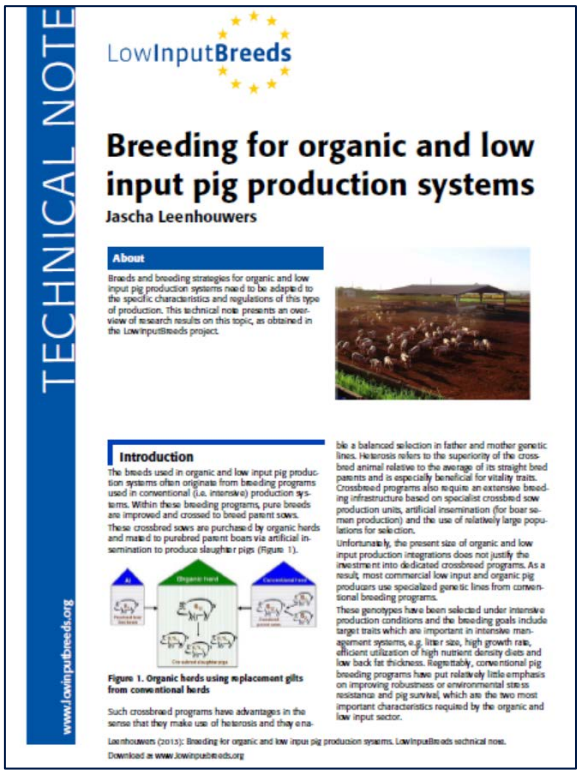
## Outlook with regard to next period

In September 2013, Saskia Bloemhof will defend her PhD thesis on genetics of robustness in sows. Her thesis is the result of research performed within the LowInputBreeds project.

In the next period the recorded video data from the first three days after birth of the first parity will be observed and analysed. We will need all the time until the end of the project in the spring of 2014 to finish all the work.

For the meat quality research, it is planned to complete two technical notes, and to submit three scientific papers as publishable final report concerning

a) performance and carcass quality,
b) meat quality including fatty acid composition, and
c) product quality and economics of the air-dried sausage production .


TECHNICAL NOTE

LowInputBreeds

Breeding for organic and low input pig production systems

Jascha Leenhouwers

About

Breeds and breeding strategies for organic and low input pig production systems need to be adapted to the specific characteristics and regulations of this type of production. This technical note presents an overview of research results on this topic, as obtained in the LowInputBreeds project.

Introduction

The breeds used in organic and low input pig production systems often originate from breeding programs used in conventional (i.e. intensive) production systems. Within these breeding programs, pure breeds are improved and crossed to breed parent sows. These crossbred sows are purchased by organic herds and mated to purebred parent boars via artificial insemination to produce slaughter pigs (Figure 1).

Figure 1. Organic herds using replacement gilts from conventional herds

Such crossbred programs have advantages in the sense that they make use of heterosis and they enable a balanced selection in father and mother genetic lines. Heterosis refers to the superiority of the crossbred animal relative to the average of its straight bred parents and is especially beneficial for vitality traits. Crossbreed programs also require an extensive breeding infrastructure based on specialist crossbred sow production units, artificial insemination (for boar semen production) and the use of relatively large populations for selection.

Unfortunately, the present size of organic and low input production integrations does not justify the investment into dedicated crossbreed programs. As a result, most commercial low input and organic pig producers use specialized genetic lines from conventional breeding programs.

These genotypes have been selected under intensive production conditions and the breeding goals include target traits which are important in intensive management systems, e.g. litter size, high growth rate, efficient utilization of high nutrient density diets and low back fat thickness. Regrettably, conventional pig breeding programs have put relatively little emphasis on improving robustness or environmental stress resistance and pig survival, which are the two most important characteristics required by the organic and low input sector.

Leenhouwers (2013): Breeding for organic and low input pig production systems. LowInputBreeds technical note.

Download at www.lowinputbreeds.org

www.lowinputbreeds.org

**LowInputBreeds Technical Note No. 3.1.: Breeding for organic and low input pig production systems by Jascha Leenhouwers. To be published at the LowInputBreeds website during summer 2013**

## Subproject 4: Laying hen production systems[1]

Ferry Leenstra[2]

In the first part of 2013 visits to free range layer farms in Switzerland and The Netherlands was an important issue. In each country we collected data from 20 organic and 20 conventional free range farms. With the farm visits we aim to set up an extensive data base on relations between genotype of the hens, rearing conditions, management practices on the layer farm and production and condition of the hens and quality of the eggs. Around August 2013 we will have sufficient data to start statistical analyses.

Unfortunately, it had to be decided to skip the farm visits in France as it proved not possible to collect reliable data from a good sample of French farms within the time frame and scope of the project. Still with the Swiss and the Dutch data we can compare two quite different situations: rather small flock size in Switzerland and large flock sizes in The Netherlands. We try to judge the hens on all farms in a standardized way around 50 weeks of age for body weight, feather cover, wounds and condition of the keel bone. Also the flocks are characterized for flightliness/quietness. For free ranging hens a good feather cover is essential to prevent too much heat loss. The condition of the breast bone was taken into account as there are indications that hens in barns or aviairies are vulnerable to their breast bone injury by falling from or bumping against the tiers and/or perches.

