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Report 644

## Innovations in Grazing

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### Abstract

This report presents the main results of the  
second meeting of the EGF Working Group  
“Grazing” which was held in Lublin, Poland on 3  
June 2012. The theme of the meeting was  
“Innovations in Grazing”.

### Keywords

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### Title

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# Innovations in Grazing

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October 2012



## **Preface**

The second meeting of the Working Group “Grazing” of the European Grassland Federation (EGF) was held in Lublin, Poland in June 2012 prior to the 24<sup>th</sup> General Meeting of the European Grassland Federation. This years’ theme was “Innovations in Grazing”. Since the popularity of grazing is declining in many European countries, innovations in grazing are certainly needed. The meeting provided interesting new insights and led to useful discussions during and especially after the meeting of the Working Group. Short summaries of the presentations can be found in this report. This report and pdf’s of the presentations are available on the internet ([www.europeangrassland.org/working-groups/grazing](http://www.europeangrassland.org/working-groups/grazing)). I would like to thank all the participants and especially the speakers for their active participation in the meeting and the lively discussions during and after the meeting. The aim of this Working Group, i.e. to exchange knowledge on all aspects of grazing and networking, has certainly been reached.

Dr. ir. Agnes van den Pol-van Dasselaar  
Chair EGF Working Group “Grazing”



## Summary

This report presents the main results of the second meeting of the EGF Working Group “Grazing” which was held in Lublin, Poland on 3 June 2012. The aim of this Working Group is to exchange knowledge on all aspects of grazing research and to provide a forum for networking.

The theme of the meeting in Lublin was “Innovations in Grazing”. There were five sessions:

- Introduction
- Technical support
- Decision support tools for farmers
- Novelties in grazing management
- Innovative approaches in knowledge transfer

The participants concluded that innovations to support grazing are certainly needed. Furthermore, it is essential to exchange knowledge on the innovations already available in several regions of Europe. The EGF Working Group “Grazing” is a valuable platform for this.





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# 1 Introduction

## 1.1 EGF Working Group “Grazing”

“Grazing” is an important theme for the European Grassland Federation (EGF). In Europe, forage is the main feed for dairy cattle and grasslands are predominantly grazed. Grazing systems are important components of the landscape in almost all European countries. A Working Group on “Grazing” will ensure detailed knowledge exchange and discussion. A Working Group “Grazing” was therefore established in Uppsala, Sweden at the General Meeting of the EGF in 2008. The aim of this Working Group is to exchange knowledge on all aspects of grazing and networking. The first meeting was held in Kiel, Germany in 2010.

The second meeting of the Working Groups was held in Lublin, Poland in 2012, prior to the 24<sup>th</sup> General Meeting of the European Grassland Federation. There were 29 participants from 13 countries in Europe. The theme of the second meeting was “Innovations in Grazing”. The rationale behind this theme is the following: in general society favours grazing and along with this it is economically attractive for farmers in most situations. However, the popularity of grazing in Europe is declining. Therefore support for farmers is required and innovations to support grazing are clearly needed.

There were four sessions during the meeting which consisted of oral presentations followed by a plenary discussion. The oral presentations are summarized in this report. The introductory presentation is described in the next paragraph. The session “Technical support” is described in Chapter 2. The session “Decision support tools for farmers” is described in Chapter 3. The session “Novelties in grazing management” is described in Chapter 4. The session “Innovative approaches in knowledge transfer” is described in Chapter 5, followed by some concluding remarks in Chapter 6. Both this report and pdf-files of the presentations of the meeting can be found at the EGF website under the pages of the Working Group “Grazing” ([www.europeangrassland.org/working-groups/grazing](http://www.europeangrassland.org/working-groups/grazing)). The program of the meeting can be found in Appendix 1 of this report.

## 1.2 Innovations in grazing

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This paper provides an insight into the magnitude of grazing in Europe and discusses recent innovations to support grazing.

### Grazing in Europe 2011

In 2008 it was shown that trends in livestock farming in Europe have resulted in a decline in the popularity of grazing (Van den Pol-van Dasselaar *et al.*, 2008). Recent data on grazing in Europe are not easily available and the majority of countries have no reliable statistical data on grazing. To obtain an insight into grazing, a survey was conducted among members of the EGF Working Group “Grazing” in October and November 2011. The members were asked to provide an educated guess on the amount of grazing dairy cattle in their country and to report on recent innovations. The percentage of dairy cattle grazing varied between the different countries. Even though the data are often only an educated guess and not statistical data, it became clear that in general, the popularity of grazing is still declining (Van den Pol-van Dasselaar, 2012).

### Advantages and disadvantages

Advantages of grazing are natural behaviour and animal health, environmental benefits such as lower ammonia volatilisation, lower fossil energy use and lower methane emission, image of dairy farming and economics. Disadvantages of grazing compared to cutting only are lower grass yield, lower grass utilisation, unbalanced diet and environmental disadvantages such as increased nitrate leaching, denitrification, nitrous oxide emissions, N losses and P losses.

### Reasons for decline in grazing

The most important reasons for the decline in grazing are:

- Difficult to control rations and optimise grassland utilisation (knowledge is lacking)
- Reduced grass growth in summer time and unpredictable grass growth over the season
- Unstable weather conditions
- Need to reduce mineral losses
- Labour efficiency
- Grazing does not “sell”
- Increased herd size in combination with not well adapted paddock organisation (available area around the milking parlor, fragmentation of land)
- Increased use of automated milking systems

Grazing is often more complicated than a no grazing system and therefore farmers choose not to employ grazing in their systems. This is especially true in new farm situations (e.g. new sheds) and for young farmers.

