EIP-AGRI Focus Group

Robust & Resilient Dairy Production Systems

Mini-paper – Farm Management Strategies to increase Robustness and Resilience of Farming systems

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Intro:

Dairy production systems European-wide face relevant changes. Open markets with (almost) no state driven regulation like the former Milk quota system on production anymore, growing and expanding farms and cow numbers per farm will give new challenges for the farm enterprise and it will request advanced and new skills for dairy entrepreneurs to stay in the business with a long term perspective. Market partners as well as dairy processing companies will be in competition for the home market (EU) and for an amount of milk and milk products to be exported in non EU countries and worldwide. The rising demand for high quality food (via a rising number of so called mid class consumers who demand valorised dairy products) both gives risks and opportunities to the dairy industry, for both producers and processors.

Due to the fact that farm enterprises are growing, the amount of foreign capital, of hired labour and possibly of not owned but rented land will increase. Farm financing, financial liquidity (in times of poor milk prices) and commercial viability must be secured to keep the entire dairy enterprise robust enough for a "permanent" volatile income situation in the future. Times of stress and (financial) imbalance are easier to be survived when the farm enterprise shows *resilience*, i.e. is in the position to adapt and to counter threats and challenges. *Robustness* – the ability to quickly regain stability (HUSDAL, 2008) is essential on dairy farm operations, considering that modern dairy farms must a have an economic perspective to secure the farm´s existence and development in a certain time frame.

The end of the quota era on the 1st of April 2015 has been a revolution in the regional, national and European dairy chains. The market liberalization increased concurrency among the dairy companies but also in a second time among dairy regions. Though our common goal remains the competitiveness of farms inside a whole dairy chain. The new market situation led rapidly to a major drop in milk prices. Breeders and people in charge of the dairy sector now wonder about the future of dairy farmers: which production system, which size, on which area, for which markets? In all the dairy basins, it will be compulsory to produce milk efficiently to master the production costs as milk price will probably be more volatile. This can only be done thanks to a very good valorization of home grown forages and an accurate resort to concentrates, well adapted to a more fluctuating milk price in the future.

Farm Strategy

Agriculture, animal husbandry and dairy farming in particular require long term investments (housing, milking equipment). On the other hand, milk as the main product of a dairy operation is meant for immediate or short term processing and consumption. Strategic orientation (business plans, permanent observation of circumstances and surroundings, knowledge based decisions) avoids failures that would affect the operation in a negative way. Professional economic advice and working groups where farmers exchange their knowledge have been proven as efficient tools to develop the single enterprise and to improve performance and sustainability. Due to the fact that income prices (milk sales) are expected to be volatile without a quota system, dairy operations are obliged to set a strategic plan for poor income price situations. A robust and resilient dairy operation, due to a strategic plan should be able to manage price "valleys" and to recover in times of a stable and prospering income situation.

Farm Enterprise (Dieter Mirbach)

Keywords:

Entrepreneur´s personality, Work load/Work force, Economic analysis/Benchmarking systems, Farm strategy

Entrepreneur´s Personality:

"Your work is going to fill a large part of your life, and the only way to be truly satisfied is to do what you believe is great work. And the only way to do great work is to love what you do. If you haven't found it yet, keep looking. Don't settle. As with all matters of the heart, you'll know when you find it".

Steve Jobs, Founder of Apple Corporation

Requirements for modern farm entrepreneurs are exceeding due to various circumstances as, among others, volatile prices/income, growing farm enterprise, extending requirements from politics, society and business partners. A robust and resilient dairy farm will need a "farm manager" and it seems that "hard skills", i.e. expert knowledge, professional (cow/technical) management etc. will become less important once the farm is expanding in herd size and work force. Then so called "soft skills" like ones own behavior towards employees and coworkers, social competence, human resources management will become more important to balance and to consolidate a dairy farm enterprise. The farmer/entrepreneur should be ready to

- Analyze his own personality (what kind of entrepreneur am I?)
- Learn advanced training in various fields
- Choose and make decisions. A wrong decision can be corrected, a "no decision" may lead into frustration and stagnancy

Competency pyramid (Kienbaum, Germany/CH)

Source: Quiring (2013) / Kienbaum

Work load and work force on farm:

The number of dairy farm enterprises in a number of relevant dairy production countries is declining. In contradiction to this, single dairy farm enterprises are expanding. Despite of a growing efficiency, the work load and the number of work hours is necessary increasing at farm level. "Typical" family farms are no longer only with family members. Working with hired labor makes a difference in organizational and personal requirements for the farm entrepreneur. On the other hand, employees give opportunities to enhance social life and to participate in society like "regular citizens", not being bound to the farm enterprise 24/7. Another option to reduce and manage growing demand of work might be to hire contractors for certain duties (harvest work, feeding with feed mixer wagons etc.).

