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AGRICULTURE & INNOVATION



EIP-AGRI Focus Group Permanent Grassland

Topic: Benchmarking European Grassland production and utilisation at national and regional levels

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1. Why benchmarking of European grassland is needed?

Approximately half of the European Union's land is farmed, highlighting the importance of agriculture in the society. Utilised agricultural area (UAA) in EU is defined as the area taken by arable land, permanent grassland, permanent crops (e.g. vineyards) and kitchen gardens. Permanent grassland

covers 32% of the UAA with important differences between the member states and differences in economics of grassland use (Figure 1) (Huyghe et al. 2014). France, UK and Spain have over 7 million of hectares of permanent grassland. In the UK, Ireland and Slovenia permanent grassland covers at least 60% of the UAA. But not only the area differs widely, moreover the kind of utilisation is variable among member states and express the ecological, structural, historical and cultural differences. Grazing systems are typically well developed for example in Ireland, UK, France and some parts of the North and Centre of Europe (The Netherlands, Denmark, Switzerland and also in many parts of the Southern European countries (Portugal, Spain, Italy, Greece). Harvesting grassland for silage production and hay production is more typical of central Europe (Germany), although it is also a common practice in many other areas where forage conservation is needed.

Grazing systems became more environmentally sustainable as necessitated by the EU Nitrates Directive (1991), Water Framework Directive (2000), Kyoto Protocol (1997) and the Soil Thematic strategy (2006), CAP (2013-2020). Emissions of greenhouse gases (GHG) are a consequence of burning fossil fuel, converting forests and grasslands into arable land, and several other natural processes. Emissions of greenhouse gases (GHG) are a consequence of natural biological processes from fossil fuel energy. Grass based livestock systems are growing in overall importance, because grasslands have multifunctions like carbon sequestration, maintenance of biodiversity etc. which are precious to use in ecosystems. Within Europe there are differences between grass production in quantity and quality terms from different countries and within countries. As yet there has never been clear benchmarking of national grass dry matter production within member states. For the grassland community to advance with knowledge of how to increase and improve grass DM production, the benchmarking and understanding of national levels of grass DM production and their differences will be an important first step to quantify. Indeed some countries may not be able to increase grass DM production due to climatic conditions and other major variables (water access, etc.). The reasons why there is variation in DM production due to climate, soil types, types of vegetation and grass quality need to be benchmarked and established.

A key question arises if European grassland is not benchmarked. How can European grassland regions be compared and how can the possibilities for any increase of profitability of permanent grassland be evaluated, if there are no data and benchmarks for each grassland type in each region? Benchmarks are necessary to understand the overall differences between European grasslands and to establish an understanding why they exist and how to use possibilities to overcome the problems. In order to make this comparison, precise definitions of what grassland has been addressed by the introduction of the necessary terminologies described by Peeters et al. (2014). Grassland overviews of Europe are given in papers of Helgadottir et al. (2014) for the North of Europe, Huyghe et al. (2014) for Mid Europe and Cosentino et al. (2014) for the Mediterranean Region.

Some of the differences in member state production are highlighted in Figure 1 which shows a strong relationship between the total costs of production and the proportion of grass in the dairy cow's diet in a number of countries (Dillon et al., 2005). The relationship shows that the average cost of milk production is reduced by 1 cent/litre for a 2.5% increase in grazed grass in the cow's diet. The data also demonstrates that a considerable proportion of the dairy cows diet (50% +) must comprise of grazed grass before a significant impact on cost of production is realised. This can be achieved easily in many EU member states.

One of the main reasons for stressing the importance of grazing is that it is a home grown resource and is a cost effective feed. In Ireland e.g. the ratio of cost of grazed grass to grass silage and concentrate is for example 1:3:5. This relationships may vary between all countries and are depending of market prices for fertilizers and all other production facilities. The exact competitiveness of grass needs to be documented for other EU member states.

It must be emphasised, that due to local conditions and e.g. a differentiated heritage system in some parts of Europe, the paddock sizes are too small for rotational grazing systems. In some countries high cost milk production systems are based around indoor feeding. From a green house gases

viewpoint this is not favourable as recent publications have stated that grazing systems have low GHG emissions (O'Brien et al., 2012; Soussana et al., 2014; del Prado et al., 2014). Fulltime indoor systems are very common in D, NL, B, Lu, PI etc.. High yielding cows are not fed adequately with grazed grass, they require a combination of grass, possibly other green forages like e.g. silage maize and concentrates. There are animal genetics suitable to grazing systems and such genetics are been used by the nations focusing on grass. Farm structure, land price and risk reduction strategies explain that stable feeding is most common in some regions, for instance in D, NL, B, Lu and PI. Moreover, high yielding cows and mixed or concentrate based feed rations have advantages in methane emissions compared with cows fed with grass only (Oenema, 2012).