### Solutions (four categories)

Because generally society favours grazing and in most situations it is economically attractive, support for grazing is required for those situations where grazing is often under debate, e.g. at farms with automated milking systems and/or large herds. Four categories of innovations can be identified. First, technical support, such as automatic sward height measurements, GPS or mobile automated milking systems. Second, novelties in grazing systems; since increased herd size makes grazing management more difficult, relatively simple grazing systems have been developed. Third, decision support tools for farmers to use on a day-to-day basis; simple decision support tools are needed, which are automatically populated with data, e.g. grass yield, grass intake, climate and weather and which provide support for grassland management decisions. Fourth, projects to stimulate grazing. This category is required to make the innovations from the previous three categories work. Preferably these projects focus not only on knowledge transfer, but also on the needs and personal preferences of the farmer.

### Conclusion

The popularity of grazing in Europe is declining. Since this is an undesirable trend from an economic and societal point of view, innovations to support grazing are required. Furthermore, exchange of knowledge is highly appreciated since the possibilities for grazing research are limited. Therefore, it is a good thing that recent innovations in grazing will be elaborated in the international workshop “Innovations in Grazing” in Poland in 2012.

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## 2 Technical support

### 2.1 Concept of a mobile automatic milking system and first results at grazing.

*Isabelle Dufrasne – University of Liège, Belgium*

In Europe, farmers have to manage larger herds but, at the same time, want to have a normal social life. So, the automatic milking system (AMS) can bring solutions. This technology implies, in most cases, the cessation of grazing although grazing is appreciated by the consumers who consider it to be a natural practice. At the experimental farm of the University of Liège, the concept of a mobile milking robot has been developed with a private company. The prototype is used indoors during the winter season and is moved outdoors during the grazing season in pastures remote from the farm. The feasibility of this prototype is being tested in the field on a herd of 45 Holstein dairy.

In 2010, the cows grazed from 22/06 until 20/10 in a rotational system. They were fetched twice a day to the AMS at 6 am and 16 pm but they could also reach it freely if they so choosed. The sward height was measured on entry to and exit from each paddock. Daily milk yield and number of milkings were analysed using a GLM including the effect of animal, days in paddock, distance between AMS and paddock, rotation cycle number and supplementation. The cows produced 19.6 kg milk daily over 2.1 milkings and 95% of the cows entered the AMS more than twice per day. The number of milkings decreased when grass height decreased ( $p < 0.001$ ;  $r^2 = 0.53$ ). The models explained 76 and 28% of the variation in milk yield and number of milkings, respectively. Amongst the parameters studied, the animal effect explained 77% of the variation in milk yield and 53% of the variation in the number of milkings ( $p < 0.001$ ). The distance explained a weak but significant variation in milk yield and number of milkings (2.3 % and 3.8% respectively;  $p < 0.001$ ). There were no clear relationships between milk yield or number of milkings and distance.

In 2011, in order to reduce the time spent by the cows waiting before milking, the cows were fetched either once, the morning, from some paddocks and twice per day from other paddocks. This was carried on in May and June. Daily milk yields and voluntary returns data were analysed using a GLM procedure including the effects of animal, number of fetchings, days in milk and number of milkings. The once per day fetching reduced daily milk yield (20.8 vs 24.2 l/cow) and milking frequency (1.8 vs 2.2/cow). Eighty three and 51% of the variation in milk yield and voluntary returns, respectively, were explained by the models. The effects of animal and days in milk explained 72 and 17%, respectively, of the variation in milk yield. Animal and number of fetchings explained 47 and 39%, respectively, of the voluntary returns. Later in the grazing season - August and September, the effect of water availability in the paddock was tested. The milking frequency and voluntary returns were increased but milk yield was not changed.

In 2012, the effects of water availability will be tested on the beginning of the grazing season and the herd will be divided into two groups in order to improve the experimental design.

### 2.2 Mobile milking program in Trévarez (Brittany, France): challenging land fragmentation

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#### Dairy production background in western France

In France there are many types of dairy management strategies and many levels of valorisation of the genetic merit for milk production. The main objectives of the farmers can be profit, optimisation of the forage system or increased cow productivity. This is particularly true in the West of France where dairy cow feeding is mainly organised around grazing and maize silage. Cows graze from 3 or 4 months up to 10 months; maize silage is fed to the cows during winter.

The average size of French farms increases. In addition, farm size often increases by acquiring some blocks far from the 'headquarters'. The question is not related to the distance from the field to the barn but how to move the herd and the milking parlour from one block to another. As the farms are usually split into a small number of blocks, there is no need to move every day but a limited number of times of per year like the "transhumance" in the mountains.

In recent times the number of automatic milking system (AMS) has increased exponentially. Demand for AMS is rising and it is now reaching new customers. At the beginning, farmers who bought AMS had intensive systems mainly based on stored forages. But now breeders who practice grazing also wish to buy an AMS and would like to keep grazing in their system.