(Economic) farm analysis

Enterprises need investment. Once bank houses and loans are needed, a business plan and a financial overview of the farm is essential. Economic analysis and comparison of own results with colleagues and other dairy enterprises lead to a detailed knowledge of the economic situation and farm perspective. Specific analysis of costs and income in the farm avoid decisions that would lead to severe wrong decisions. There are various systems for the economic analysis and farm available (regional/national/European or even worldwide). Appropriate systems must be able to consider the individual circumstances without leaving a common basis for (horizontal) economic farm comparison. An economic cost of production comparison clearly shows strong and weak points of the enterprise. Taking the (right) decisions, based on figures (and not on feelings) makes a dairy farm more robust and resilient against volatile income situation.

What means "resilience" from a farmer's point of view? Which stressors did the dairy farmers have to face over the last 20 years period?

(Proposed by Valerie Brocard)

A recent study was carried out (Fagon et al, under press) to put to the fore the means and tools available to enhance competitiveness and resilience in dairy cattle farms. would it be possible to describe the strategies leading to success by studying the most economically resilient farms? Data from 330 dairy farms followed during 7 years were added to information coming from 4 focus groups in 4 different regions with various backgrounds (lowlands, upland, etc…).

The definition given by farmers to resilience was the following: "being able to question your way of producing milk in order to adapt, but still keep the consistency of the production system". The advisers defined resilienceas "the capacity to come back to the initial state after a shock while

revising or adopting a new strategy to gain profit from the consequences of the shock”. The words adaptation, robustness, flexibility, new strategy, face difficult times etc…were also listed.
The list of stressors lived by farmers since 2000 can be classified in 4 main external types:

- Climatic hazards (droughts)
- Unfavourable economic background (milk price crisis, increase in input prices…)
- Political decisions (CAP, end of quota period);
- Major diseases (BSE, Blue Tongue etc…)

“Internal” stressors, related to the labour force (health problems, worker or associate arriving or leaving, family problems) or sanitary problems on the farm, can be added to the previously discussed “external” ones.
(see figure)

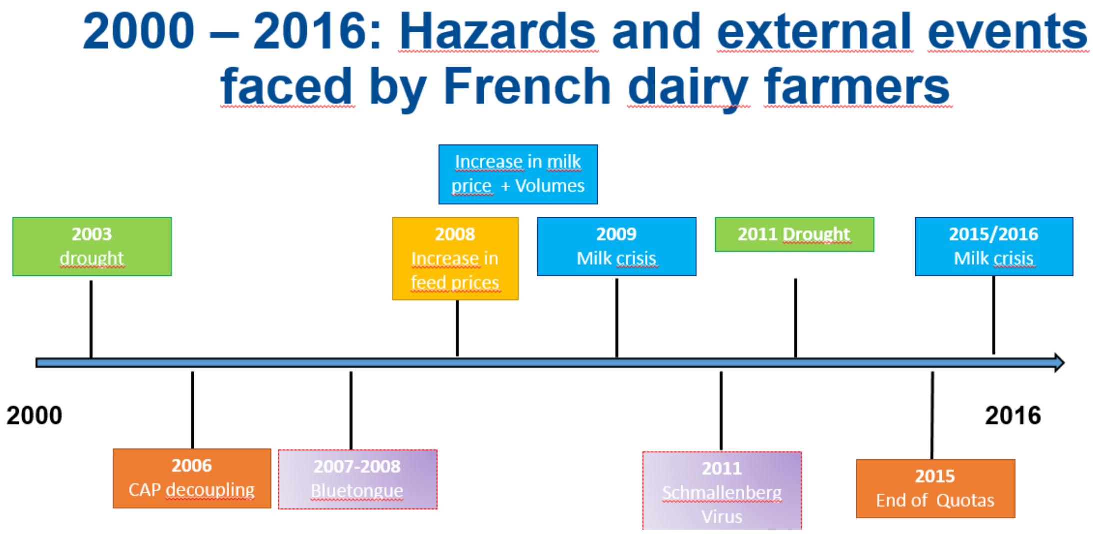


Table: Hazards and external events faced by French dairy farmers (Fagon et al, under press)