The objective of this work is to benchmark grass DM production of EU member states and to establish the reasons for differences in grass output, differences in botanical composition, grazing season length, ratio of grazing to cutting. A clear view of the level of grazing and utilisation intensity of EU countries can be developed from this work. The second objective is to establish which tools will work at farm level, in which farmers can use within their region to increase their grassland knowledge.

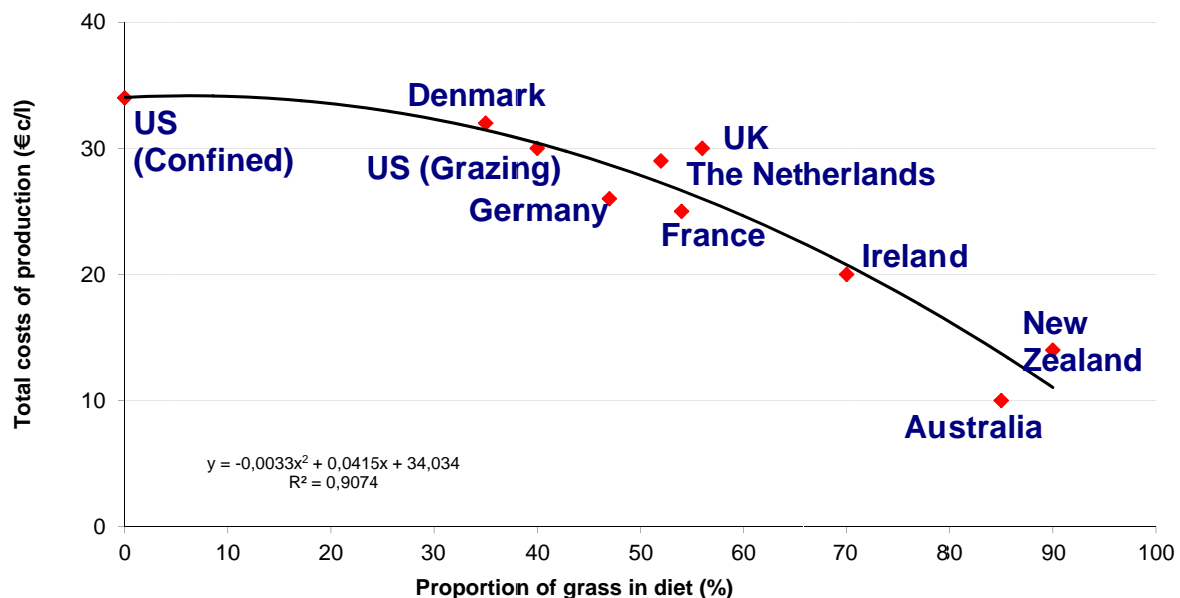


Figure 1. Relationship between total cost of production and proportion of grazed grass in the dairy cow's diet, ranging from total confinement (0% grass) to grass based feed systems (90% grass) (Dillon et al., 2005)

Which benchmarks are needed to describe grassland productivity?

The quantification of grass DM production across regional farm systems is essential to determine areas where efficiencies can be realized and potential exists to increase sward productivity and efficiency. The key issue for Europe is that we are working in the absence of relevant data, using old colour coded area maps of countries is only an illustration and does not establish the proper detail required for informed decision making. In Europe we should be moving on from the debate about the grassland productivity regions to establishing what level of production is been achieved, what is the sward type, how it can be influenced, what is the level of grass utilisation. Benchmarks for describing grassland productivity, and in order to allow various comparisons between countries, should consider the following parameters and regional levels. Terminology is based on Allen et al. (2011).