## Presentation of the experimental unit Trévarez

### *Trévarez project: increasing the grazeable area thanks to a mobile robot*

Trévarez experimental farm is located in a wet area in western France (1200 mm average rainfall per year) with regular grass growth over the year. As with many commercial farms, only part of its agricultural area can be grazed by the dairy herds because it is split into four main blocks of fields by roads and neighbours. Grazed grass has always been the base of the forage system because of its low production cost and high availability under this oceanic climate. The implementation of strong environmental restraints as well as new demands like favourable fatty acid profiles in milk enhanced the wish to keep grass as the base of the forage system. It is therefore absolutely necessary to find solutions to graze the current “non grazeable area” particularly if cow numbers continue to increase. A mobile automatic milking solution might provide the opportunity to graze the big blocks which are on the other side of the road or far from the current milking parlour, and would also be consistent with our former experimental projects on “decreasing the daily working time on farms”.

The project we are currently developing is the following:

Implementation of a robotic milking solution in grass based systems with a mobile milking unit enabling the use of paddocks or groups of paddocks which can currently not be grazed by the lactating cows because of distance or road traffic.

### *Material and methods:*

Review of existing prototypes and redaction of specifications for a Breton project: the project included the description of several technical options for the mobile unit (strengths and weaknesses of existing prototypes) in relation to the farm situation (isolated paddocks and big blocks with existing platforms), redaction of the project specifications to submit to companies in order to develop a “Breton” prototype.

Experiment: test of this prototype on one group (45 to 60) of high genetic merit Holstein cows grazing 8-9 months per year (0.4 ha grazed grass per cow), and with a 100% grass diet for 3-4 months.

Herd management strategy: maximising milk produced from the forages through a low concentrate level (700 kg/cow/yr). This farmlet will be converted into organic production (start 2013). The target will be to produce around 7,000 to 7,500 kg milk/cow/year. Some specific very low cost strategies might also be tested: spring block calvings, with one-a-day milking in early lactation and very low concentrate levels (300 kg/yr).

### *Implementation:*

Design and building of a new winter barn used from 15th of October to 15th of April in an average year. Cows will be able to graze in March-April and October-November around this winter shed (0.15 ha per cow); the mobile robot will be used inside the barn. Barn delivered by 1st of June 2012. Design of an open stabilized platform for the mobile robot on the summer site used by cows from 15th of April to 15th of October. Cows will be able to graze 0.35 ha per cow during on this summer location 4.5 km away from winter site. First summer grazing in 2013.

Design of mobile robot: a Delaval AMS on a trailer (Rolland SA) and a second trailer with the milk tank (delivered 15th of June 2012).

### *Partners involved (France):*

The regional Breton applied research organisation (Pôle Herbivores des Chambres d'Agriculture de Bretagne) and the French Livestock Institute.

## **2.3 Estimation of grazing time and grass intake on pasture for dairy cows using tightly and loosely mounted di- and tri-axial accelerometers**

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The aim of the studies was to assess whether and how head mounted accelerometer sensors could be used to estimate grazing time and grass intake in differing levels of herbage allowance and grass

height. Two field experiments were conducted using high yielding milking cows in 2009 (EX1) with ad libitum feeding inside and 2010 (EX2) with restricted feeding inside and approximately seven hours of grazing. For both experiments, data collected were i) activity data measured by accelerometers, ii) manual bite counts and iii) estimation of grass intake.

Grazing time per cow could be estimated using head mounted accelerometers. Estimation of grazing time was computed using threshold values of raw downloaded data for one axis only. Loosely mounted sensors underneath the neck attached to the neck collar, which could swing back and forth slightly, did not significantly change the results of the estimations for grazing time, as compared to tightly mounted sensors. Bite count recordings showed systematic differences in bite frequency per cow (ranging from 48 to 62 bites  $\text{min}^{-1}$ ).

Modelled estimation of grass intake for cows which were fed restricted indoors ( $\approx 30\%$  of diet), by using bite frequency and grazing time registration per cow on permanent grazing, showed an estimated precision between  $\pm 1.2$  and  $\pm 1.4$  kg DM  $\text{cow}^{-1} \text{ day}^{-1}$  for permanent grazing (initial grass height of 11 cm).

Combining individual bite rate registration per cow in the modelling together with the grazing time registration, improved the modelled intake estimation from  $\pm 2.3$  kg DM  $\text{cow}^{-1} \text{ day}^{-1}$  to  $\pm 1.3$  kg DM  $\text{cow}^{-1} \text{ day}^{-1}$  in a permanent grazing system.

### 3 Decision support tools for farmers

#### 3.1 Guidelines and tools to get the most from grazing in Ireland

*Deirdre Hennessy, Teagasc, Animal and Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork, Ireland*

##### Introduction

Ireland has a long grass growing season, and correspondingly a long grazing season. Milk and meat production systems in Ireland are predominantly grass based, with calving and lambing occurring mostly in spring to coincide with increasing grass growth and supply. Although grass growth occurs in early spring it is often at rates below feed demand; in the main grazing season (mid-April to mid-August) grass growth rates per day are usually greater than feed demand, while in autumn grass growth begins to decline more rapidly than the decline in feed demand. Hence, there is a requirement for practical grassland management tools to manage grass supply and feed demand. Three main tools are available to manage grass during the grazing season, they are the spring rotation planner, the grass wedge during the main grazing season and autumn budgeting combined with the 60:40 rule. In addition to these three tools, measuring grass availability on farm on a weekly basis is crucial.