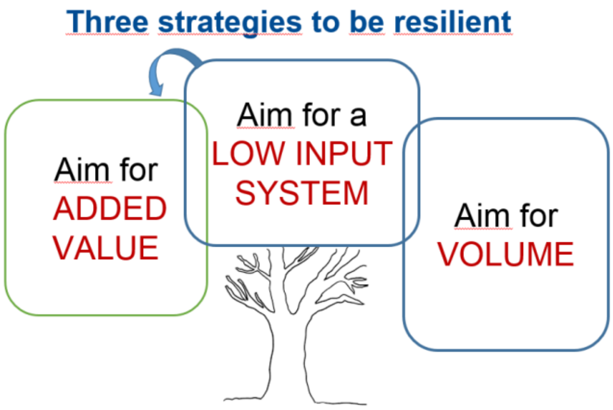
Type of external event	Climatic hazards	policies	epidemics	Economic background
Year/event	2003: drought 2011: drought	2006: CAP decoupling 2015: end of quotas	2007-08: bluetongue 2011: Schmallenberg virus	2008: increase in feed prices 2008: increase in milk prices + volumes 2009: milk crisis 2015/16: milk crisis
Internal events	health problems, worker or associate arriving or leaving, family problems) or sanitary problems on the farm.			

The analysis of the dataset performed in the cited study showed that the most resilient farms are larger, with a higher labour productivity (milk per WU), a greater feeding self sufficiency (lower feeding cost), and a higher economic efficiency (profit % income). For the farmers point of view, the resilience comes mainly from the breeder himself: the job requires many skills to be a good manager. The most difficult being having clear and continuous targets with priorities over the long time periods, and not to forget them for new trends. The factors favouring resilience from the farmer’s points of view are the following:

- Aim for profit rather than for technical performance
- Optimize the use of the farm plants and structure event if it is not ideal
- Develop several activities (diversification)
- Limit the costs and aim for a greater feeding self sufficiency: optimize the system rather than changing it completely, invest properly after testing various options, firstly "digest" the former investments.

Three strategies appear as solutions for an enhanced resilience:

- Aim for VOLUME: labour productivity, well calculated investments, financing capacity preserved. The risks in this strategy are the following: a high dependency towards inputs, the amount of labour, and a risk of excess of investments.
- Aim for a LOW INPUT SYSTEM: mastering the production costs, self sufficiency, well measured extension of the farm. The risks in this strategy are the following: reach a sufficient level of labour productivity, and master a complex production system.
- Aim for ADDED VALUE: high prices, a greater self sufficiency, production under specifications (PDO, organic milk etc…), increase grazing in the system. Again the risks in this strategy are the following: reach a sufficient level of labour productivity, master a relatively complex production system, and find the market.



Fagon et al, 2017.

Finally to be resilient it appears necessary to remain "open minded". Though many problems can be solved from inside the farm (technical choices, targets in terms of profit, work organization, investments…), enlarging the circle of discussion can provide solutions to build the resilience of the system. It can be done through:

- Local collective organizations (machinery coops, shared workers, buying groups, shared rotations of fields…)
- Exchanges: discussion groups, advisers, citizens;
- Partnerships: financiers, providers, buyers, consumers…

The following (socio economic) Indicators for Resilience and Robustness on Farm level can be considered:

- Income over feed cost
- Break even point, i.e. milk price at which full economic costs are covered (EDF definition)
- Forage/feed self sufficiency (Grain can be used as Energy component in the non forage part of the diet)
- Mineral/nutrient balance on Farm (Nutrient balance as a demand to meet requirements of the EU legislation (e.g. nitrogen directive)

Lines/characteristics of the point where resilience of the enterprise is given would have to be definded.

Efficient utilization of resources: Agro Production, Feed basis (Mauro Coppa, Valerie Brocard)

Keywords:

Feed basis on the farm, Improving own feed/forage basis, Gras use versus concentrate/cereals, non (human)edible feed sources, crop rotation, forage quality versus yield, feed costs, grazing systems and yield, efficient forage use, feed costs for purchased feed, diversification on farm grazing and GHG emissions, and environmental regulations

In the global context of an increasing demand for dairy products worldwide, with a more limited resort to natural resources, coupled with a competition with human food, one of the major challenges of European dairy production will be to produce more with less inputs and resources. In the same time, the triple performance (economic, social and environmental) of the sector has to be improved. The aim is thus to enhance the competitiveness of the dairy sector by producing more with a reduced production cost. The working conditions of the breeders as well as the attractiveness of the job of "dairy farmer" also have to be improved. The challenge is also to reduce the environmental footprint of dairy production and to put to the fore its positive impacts on environment in terms of biodiversity, energy production, etc...