1. DM-Yield
 - 1.1 On national level
 - 1.2 On regional level under regard of the difference between growth climate zones
 - 1.3 On farm and field level
2. Proportion of home-grown feed and output from grass-based diets
 - 2.1 for milk production
 - 2.2 for meat production
3. Grass feed utilisation
 - 3.1 Grazing (potential and intensity expressed as number of LU grazing days per year; proportion of grazing days to the total growing period in the year; length of housing period caused by drought or cold)
 - 3.1.1 Rotational grazing
 - 3.1.2 Set stocking (continuous grazing)
 - 3.1.3 Mountain and Mediterranean grazing
 - 3.1.4 Stocking density (LU/ha UAA; LU/ha of green forage area; LU/ha of permanent + temporary grassland; LU/ha permanent grassland)
 - 3.2 Cutting (for fresh grass, silage or hay) (proportion of permanent + temporary grassland area)
4. Grassland types (definitions see within Peeters et al. (2014))
 - 4.1 Permanent grasslands
 - 4.1.1 Agriculturally improved grasslands
 - 4.1.2 Natural and semi-natural grasslands
 - 4.1.2.1 Pastures, including rangelands, rough grazing, forest pastures, etc.
 - 4.1.2.1.1 Sole use
 - 4.1.2.1.2 Common land
 - 4.1.2.2 Traditional hay meadows
 - 4.1.3 Permanent grasslands no longer used for production
 - 4.2 Agroforestry systems
5. Botanical composition expressed as percentages of grasses, legumes and other species (herbs, grass-like plants, woody plants, shrubs)
6. Grassland quality
 - 6.1 Seasonal variation of grassland quality (digestibility, lignin, fibre, crude protein, WSC, fat)
 - 6.2 Quality of conserved grass

For all these criteria a lot of data are already available in different countries and in different languages. It is of interest that substantial comparisons are still not possible caused by different methods for data sampling, different quality criteria and because many countries don't have monitoring or reporting systems for all data. Even on national level there are not many reports available which describe the national situation under comparable situations.

The quantifications of grass DM production can also be measured indirectly by output parameters, for example milk and beef production of different animal types or wool. An advantage of the method is the better insight into grass utilization. A limitation of this method is that more parameters are needed. For example the Annual Nutrient Cycle (ANCA) is using this method. The tool will be used by 10.000 dairy farmers in the Netherlands in 2015. Input for the ANCA is among others that specialized organisations are allowed to take samples of the grass silage. Next to the amount of grass silage in m³ including density, also the VEM, protein, etc. are estimated.

Research level

We are proposing to quantify grass DM output at a number of levels. At the outset grass DM production needs to be quantified at research level.

Current methodologies used are cutting grass with a standard protocol and establishing the seasonality and total DM production of a region. The method of Corral and Fenelon (1978) (See Figure 2) has been established to quantify grass DM production, this method has several uses. It can give a first estimate, under a common methodology of what's been achieved at national levels, also some countries may have already dataset built upon this harvesting methodology i.e. Germany and Ireland.

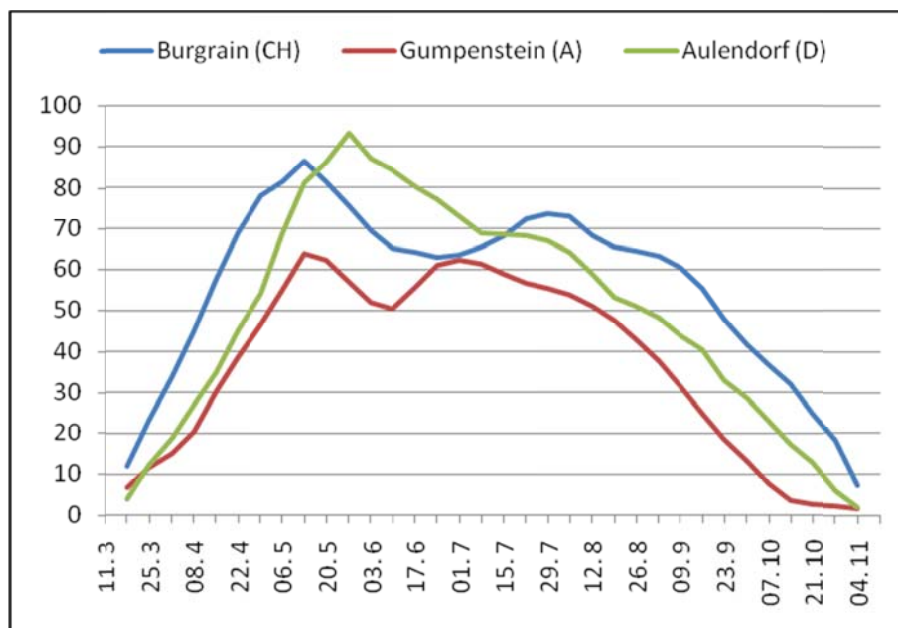


Figure 2. Grass growth ($\text{kg ha}^{-1} \text{d}^{-1}$) during growing season at different sites (averages from at least 3 years, measured with the method of Corral and Fenelon (1978) (Thomet et al., 2011)

In some research centers is the grassland DM output measured weekly, i.e. Pasturebase Ireland (Griffith et al, 2014) or Agricheck in Northern Ireland. These systems can automatically give us an understanding of the level and variation of DM output in those countries.