##### Spring rotation planner

The spring rotation planner uses information such as land available to the herd, stocking rate, and calving spread to allocate an increasing proportion of the farm to the herd each day from turnout in spring up the day when grass growth exceeds grass demand by the herd (magic day). In addition, weekly farm grass measurement will provide information on the quantity of grass available to the herd each day, allowing supplementation with adequate quantities of concentrate and/or silage.

##### Grass wedge

The grass wedge uses the data collected during the weekly farm walk to create a visual representation of the herbage mass available in each paddock on the farm. A line drawn from the target pre-grazing yield to the target post-grazing residual provides a guideline on surpluses and deficits. This wedge allows farmers react to surpluses and deficits, and consequently ensure an adequate supply of good quality herbage to meet the requirements of the grazing herd.

##### Autumn grazing management

Feed demand on farm typically exceeds grass growth from late September onwards. To ensure grass is available for grazing until housing in late November average farm cover (grass available on the farm) must be increased during August and September. This is achieved by increasing rotation length from mid-August. Begin closing paddocks from grazing from the second week of October until housing. Once a paddock has been grazed in this final rotation it must not be grazed again until the following spring. It is important to adhere to the 60:40 rule during this time; that is 60% of the farm should be closed to grazing by the end of the first week of November, and the final 40% must be closed by 1<sup>st</sup> of December.

##### Other tools

On-off grazing allows cows to graze grass even during periods of inclement weather or when underfoot conditions are not ideal. Using this technique animals are turned out for 3 to 4 hours in the morning and again in the evening. Once they have grazed their allocated grazing area they are then housed. An alternative strategy would be to have livestock grazing by day and housed at night. The Grass Calculator retrospectively calculates the quantity of grass grown on the farm and can be used to provide information on the grass growing capacity of the farm. Strip grazing and rotational grazing allows best use of grass, helps maintain grass quality and allows for easy allocation of available herbage.

##### Conclusion

The information provided in this document consists of dates and information predominantly for dairy herds in the south of Ireland. However, each of these tools can be adapted for use in other regions to match the grazing season length and requirements from grass for grazing dairy and beef herds and sheep flocks. Further information on all of the tools and guidelines discussed here is available on [www.agresearch.teagasc.ie/moorepark](http://www.agresearch.teagasc.ie/moorepark)



### 3.2 Decision support tools and indicators for grazing in the Netherlands

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In the Netherlands, the number of grazing cattle has been declining over the last 20 years from almost 100% in 1990 to 74% in 2010. At the majority of the Dutch farms cows only graze during daytime. There are several reasons for less grazing, e.g. an increase in herd size and automatic milking. Societal discussions and public concerns led to discussions within dairy companies about grazing. Recently some dairy companies provide a bonus on “grazing milk” of about 0.5 euro cent per kg milk. The perception of grazing by farmers is currently also changing. Farmers are more and more asking “How to graze?” instead of “shall I graze or shall I not?”

There are hardly any grazing tools for farmers available and grazing management is not very well quantified. Therefore, the aim of our study was to support farmers in their grazing management by (i) quantifying grazing in tools and indicators and (ii) implementing these tools and indicators in practice. In this participatory study, we cooperated with advisors, farmers and researchers. First, an inventory was carried out to discover what farmers need with respect to grazing. The main concerns of farmers were i) how to deal with the changing weather circumstances, ii) how to maintain stable milk production, iii) how to plan grazing and stay in control, iv) how to manage labour input, v) how to manage grazing in general.

We identified four ways to support farmers:

- grass growth should be predictable
- decisions in grazing management should be facilitated
- the economic differences between grazing and zero grazing should be clarified
- for the combination grazing and AMS, experience and knowledge should be gained

Several indicators and tools for grazing have been identified, both nationally and internationally (Van den Pol-van Dasselaar *et al.*, 2012). The international tools are not yet applicable for the Dutch circumstances. Typical for the Dutch situation is the ration of fresh grass and supplementary roughage and concentrates fed to dairy cattle during the grazing season. In our study we focused on the development of an insight into grass growth per ha per day (operational indicator) and a flowchart for grazing systems (tactic tool). A prediction of grass growth for today and for the next week will support farmers in their grassland management. This project led to a pilot of grass growth prediction on the internet as a joint effort of research and the feed industry. A flow chart for grazing systems (MY GRAZING SYSTEM) is currently being developed in cooperation with an industrial partner specialized in automatic milking equipment. The flow chart is aimed at advisors and farmers.

We conclude that indicators and tools have to be identifiable and recognizable for farmers. For a high impact, cooperation with stakeholders is necessary.

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## 4 Grazing management

### 4.1 Extensive grazing of Polish Heath Sheep on pastures established on fallow lands in North-West Poland

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Process of natural succession has been taken place on abandoned arable lands of low soil quality where agricultural activities would not bring sufficient income to farmer. Such fallowed lands could be managed similarly to the poor grassland areas by extensive grazing of farm animal breeds well adapted to such environmental and nutritional conditions. Extensive grazing by some primitive sheep breeds as Polish Heath Sheep seems to be a perfect solution. Moreover, maintaining the unique landscape values and high natural biodiversity of these areas are the other benefits of high value (Groberk *et al.* 2003).