The increase in the world population with a prospect of 9 billion inhabitants in 2050 will lead to increasing tensions on the use of resources necessary to produce human food and animal proteins in particular (water, energy, fertilizers, vegetal proteins, arable land). The European dairy sector will be part of this challenge. It will contribute to the global dairy production increase at world level, as some European basins show favorable conditions for this sector (climate, land, farmers and structures). Several dairy regions and countries already forecast growth rates for dairy sector over 20% between 2015 and 2020. This will have to be combined together with a good use of resources both for economic and environmental reasons. These conditions will be compulsory to define what will be the efficient dairy systems in the future (Peyraud et al, 2012).

To reach these targets, it might be pertinent to implement processes to increase the resort to biological regulations (nitrogen symbiotic fixation by legumes, recycling of livestock effluents and efficiency of N, P and K cycles, maximizing photosynthesis, carbon storage, good functioning of soils, exploration of genetic diversity), in order to be productive but also less dependent on inputs (Dumont et al., 2013).

<u>Produce with less inputs</u>

Inputs used in dairy farms are submitted to volatility and periods with high prices as never before. Moreover, the current crisis on the price of animal products creates the emergency to propose in the short term realistic solutions for farmers. It is thus necessary to propose farmers technical and practical solutions to go on creating high quality products but at moderate costs. The proposed solutions should be applicable in the largest number of breeding situations as possible.

Feeding efficiency is defined as the balance between the herd requirements and all the resources than can be harvested or grown on farm (Elluin et al., 2014; Rouillé et al., 2014). This factor can be analyzed through three indicators: dry matter, energy and protein self-sufficiencies.
To meet the challenges of global change adaptation of agricultural systems, to increase and secure food production, the solutions could be: i) designing farming systems based on biological regulations and interactions between the components of the farm, ii) increasing local feed resources and inputs self-sufficiency, iii) working with local actors (Cerf et al, 2006). Moreover, feeding self-sufficiency is a major goal for dairy farming, so as to deal with the ups and downs of input costs and of climatic hazards, to improve the traceability of feed and to reduce the dependence to imported proteins.

<u>Feeding self-sufficiency of farms</u>

The main challenge in dairy farms thus consists in improving the home-grown feedstuff and protein production, so as to improve protein self-sufficiency. The relatively high availability of land at a moderate price in some countries is an opportunity to meet feed requirements of the animals with home grown fodder and crops. This strategy is a major competitiveness issue in terms of production costs for dairy systems and also an efficient solution to reduce losses to the environment, e.g. through nitrate leaching and greenhouse gas emissions. Self-sufficiency is also important in terms of breeding’s image. More than the question of self-sufficiency in terms of dry matter, energy or proteins, the question of competition between proteins available for food and feed is important, and puts the notion of edible proteins into the fore (Wilkinson, 2011).
An increasing dependence of European dairy farms from off-farms and human-edible feedstuff, often imported from other continents (i.e. soybean form South America) is occurring. Reconsidering dairy farming systems, starting from crop setting, to reinforce the use of non-human-edible feedstuffs and to reduce inputs and improve self-sufficiency have to be a priority issue to increase robustness and resilience of a dairy farm.
The forages utilization in animal nutrition have to be increased. When forages are managed to reach high nutritive value, they can be an important protein and energy sources to sustain even high milk yield and to assure typicality and quality to dairy products. Such forages produced on farm are the cheapest feedstuff and will allow to reduce concentrates use and input in the farming systems and production cost, increasing dairy farms competitiveness in both intensive and extensive dairy farming systems. Keeping this strong link between dairy production and forage and territory should be a major target both for economic and environmental purposes (Brocard et al, 2015). It also contributes to the specificity and the image of dairy products for consumers.
The increase of high quality forage self-sufficiency can be targeted in farming system with different levels of milk yield, different agricultural setting and different levels of intensification.
In the high milk yielding dairy farming system of the fertile areas in which climatic condition favor maize cultivation, in example, cow feeding has been simplified by the on farm production of the energy quota of cow requirement trough maize silage and by purchasing off-farm the protein (i.e. soybean) required to fulfill animal requirements. This is particularly emphasized in the region with low availability of arable land, with in which high yielding crops such as maize silage, are required to feed a herd. In these farming systems, facing the increasing soybean and protein costs, the economic competitiveness is no longer guaranteed and the farm remains economically efficient only with very high milk yield and a high milk price (Borreani et al., 2013). With a decrease in milk price, as occurred after the end of the quota system, these farming systems became no longer profitable. The conversion of part of the crop production to grass or legume grasslands (i.e. alfalfa or clover) around at least the 40-50% of the farm arable land, for the production of high quality forage, harvested at an early phenologic stage and conserved with the aim or reducing the field losses, such as for haylage or silage, appear strategic. Indeed, it would assure an increase in the farm protein self-sufficiency from about 30% to over the 50%, and a reduction of the dependence of protein-rich feedstuff from the market (Tabacco et al., 2016). The use of