New methods for measuring grassland production are available with GIS and GPS measures (see i.e. Schaumberger, 2005). These methods should give a better overview about the situation of grassland productivity in whole regions.

A coordinated experiment organised by Corral under the auspices of the FAO Lowland Grassland Sub-network measured the production and productivity of cutting grasslands according to a standardised protocol at 32 European sites (Corral and Fenlon, 1978). This experiment showed the potential of production of grasslands all over Europe. Lee (1983) gathered considerable production data about most European countries. Hume and Corral (1986) attempted to create a production map by using the data of a meteorological network and a grass growth model. Jones and Carter (1992) also drew up a map of annual rain fed herbage yields. A synthesis of all this information has been made (Peeters and Kopec, 1996). The results are presented in Figure 3. As expected, major differences in the annual productions of mown and heavily fertilised grasslands are recorded between sites. The highest yield for ryegrass reaches almost 20 t DM/ha in Germany (Kiel) whereas the lowest yield is only 2 t in Portugal. The most productive sites (i.e., those where production exceeds 15 t DM/ha) are situated in north-western France, Belgium, the Netherlands, Northern Germany, the prealpine areas of Germany, Denmark, Ireland and the United Kingdom. The most of these stations are located on the Atlantic side

of Europe between 52° and 57° of latitude. The less productive sites are situated at high or low latitudes of Europe. At high latitudes, as in Iceland, production is obviously limited by low temperatures and low levels of photo synthetically active radiation (PAR). The figure also shows consistent low production levels along the Mediterranean where drier and hotter conditions limit grassland productivity on herbaceous-dominated pastures.

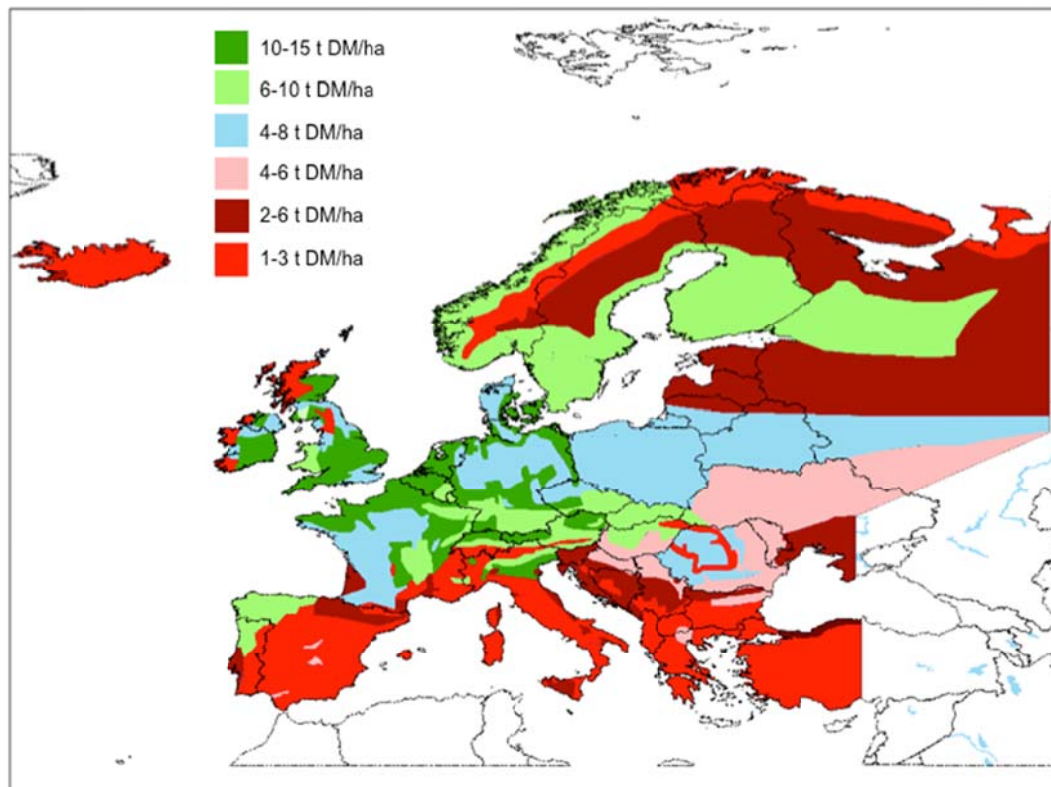


Figure 3. Production potential (annual yields in t DM/ha) of mown and heavily fertilised grasslands (A. Peeters own calculation) (Huyghe et al., 2014)

Note: This map does not reflect the yields for Mediterranean Southern European Regions, where well fertilized (with phosphorous) permanent sown biodiverse pastures rich in legumes are yielding 3 to 6 t DM ha⁻¹ a⁻¹.