The experiment was conducted during three consecutive years (2006-2008) on a sheep farm allocated in the North West part of Poland (wielkopolskie voivodeship). The pastures had been established themselves on abandoned arable land for 10 years and no additional fertilization had been used since then. Official phonological data indicated that June, July and August were the hottest months during 2006-2008 (17.5, 20.0 and 17.6°C, respectively). In average, May, June and August were the months of highest rainfalls (63.33, 61.67 and 90.00 mm, respectively). Flocks of approx. 100 ewes/yr with lambs of Polish Heath Sheep was pastured extensively on 50 ha area (0.2 LSU/ha). Feeding was based on pasture during vegetation, as well as grass silage, sugar beet pulp and crushed grain (wheat and ray) during the rest of the year. Samples and data were collected every year during the vegetation period: from May to October. Plant samples were randomly collected on approx. 5% of the total area (3 ha). Places of plant samplings as longitude (53°11'65"- 53°13'39"), latitude (16°37'39"- 16°30'02") and altitude (102-108 m) were defined via GPS device. Plant samples were collected four times per year (May, June/July, August and September/October) from four different studied areas. In total, 48 herbage samples were collected. Then botanical, chemical, nutritional and production analyses were performed. Production performance of animals were also studied. In each year of experiment, a group of ewes which had lambed before the grazing season were selected from the flock. Ewes and lambs were weighed twice: before (Spring) and after (Autumn) grazing season. Changes in body weights of ewes (n=192) and lambs (n=240) as well as the growth development of lambs (n=120) during grazing were calculated. A general linear model was applied to estimate the effects of place of sampling (for herbage) or sex (for animals), year and month of vegetation as well as double-factors' interactions were also considered (SPSS v.10, 2001).

Obtained results and analyses indicated that month of vegetative period affected botanical composition of pastures, regarding especially Poaceae (87.43%, SEM: 0.76, P<0.05) and Asteraceae (1.55%, SEM: 0.19, P<0.05) percentages as well as average pasture yield (1.29 t DM/ha, SEM: 0.11, P<0.01), which was the highest at the end of June start of July (2.13 t DM/ha, SEM: 0.11). Sufficient environmental conditions for rearing lambs were observed: average body weight of lambs at the end of grazing season was significantly higher compared to the beginning (9.13 vs. 19.98 kg, respectively, at SEM: 0.55, P<0.01,). No significant increase in ewe body weight during grazing season was observed. Maintaining the studied area as permanent grassland could be perfectly realized via extensive grazing of Polish Heath Sheep.

#### Acknowledgments.

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## 4.2 Grazing in Poland

*Piotr Goliński, Department of Grassland and Natural Landscape Sciences, Poznań University of Life Sciences (PULS), Poland*

Piotr Goliński of the Poznań University of Life Sciences in Poland presented an overview of grazing in Poland. The share of permanent pasture in Poland has decreased during the last 20 years by more than 50%. The number of cattle and sheep has also decreased. Several regional programs have been initiated to stimulate economic development and preservation of cultural heritage. The European project MultiSward aims to increase reliance on grasslands and on multi-species swards for competitive and sustainable ruminant production systems. Preliminary results of MultiSward for grasslands in Poland were shown.

With respect to grazing in Poland, the following final remarks were made:

- Decreasing role of pasture sward in the nutrition of dairy cows
- Increased use of grassland resources by grazing beef cattle (suckler cows, young beef)
- Growing importance of pastures in horse breeding and rearing
- Dramatic situation in sheep production and pasturing influencing the biodiversity and landscape quality, particularly in mountain regions
- Attempts to restore sheep grazing in mountain regions using the regional programmes
- Innovations in grazing, among others in the MultiSward project (extension of grazing period for beef cattle, evaluation of lamb production in continuous grazing system regarding to different breeds)

## 4.3 Winter Grazing linked to Out Wintering Pads: a way to support grazing in France

*Jean-Pierre Farrié, Institut de l'Elevage IDELE - French Livestock Institute, France*

While growing in size and decreasing in fodder intensification, beef production systems (cow calving systems, and sheep systems as well) become more and more economically sensitive mainly because of increasing production costs. In this environment, enhancing grazing during winter time may be a way to reduce housing and associated costs: feeding, straw for litter, work time.

For these purposes, a program involving three experimental sites located in plains or mid mountains of central part of France, where extensive systems are rather common, was undertaken. Pregnant cows and heifers are being bred in conditions which combine out-wintering pads and swards assigned to winter grazing. The strategy mainly lies in the ability and easiness either to let the animals grazing loose on the swards or to keep them closed in the pads for several days if needed, according to weather conditions. Equipment required is a strong fence around the pad and a fodder rack easily filled, plus a roof in snowy conditions only. The aim is to reduce by half the amount of fodder and straw for litter during five months of wintering.

Animal performance and welfare indicators, grassland reaction (including soil appearance) and fodder production during the spring, and human welfare as well (work conditions for farmer), are evaluated. Winter grazing (WGz) was performed at a stocking rate of 3 LU per ha for 90 to 120 days in wintertime in 2011 and 2012. The animals spent much of the time on the swards, entering the pads mainly to take fodder and sometimes to rest and lie. During the WGz periods, through a rather dry winter in 2011 (150 mm rainfall on four months) and through a rather wet one in 2012 (250 mm rainfall in the same duration) it was necessary to keep the animals closed on the pads very few times: from 0 to seven days all over the winter according to the situations and weather conditions. Feet prints and bare soil appeared in the middle of the winter, but decreased very early in spring. The target of saving 50% of straw litter was close to be achieved, but feed providing was reduced by about 25% only (compared to indoor feeding), less than 50% expected. Animal performances measured on two year old heifers and pregnant cows were compatible with breeding objectives on farms.