The data set is not yet complete, but some indications are apparent: many hens indeed have a breastbone that was broken some time during their life. From the Dutch data set there is an indication, that hens raised in systems with a height adjustable floor have less broken keel bones than hens raised in systems of fixed height. This suggests hens benefit from differences in height within the system and being trained in jumping and landing. Foot pad lesions were also quite common. Across genotypes there was a tendency that Swiss flocks scored better for feather cover and condition of the keel bone, while Dutch flocks scored slightly better for foot pads.

During the farm visits, in discussions with the farmers, we get indications that on average the results of free ranging hens are improving when compared to the performance of hens housed inside. At the start of the LowInputBreeds project mortality on free range farms was significantly higher than on farms where the hens were kept inside, currently mortality is more similar as data from farm management packages indicate.

**Photo: This enriched second hand greenhouse next to the stable serves as an attractive bad weather run. (Photo: Monique Bestman)**

We collected data on egg production and tried to get egg quality characteristics from the egg traders involved. We received data on percentage 2nd grade eggs, egg weight and in most cases also haugh units, an indicator for freshness of the eggs. In general the lay periods in free range flocks are terminated at a

[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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younger age than flocks housed in colony cages or inside. The latter are often kept until 80 weeks of age, while most free range flocks are terminated around 70 weeks of age. This is because eggs from free range flocks are sold as table eggs rather than processing, where deteriorating shell quality of older hens is less important. For sustainability and ethical reasons it might be attractive to keep hens longer or moult them for a second laying period. During the farm visits we tried to get an impression if and why farmers might consider to keep flocks for longer or moult the hens. Until now the number of moulted flocks and also those longer than 70-75 weeks is very limited.

In Switzerland hens from moulted flocks are tested on an experimental scale for health parameters and especially resistance to intestinal parasites.

From farms differing in vegetation cover of the range, we collect eggs in winter and in summer, to get an indication of differences in fatty acid composition that might be caused by consumption of 'green stuff' from the range. The yolk samples from these eggs are now prepared for analysis.

At the start of the LowInputBreeds project chances of allowing meat and bone meal back into poultry diets appeared rather high, nowadays it is clear that the required canalization of meat and bone meal per species will be complex and imply a very high cost. Consequently it is not likely that meat and bone meal will be an attractive (and allowed) ingredient for poultry diets in the coming years. In cooperation with the EU program CORE Organic (www.coreorganic2.org) therefor a selection was made of feed ingredients that can be grown/produced in Europe and have a high protein and essential amino acid content that might be an alternative to imported soy products. Currently on farm testing of diets with one of the most promising alternative protein ingredients is in preparation.

# Third LowInputBreeds Symposium/64th Annual EAAP Meeting


**The third symposium of the European-funded research project LowInputBreeds will take place in Nantes, France, on August 28. It will be held in the framework of the 64th Annual Meeting of the European Federation of Animal Science (EAAP) that takes place from the 26th to the 30th of August 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 in Low Input Production Systems" to the EAAP meeting. This session (no 42) will take place in the afternoon of Wednesday August 28, 2013. The session will be followed by the General Assembly of the LowInputBreeds project.**

Previous symposia of the LowInputBreeds project took place in 2011 in Wageningen, The Netherlands, and in 2012 in Hammamet, Tunisia.[1]

### Venue

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

### 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

# The LowInputBreeds technical notes

Helga Willer[2]

Partners of the LowInputBreeds project are currently preparing a number of technical notes, which give an introduction to the key themes of the LowInputBreeds project and which summarize key results of the project.

The following notes are planned and the first ones are expected to be published during 2013. They will be made available at the LowInputBreeds website (www.lowinputbreeds.org) under “Publications”.

1.1 Cattle breeding

1.2 Cattle management

1.3 Feeding and milk quality

1.4 Cross breeding

2.1 Sheep breeding

2.2 Lamb meat quality produced in organic and low-input grassland-based systems

[1] Information on the LowInputBreeds symposia is available at http://www.lowinputbreeds.org/events.html.

[2] Dr. Helga Willer, Research Institute of Organic Agriculture (FiBL), Ackerstrasse, 5070 Frick, Switzerland, helga.willer@fibl.org, www.fibl.org

2.3 Feeding and meat quality under Mediterranean conditions
2.4 Feeding and sheep milk quality under Mediterranean conditions
2.5 Parasites in sheep (GIN)
2.6 Bioactive forages and concentrates
3.1 Pig breeding
3.2 Pigs meat quality
3.3 Old pig breeds
3.4 Heat stress (working title)
3.5 Pig and piglet management
4.1 Poultry breeding of laying Hens
4.2 Moulting
4.3 Poultry feeding
4.4 Egg quality
4.5 Management of free ranging laying hens
4.6 Raising cockerels

## 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

Partner 1: Newcastle University UNEW, UK, Coordinator
Partner 2: Research Institute of Organic Agriculture FiBL, Switzerland, Scientific coordinator
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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
Partner 22: Louis Bolk Institute, Driebergen, The Netherlands

### Additional partners

Partner 24: The Department of Veterinary Science and Public Health (DIVET) of the Faculty of Veterinary Medicine at Milan University, Italy
Partner 25: Department of Animal Breeding and Product Quality, Animal Production Research Centre, Nitra, Slovakia
Partner 26: Irish Agriculture and Food Development Authority – Teagasc

**Imprint**

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This newsletter is available at project website at www.lowinputbreeds.org/lib-newsletter.html. The newsletter is published twice per year.