Only few comparisons of direct record of grass dry matter (DM) production within a coordinated network organized by member states are available.

Farm level

A number of steps are needed to implement a “grassland” tool successfully within farms of region or country.

- 1) The tool needs to be farmer-friendly, not only for the elite farmers
- 2) Advisors / Agrisuppliers / purchasers/Scientific bodies/ Government need to embrace the grassland tool
- 3) The tool needs “true” outcome – eg. scientific proven.

To develop a grass tool make sure to make a combination of representatives of the 3 groups: farmers; Advisor / Agrisupplier / Scientific bodies/ Government. Depending how the tool needs to be used: management; governmental proof.

At farm level there is a number of avenues of establishing farm DM matter production, the most recent is measuring farm grass cover weekly over the grazing season either by using visual assessment of herbage mass (O'Donovan et al., 2002) or by using the rising plate meter or the sward stick. Different experiences gave that the relationship between herbage mass and sward height depends on sward density and therefore on the animal that is grazing. This weekly profile can then be used to establish the grass production of the paddocks of the farm once the grazing and silage harvest dates are known. In 2013, Teagasc in Ireland has developed a national grass database whereby farmers (dairy, beef and sheep) can quantify week grass growths on their farm using this web based software (Pasturebase Ireland). This is an important step forward in trying to capture the on farm variation in grass growth, but also to try an attempt to increase grassland utilisation on farms. The same method is slowly being adopted in the Netherlands via the projects "Dynamisch Weiden" and "Amazing Grazing".

In France a computer spreadsheet called "Herb'Avenir" (Future grass) integrates growth models for each region. At paddock level grassland production is measured by cutting and weighting the herbage or by visual assessment (O'Donovan et al., 2002). The rising plate meter is also used – equating compressed sward height to herbage mass. Special grassland monitoring programs in Germany like in Bavaria (Heinz, et al., 2008) or in Thuringia collect data over a long time at many locations and allow observations on different grassland sites. In North-Germany data for forage quality are measured by a method called "Reifeprüfung", where the change of crude fibre contents of *Lolium perenne* plants give signals for best harvest times. In many parts of Europe the phenology of grassland plants is crucially for harvest times.

In South Tyrol (Italy) a user-friendly, web-based tool allowing farmers to estimate the potential forage quality at the first cut of permanent meadows depending on the harvesting date, topographic features, management and meteorological conditions during plant growth is being currently developed. This system, called webGRAS (<http://www.laimburg.it/en/mountain-agriculture/1903.asp>) is based on data collected over ten years at selected locations making use of a sequential sampling over seven weeks starting from the time of stem elongation.

Establishment of National Grassland databases

Ireland has developed its own national grassland database -(Pasturebase Ireland (Griffith et al., 2014)). It may be now time for such an initiative to be replicated in other EU member states. This type of initiative can be very powerful to establish the relative differences in DM production within the state.

In Germany the von Thuenen-Institute installed a world-wide-net for agricultural benchmarks (www.agribenchmark.org). This net should be completed for Europe and for the subjects of permanent and temporarily grassland.

In the Netherlands, the CBS (Centraal Bureau voor de Statistiek) collects data on grassland area and kg DM harvested from harvested grasslands. The CBS collects data on grazing (% of farms that practice grazing). The amount of grass harvested by grazing is however not estimated, so it is not possible to provide a total yield of grasslands.

Grassland Utilisation – grazing or cutting or both?