Other results are on the way, such as leaching assessment (under the pads), and subsequent effect of WGz: it is likely that WGz will delay biomass production in the spring. Efficiency of WGz is expected to be improved by rotational grazing, and may be by a better management of the periods alternating animals free on the swards / animals kept closed on the pads.

#### 4.4 Grazing in Spain

*M.R. Mosquera-Losada<sup>1</sup>, A. González-Rodríguez<sup>2</sup>, C. Dupraz<sup>3</sup>, A.Rigueiro-Rodríguez<sup>1</sup>*

<sup>1</sup> University of Santiago de Compostela, Spain

<sup>2</sup> Agrarian Research Centre of Mabegondo, Spain

<sup>3</sup> INRA, Montpellier, France

Rosa Mosquera-Losada of Universidad de Santiago de Compostela in Spain presented an overview of grazing in Spain. Items which were presented were: grazing systems, dairy production, reducing concentrate use and environmental benefits. It was concluded that agroforestry could help to solve some of the future problems of intensive dairy systems through i) increasing combined production and ii) reducing environmental problems (nitrate leaching, biodiversity and improving carbon sequestration).

#### 4.5 Comparison of Dairy Farming Systems: A Case Study of Indoor Feeding Versus Pasture-based Feeding

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Keywords: dairy farming, indoor feeding, pasture, productivity, efficiency, income

##### Introduction and objective

Due to the liberalisation of the agriculture market, the Swiss dairy industry, and in particular the industry's dairy farmers, have been challenged to increase its efficiency. Recently in Switzerland the pasture-based production systems have been intensively investigated. We compared two herds: an indoor feeding (IF) herd and a pasture-based feeding (PF) herd, on the same farm with an equal agricultural area. This study aims to determine which of these two dairy production systems is more efficient in terms of animal performance, area productivity, farm income and labour income.

##### Materials and methods

We established two herds of dairy cows and followed-up with both herds for three years. The indoor feeding herd consisted of 24 dairy cows (Brown Swiss: Holstein-Friesian 1:1) with a milk performance goal of 8,500 kg lactation<sup>-1</sup>. The cows in the IF herd were fed a part-mixed ration (PMR) with maize/grass silage and protein concentrate (milk performance potential: 27 kg). According to their individual requirements the concentrate rationing was administered by a concentrate dispenser. During the vegetation period, the IF cows were driven on a "Siesta pasture" (~ 2 h d<sup>-1</sup>). Calving took place throughout the entire year with preference given to calving that occurred from June to September.

The pasture-based herd consisted of 28 dairy cows (Brown-Swiss:Swiss Fleckvieh 1:1) with a milk performance goal of about 6,300 kg lactation<sup>-1</sup>. They were held on a semi-continuous pasture and fed concentrate at the beginning of the lactation (280 kg cow<sup>-1</sup> lactation<sup>-1</sup>). In winter, they were held indoors and offered hay ad libitum, which was harvested from their pastures. The covering season lasted until 20<sup>th</sup> July, block calving took place from February to April and drying off began in mid-December.

The chemical analysis of the feed was conducted using the NIRS-method at Dairy One Laboratory, N.Y., US. Milk analysis was performed by standard milk record. A statistical analysis according to R using a two-way ANOVA model was performed for the feed system and the year, but only for the Brown Swiss dairy cow breed.

##### Results and conclusions

In the high-yielding grassland regions in Europe, dairy cows that are fed indoors by PMR, according to their individual requirements and by 1,100 kg concentrate per lactation, yield around 9,000 kg ECM. The milk solids, feed conversion and feed efficiency were higher in the IF cows compared to the PF cows. In the IF herd, the higher efficiency was achieved by purchasing and using a protein concentrate.

In the high-yield grassland regions in Europe, dairy cows in a PF system are additionally fed by 300 kg concentrate per lactation, yielding around 6,000 kg ECM. This PF production system is almost self-sufficient. Species-appropriate animal husbandry, pasture-based feeding and lower production intensity result in a higher rate of fertility. In a PF system, milk yield and milk solids fluctuate greatly depending on the vegetation period.

Within the Swiss agricultural framework and in respect to the herd type and farm size being investigated, the higher milk yield of the IF system cannot compensate for higher direct and overhead costs. Under the given conditions, the PF systems result in a higher agriculture income and higher labour income with similar labour productivity, as compared to the results obtained from an IF system. However, efficiency is not the only selection criterion for choosing a production system.

#### 4.6 Pasture based farm designs

*Paul Galama, Wageningen UR Livestock Research, the Netherlands, [paul.galama@wur.nl](mailto:paul.galama@wur.nl)*

##### Introduction

Grazing of dairy cows is decreasing in the Netherlands, especially on farms with large herds and farms with milking robots. Dutch farmers who focus on a high milk production per cow also tend to keep their cows more inside. Next to this, the increased fragmentation of land and increased diversity of dairy farms in relation to size and intensity asks for more flexible dairy systems. Innovative components are needed to create new farm designs based on pasture. We will discuss these components and designs in an international network of researchers, advisors and farmers. The ultimate goal is to implement some of these innovations in practice.