In recent years grazing management strategies have been identified to increase the proportion of grazed grass and reduce the dependency on indoor feeding in grassland systems of milk and meat production. Lengthening the grazing season by 27 days has been shown to reduce the cost of milk production by 1 cent/litre in Ireland (Lapple et al., 2012). By comparing average data of farms from

the 'Sustainable Agriculture Networks (SAN)' and from conventional farms sampled in the 'Agricultural Farm Accountancy Data Network (RICA)' in the same regions of France, Le Rohélec and Mouchet (2008) showed that grassland-based systems in the lowland are able to provide good incomes to farmers, because of the savings on production costs despite the fact that these systems receive less subsidies. The continuous follow-up between 2008 and 2012, of about forty farms of the SAN, mainly located in Brittany, and of farms of the RICA (see Peyraud et al., 2014) confirms the results obtained in international comparisons. The farms of the SAN network are smaller on average than those of the RICA network (56 vs 78 ha), use more grass (87 vs 67% of their Main Forage Area (MFA)) and thus less green maize silage (11 vs 32%) and produce less cereals (8 vs 20 ha). In spite of a lower quota (266 500 vs 349 900 litres) and a smaller total product per agricultural working unit (AWU) (88 454 vs 104 840 €/AWU), the farms of the SAN network produce an added-value and an income before tax rather higher (21 907 vs 17 261 €/AWU) than average farms of the RICA. These savings relate mainly to the purchases of concentrated feed (154 vs 320 €/ha) and inorganic fertilizers (21 vs 92 €/ha). The economic result before tax and without subsidies, which reveals the real technical performance of the system, is even much higher in the farms of the SAN network (7 180 vs 1 490 €/AWU) (Peyraud et al., 2012).

In the study of Samson et al. (2012) the three classes of intensification/self-sufficiency based on the input costs per ha are closely associated to a reduction of grassland in the fodder area (1). The degree of intensification does not seem to be a key explanatory factor of the differences in technique-economic performances. In this study, the most self-sufficient, which are also the more grassland-based systems, appear to be more resilient¹ to price crisis because the share of variable costs in the cost of milk production is always significantly lower than in the more intensive systems (0.10 vs 0.13 vs 0.16 €/l respectively for the extensive, intermediate and more intensive systems) whereas the marketing price of milk practically does not vary from one system to another. This resilience of the more self-sufficient and grassland-based systems is well shown in the data of the SAN network. Economic performances of grassland-based systems strongly depend on the relative prices of animal products and cereals. If grassland-based systems appear to be more resilient, they are also less able to benefit from market improvements (Peeters, 2014).

This needs to be established for other member states. While the focus previously in European initiatives has been to highlight the areas of grassland in Europe. We must now step forward and examine the level of grazing taking place in these member states. In many countries the level of grazing may be much lower than the level of harvesting/ ensilaging or hay making, however such data are not generally available. A key question remains in Europe, what is the intensity of grassland use across member states, some member states have intensive grassland use such as Ireland, UK, Western France, part of Belgium, Northern Germany or the alpine belt of Southern Germany and parts of Austria and Switzerland or South-Tyrol. Other countries or different regions in that countries are intermediate (Holland, parts of Belgium), while more are with low intensity (Italy, Spain, Romania, etc.).

Even in more mountainous regions it would be important to classify the exact usage of grassland to establish how grazing intensity is different across the regions and countries. The use of the term "grazing days" and its necessary definition regarding time and intensity is useful to establish the level of actual grass utilisation across countries.

¹ Resilience refers here to the aptitude of a (eco-)system to maintain its performances (here the economic performance) relatively stable vis-a-vis a risk (here a risk of price on the products). Resilience characterizes the capacity of a (eco-)system to recover a normal functioning and performance after a disturbance. The systems represented in the SAN sample appear thus having a good resilience for the economic performance.

Table 1. Indoor feeding days (caused by winter cold or summer drought) and number of grazing days in different countries of Europe. Sources:

Country	Winter days indoors	Grazing days
Germany	180 (north) – 220 (south)	
Ireland, UK	100 -160 days	200-300 days at grass
Austria, Slovenia	120	
France – mountainous regions		120 to 160 days
Poland		
Sweden, Finland, Baltic states		
Netherlands		80% farmers grazing of which 25% day & night 75% between 6 – 8 hours per day at least 120 days
Portugal (beef cattle, sheep and goats)	0-90	270-365 (in most of the areas, grazing takes place during all year, day&night). Only dairy cows are kept indoors for longer periods, sometimes permanently, particularly in small size farms.

Scientific advances made possible by the functional approach of vegetations (Cruz et al., 2002 and Pontes et al., 2007) allow to propose the types of grasslands (Cruz et al., 2010) that are the basis of grasslands diagnosis agronomic tools. The methodology aims to characterize the diversity of grassland present on farming systems and assess how farmers use the grass growth potential through their practices. This approach aims to improve the quality of the grass at the moment of its use.

In the Netherlands projects like Amazing Grazing (<http://www.amazinggrazing.eu/en>) and Dynamic Grazing are especially used to to improve the benefits of grazing and to show these benefits at farm level.

The role of multispecies grassland

Grassland species and varieties and traits vary within countries and vary widely depending on climate. There is a large effect of species type on DM productivity and some countries will not have the requirement for the same pasture species as others. In the context of benchmarking DM productivity of nations (Table 2), the same approach should be undertaken for pasture species. In countries exposed to mid summer droughts and cold winters, species rich pastures with different pasture combinations are more resilience to monoculture type swards, yet much of these aspects remain undocumented when establishing the DM production variation across countries.

There are questions to pose on this topic

1. What species are present in grassland regions?

Table 2: Summary of some grassland types and attributes in Europe.

Grassland type	Country	Area/ region	Utilisation	Intensity (cuts per a)	Number of species	Yield t DM/a	Protein content %	Energy value	Most common species
Permanent grassland	D	North Germany	silage	5	5-10	8-12	18		<i>Lolium perenne</i> , <i>Taraxacum off.</i>
	D	South Germany	silage	5 (6)	7- 5	8-12	18		<i>Alopecurus pratense</i> , <i>Lolium perenne</i> , <i>Dact. glom.</i>
	Ir	All	pasture	6 (7)	5	9-16	18	1.0UFL	<i>Lol. per.</i> ; <i>Poa prat.</i> , <i>Poa triv.</i> , <i>Fest. ar.</i>
Permanent/ temporary grassland	NL		Silage / pasture						<i>Lol. per.</i>
Semi natural grassland	D	Hilly and mountainous areas	Meadow	2	25-65	4-7	12-14		<i>Vulpia</i> , <i>Bromus</i> , <i>Hordeum</i> , <i>Agrostis</i> , <i>Lolium</i> , <i>Trifolium</i> , <i>Ornithopus</i> ,
Permanent natural grassland	PT, E	All	Grazing	0	10-50	1-3	6-16	<0,7UFL	<i>T.subt.</i> , <i>T. michelianum</i> , <i>Tresupinatum</i>
Sown rainfed biodiverse legume rich permanent grasslands	PT, E	All	Grazing	0	6-20 spp/cvs	3-6	8- 22	0.7-1.0	<i>Ornithopus</i> , <i>Biserrulla</i> , <i>Medicago spp.</i> , <i>Lolium mult</i> , <i>Dactylis</i> , etc.
Irrigated biod,perm. grassland	PT, E	Center and South Irrigated schemes	Grazing + 1 cut for haylage	1 cut	6-9 spp/cvs	12-20	12-22	0,8-1.1	<i>T. repens</i> , <i>T. fragif.</i> , <i>Lotus</i> , <i>Fest</i> , <i>arund</i> , <i>Lolium perenne</i> , <i>Dactylis glom.</i>

Table 3 allows to classify grasslands into 3 functional types (AB, b and C) and to diagnose foraging practices taking into account the plant diversity.

2. Can we predict the grass growth?

The availability of a national grass growth database would greatly assist the development of a grass growth prediction within countries. Most predictions of grass growth capacity are generated from meteorological modeling based on soil and air temperature (Brereton, 1985). The development of a national database will allow actual data to be used to generate regional grass-growth rates, particularly if linked to regional meteorological data.

In Massif central mountains in France where permanent grasslands represent the first forage resources. Measurement of grass growth is an essential tool to managing grass. In mountain areas, 60% of the growth is assumed to take place in spring. Chambers of Agriculture of the Massif Central have set up an observatory of grass growth for three years. The grass growth is not directly measured but evaluated by 5 dates of grassland practices which represent the keys of a well utilization of the different type grass growth (Benchmark).

Table 3. The three grassland types with highest frequency in France and their characteristics (°J : transformation of a grassland practice date by accumulated average daily temperatures (= total, starting to the first of february, of averaged daily temperatures capped between 0 ° and 18 ° C). HERB'AGE tool: www.agir.toulouse.inra.fr/agir/)