##### Challenges

The challenges for pasture based farm designs are to achieve a high milk production with grass in combination with a high grass production per ha, a long grazing period and low grazing losses. Flexible components are necessary to facilitate grazing on distant plots, grazing of large herds and for the combination of grazing and milking robots or a family herd.

##### Components

Innovative components to stimulate grazing are:

- Mobile milking systems (robot or parlour).  
When the milking equipment comes to the cow grazing on distant plots is easier.
- Mobile feeding.  
Can be used for supplemental feeding in the field during summer and in bedded pack barn (stable with no cubicles) during winter.
- Mobile electric fence.  
Can be used for strip grazing in longer grass and forces cows to stay less hours in an outdoor or indoor bedded pack system (simple housing).
- Mobile roof / shelter.  
Protects the animal against sun and rain while using grassland as a stable.
- Outdoor bedded pack.  
Simple housing with draining system to collect manure.
- Family herd.  
Keep dairy cows and calves together or keep dairy cows, dry cows and heifers in one group. Keep not pregnant young cattle separate. A family herd avoids stress, since animals remain in the same group.
- Regional feed centre.  
Roughage and concentrate replacers are stored in a central place where a total mixed ration (TMR) for several farms in a region of 15 km is made. A regional feed centre facilitates the combination of day grazing and supplemental feeding.

##### Farm designs

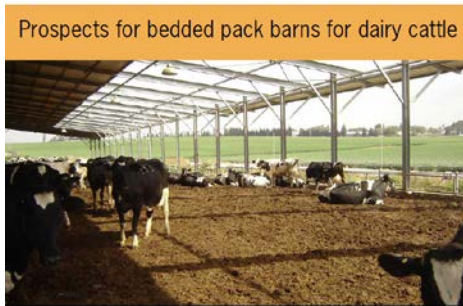
The components are put together in farm systems. Some examples are given:

- A family herd in a system of strip and continuous grazing,
- Grazing whole year on grass, winter wheat or turnips,
- Grazing of large herds with high production (cows central or cows in a region in combination with a central feed centre),
- Large herds in nature land.

More information

For more information please send me an email ([paul.galama@wur.nl](mailto:paul.galama@wur.nl)) and I send you a book about bedded pack barns, regional feed centre or the project “Cow Power” or more information on the projects “Family herd” and “Amazing Grazing”.

- Bedded pack barns (book, July 2011)  
Barns without cubicles and much space per cow. Bedding can be composed of different materials like wooden chips (to make compost with aerating system) or compost from a compost factory or other organic material. [www.vrijloopstallen.wur.nl](http://www.vrijloopstallen.wur.nl)



- Regional feed centre (March 2011)  
Book gives an overview of feed centres in different countries and experiences from the first regional feed centre in the Netherlands. Economic calculations are made for five types of dairy farms. Energy use (MJ per 100 kg milk) is calculated for mixed farms on regional level, a cooperation of dairy farmers and arable farmers. For a website of the first feed centre of three entrepreneurs, see [www.voercentrum.nl](http://www.voercentrum.nl).
- Family herd  
You can find background information, experiences of farmers and designs on the website [www.familiekuddes.wur.nl](http://www.familiekuddes.wur.nl) (in Dutch).
- Amazing Grazing  
In 2012 the project “Amazing Grazing” started. This is a project to discuss new ideas on grazing. For more information go to facebook “Amazing Grazing Dairy” or visit the website [www.amazinggrazing.eu](http://www.amazinggrazing.eu).
- Farm designs (more space per cow and mobile roof / shelter)  
One of the designs in the project “Cow Power” is called “De Meent” and is focussing on more space per cow. It uses the paddock as a stable and a mobile shelter against sun and rain. <http://www.duurzameveehouderij.wur.nl/UK/projects/cowpower/>.



## 5 Innovative approaches in knowledge transfer

### 5.1 Innovative and sustainable systems combining automatic milking and precision grazing

*Bernadette O'Brien, Teagasc, Animal and Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork, Ireland.*

The principle of an automatic milking system (AMS) requires a significant change in approach to herd and farm management (from that in a conventional system) for two main reasons: (i) cows are attracted to visit for milking by the lure of feed in or after the AMS and (ii) milking is distributed over a 24h period. Also, the perceived conflict with cow grazing needs to be addressed. This is a key challenge.

#### AMS project start-up at Moorepark

The farm-let associated with the AMS consists of a 24 ha milking platform. During the lactation of 2011 (start-up year) there were 63 cows in the system (target 80 cows) with a mean calving date of 15th February (range 1st February-15th March). This herd comprised 25 Friesian, 16 Jersey Friesian crossbreeds and 20 Norwegian Red cows as well as 2 of mixed breed. The land area was divided into 3 grazing sections of 8 ha each (A, B, C) which are further divided into 1 ha paddocks. Water is located at the dairy. Maximum distance to furthest paddock is ~750m. The dairy features one Merlin AMS unit installed adjacent to the existing shed. The grass allocation is critical to optimal cow visits to the AMS unit. Cows graze defined areas or portions of each of the 3 grazing sections during each 24 h period. Cows move between the grazing Sections A, B and C at 1:00 am, 11:00 am and 6:30 pm, respectively. Cows grazed to a post-grazing height of 3.5-4.0 cm. All cows received 1 kg concentrate feed per 24 h period during most of the lactation.