Functional type	AB	b	C
Grassland productivity	High	medium high	weak
Fertility and soil depth	Increased Deep soil	Medium Soil less fertile	Weak Shallow soil
Early ripening	Very early to early	late	Enough early
Signs of full flowering	800°C to 1000°C	1400°C	1100°C
Type of leaflet	Medium to large	medium	fine
Type of cover	Strong tufts of grass	Medium carpet	Dense and short cutted carpet
Dominant grasses	<i>Lolium perenne</i> , <i>Dactylis glomerata</i> , <i>Festuca pratense</i> , <i>Holcus lanatus</i> ,..	<i>Agrostis spec.</i> , <i>Phleum pratense</i> , <i>Arrhenatherum elatius</i> ,	<i>Festuca rubra</i> , <i>Festuca ovina</i> , <i>Briza media</i> ,
Legumes	<i>Trifolium pratensis</i> , <i>Trifolium repens</i>		<i>Lotus corniculatus</i> , <i>Medicago lupulina</i>
Other dominant species	<i>Taraxacum off.</i> , <i>Rumex spec.</i> , <i>Umbelliferae</i>	<i>Centaurea spec.</i>	<i>Achillea millefolium</i> , <i>Hieracium pilosella</i>

The first objective of this observatory is to assess the state of the grassland resource at different key periods (benchmark stages): outdoor herd, herd to pasture (300 ° .J), end of the very first grazing (500 ° .J), early cutting (750 ° .J), intermediate cutting (1000 ° .J), late cutting (1200 ° .J), compared to weather data from 35 weather stations in Massif central (rainfall, temperature and estimated potential evapotranspiration). Can then be estimated for each year, the grass production situation on the territory against these benchmark stages.

The second objective of this observatory is to evaluate the real use of the forage resource by farmers based on a network of 47 farms distributed in the Massif Central (cattle milk and meat, milk and sheep meat and goat milk). Alongside each county the Chamber of Agriculture achieved a monthly bulletin INFO-PRAIRIE to inform farmers on weather (Advanced accumulated temperature) and advise about their practices in relation to the altitude and the type of prairie. Info-Prairie synthesizes temperatures, observations of vegetative stages and monitoring of the shoot to maximize the quality of grass harvested or grazed. Info-Prairie gives farmers benchmarks for how best to manage permanent grasslands.

Prediction of grass growth can also be done by several whole farm models, like e.g. DairyWise (Schils et al., 2007). As long as the respective meteorological data are available, different models should be usable. For instance, the wegGRAS include also about 6000 single measurements over 10 years of DM yield at the first cut.

3. Are the forage quality criteria between the regions and countries the same?

Forage quality changes depending of notably on utilization dates, seasons, fertilization, botanical composition, and regions. How to evaluate forage values? Methods for measuring i.e. energy content, crude protein, crude fiber, minerals are to be compared. The use of NIRS and its calibration across countries or at least countries using a common NIRS calibration for different species would help overcome the knowledge deficit in this area. However, documenting grass quality differences is not the primary objective of this work, it may become a major element in the next number of years..

Relevant projects

Amazing Grazing (www.amazinggrazing.eu)

The project Amazing Grazing (www.amazinggrazing.eu) in the Netherlands addresses questions like "How do we ensure that the yield of the pasture is higher with grazing compared to mowing?" The challenges are reducing the grazing losses and increasing the gross output. Innovative ways of thinking are needed concerning grazing systems, type of vegetation or grass, reducing trampling, extending the grazing season and smart combinations with type of cow and cows per ha. A part of the project focuses on "Management by measurement". Farmers measure grass yield by weekly farm walks using rising plate metres. Results are disseminated in a grazing bulletin that is spread throughout the Netherlands (in cooperation with Dynamisch Weiden and other initiatives).

Dynamisch Weiden

Network of young dairy farmers in the Netherlands that aims the proportion of grazed grass in the diet of dairy cows thus increasing the financial benefits of their farms. They measure grass yield by weekly farm walks using rising plate metres. Results are disseminated in a grazing bulletin that is spread throughout the Netherlands (in cooperation with Dynamisch Weiden and other initiatives).

Pasturebase Ireland

www.pasturebaseireland.ie

Pasture base Ireland is a national grassland database run by Teagasc Moorepark. It has approximately 600 dairy, beef and sheep farmers using the sytem. In total it has 850 users and was launched in January 2013. It is both a decision support grassland package and a grassland database. It produces weekly and annual grassland reports which inform the grassland industry.

Research questions

The cost of grass as a feed (grazed and harvested) needs to be established for each EU member state using a common methodology

What are the achieved DM Production levels for grasslands in Europe

What are the Potential DM production levels that can be achieved in grasslands in Europe

The limiting factors explaining the production gap needs to be explored

A grassland measurement network needs to be established throughout Europe

The variation between EU member states, accounting for soil type, climate, management etc. needs to be completed and understood

The level of grass utilisation and its breakdown between grazing and harvesting needs to be established for each EU member state.

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