#### Production data

Peak milk yield was reached at 23.9 kg/cow/day in June. Lactation milk yields for the cow breeds Friesian, Jersey crossbreeds and Norwegian Red were 4,953 kg, 3,651 kg and 5,054 kg, respectively. There were on average 113 milkings per day, peaking at 123 milkings per day in August. Between 5 and 6 milking events per h were recorded between the hours of 08:00 and 22:00. Average number of milkings per cow per day for the complete herd was 1.7 and 1.8, 1.5 and 2.0 for the cow breeds Friesian, Jersey crossbreeds and Norwegian Red, respectively. Average SCC was  $180 \times 10^3$  cells/ml.

#### Future

A main challenge with automatic milking currently is the high capital cost but the concept of combining automatic milking and cow grazing is crucial from a number of perspectives, including economic, legislative (requirement for cows outdoors for specific time periods) and consumer perception. An FP7 funded EU project (coordinated by Ireland) is commencing in January, 2013. Its objective is to develop and implement innovative and sustainable systems that combine Automatic Milking and Precision Grazing for dairy cows. Planned outputs include: protocols for optimum feeding strategies; Pasture management tools; a tried and tested sustainability assessment tool for farmers; Web based decision support tool to optimise economic efficiency, all to be used when combining grazing with AM technology, and finally, Guidelines for optimized operation of both mobile and carousel AM units in grazing scenarios.



## 6 Concluding remarks

### Evaluation of the day

The general opinion with respect to the meeting was very positive. It is good to meet people and to know what they are working on. In future meetings we should plan more time for discussion and less presentation time. Further exchange between researchers was highly encouraged. The participants of the day consider grazing an important topic for Europe. They concluded that innovations to support grazing are certainly needed. Therefore the EGF Working Group "Grazing" should continue to exchange knowledge and should continue to network. Furthermore, it is essential to exchange knowledge about the already available innovations in several regions of Europe. The EGF Working Group "Grazing" is a valuable platform for this.

### Reporting

The highlights of the meeting were illustrated in an oral presentation during the General Meeting of the European Grassland Federation on 4 June 2012 which enabled a large group of EGF-attendants to be informed about "Innovations in Grazing" and about the people involved in grazing research. Next to this, the results from the Working Group "Grazing" were briefly reported in the Business Meeting of the European Grassland Federation on 7 June 2012. Finally the proceedings (this report) and the pdf's of the presentations are available on the website of EGF ([www.europeangrassland.org/working-groups/grazing](http://www.europeangrassland.org/working-groups/grazing)). In the coming years, the EGF Working Group "Grazing" will continue to exchange knowledge, methods and innovations, and will continue to network.



## Appendix 1. Agenda of the meeting

### Meeting of the EGF Working Group “Grazing” “Innovations in Grazing”

Lublin (Room 2 of Congress Centre), 3 June 2012, 9.00-17.00

#### Introduction (9.00 – 9.45)

- Welcome and introduction of participants
- Innovations in grazing (including overview of grazing in Europe in 2011). *Agnes van den Pol-van Dasselaar, Wageningen UR Livestock Research, the Netherlands*

#### Technical support (9.45 – 11.00)

- Concept of mobile automatic system and first results at grazing. *Isabelle Dufrasne, University of Liège, Belgium*
- Mobile milking program in Trévarez: challenging land fragmentation. *Valérie Brocard, Institut d'Élevage, France*
- Estimating pastoral grass intake by use of accelerometers. *Frank Oudshoorn, Aarhus University, Denmark*

#### Coffee and discussion (11.00 – 11.30)

- What additional technical support is needed?

#### Decision support tools for farmers (11.30-12.20)

- Guidelines and tools to get the most from grazing in Ireland. *Deirdre Hennessy, Teagasc, Ireland*
- Decision Support Tools for grazing. *Bert Philipsen, Wageningen UR Livestock Research, the Netherlands*

#### Poland (12.20-12.30)

- Extensive grazing of Polish Heath Sheep on pastures established on fallow lands in North-West Poland. *Ewa Strzelec, Warsaw University of Life Sciences, Poland*

#### Lunch (12.30 – 14.00)

#### Novelties in grazing management (14.00 – 15.45)

- Grazing in Poland. *Piotr Goliński, Poznan University of Life Sciences, Poland*
- Enhanced winter grazing linked with the use of out-wintering pads. *Jean-Pierre Farrié, Institut de l'Élevage, France*
- Grazing in Spain. *Rosa Mosquera-Losada, Universidad de Santiago de Compostela, Spain*
- Comparison of dairy farming systems: indoor feeding versus pasture-based feeding – a case study. *Pius Hofstetter, Vocational Education and Training Centre for Nature and Nutrition, Switzerland*
- Innovative design of pasture based farm systems. *Paul Galama, Wageningen UR Livestock Research, the Netherlands*

#### Coffee and discussion (15.45 – 16.15)

- How to use innovations in grazing to support farmers in their grazing management

#### Innovative approaches in knowledge transfer (16.15 – 17.00)

- Innovative and sustainable systems combining automatic milking and precision grazing. *Bernadette O'Brien, Teagasc, Ireland*
- Final discussion
- Evaluation of the meeting