high proportion of grass derived forages if high quality derives in a significant reduction in feeding costs by more than 20% and in an increase in income over feed costs by about 10% (Borreani et al., 2013). The revenues of the farm can rise up by about 25% (Tabacco et al., 2016). This approach implies a change in the conception of forage production, from DM source to protein and energy source, by preferring the protein and energy yield as a strategy to make dairy farm more robust and resilient.

The introduction of grasslands for forage production in the crop rotation, reaching about 50% of the farm agricultural surface, also has some positive implication in the reduction of pesticides, especially against those insect or pathogens that find their optimum with mono-cropping practices. This leads to a positive effect on environmental impact, but also on production cost, as the cost of use of pesticide can decrease by more than 60% (Tabacco et al., 2016). Similarly, the use of legumes in the crop rotation would then favor fixation in the soil that significantly reduce by about 50% the needs of N input by mineral fertilization for the following crop, reducing production costs as well (Tabacco et al., 2016). A significant reduction (about the 25%) also occurs on the fuel and energy lower consumption.

The increased use of high quality forages would also have important consequences on animal health and welfare, reducing the outbreak of subclinical metabolic disorders, reducing veterinary costs, contributing to make the cow productive life longer, and improving fertility, with a consequent increased profitability of the dairy farm (Comino et al., 2015). A longer cow productive life implies a lower return replacement rate, with a consequent reduction in the overall cost at a farm level (feeding costs, veterinary costs, housing, etc.). Contemporarily, it can favor a higher culling rate, which can be positive for a more efficient genetic selection of individuals, improving the robustness of the herd. A high fertility rate results in a larger number of pregnant heifers, which can be sold and generate an extra income form the dairy farm or that can be crossed with breeds specialized in meat production: the generated crossbred forms a part of the herd which can find a better economical collocation as calves for fattening.

On the other hand, a higher fertility often results in a short-term increase of cow density on the farm, without any possible quick adaptation to farm surface or housing systems. This can be a weak point, as, if the access for feedstuff and rest bunks is not guaranteed in each moment to all the cows, the impact on animal welfare would generate a turnaround of production costs, with a loss in milk yield and an increase of veterinary costs.

The conversion of cereals to grass or legume grasslands for forage production is often limited by the lack of availability of further land, needed to compensate a possible lower yield of such cultures compared i.e. to maize silage. This limit can be overcome by the cooperation between a dairy farm and the farms producing cereal or forages located in a neighbouring territory. The dairy farm can buy directly the forage before harvesting and harvesting it on its own or can ask the other farmers to produce forages targeted for the requirement of the herd instead of traditional products (i.e. haylage or grass silage instead of hay or high moisture corn silage instead of corn grain). This cooperation results in a lower harvesting work (thus, reduced harvesting costs) which can lead to a lower price for the dairy farmer compared to traditional forages, but with a higher protein or energy yield.

In the farming system with a low stocking density, having a large proportion of the surface of grassland (temporary or permanent), such as in mountain areas etc., the feeding costs are usually lower compared to the intensive dairy farming systems, but facing a low milk yield that make these system often underperforming. The economic performance of these systems has been often approached through the increase of the added value to the derived dairy products. However, a more efficient use of forages can have significant impact on the economic performance as well. When grazing is not applied a sufficient attention, it is often paid to manage it to maximize the energy or protein yield of grassland (herbage phenologic stage, cow grazing selection, grazing management, etc.), especially in mountain areas (Farruggia et al., 2014). An unfocused grazing management can result in losses in milk yield (Farruggia et al., 2014). Several

research have highlighted indeed the economic efficiency of grazing if managed under intensive management practices (Ho et al., 2013; Hanson et al., 2013; Winsten et al., 2010). According to these researches in several cases it is possible to convert "zero grazing dairy system" to "intensive managed grazing dairy system", increasing farm profitability, with positive effect on environmental impact, product quality and animal welfare. However, the weakest point of grassland based dairy farming system is often the lack of targeted strategies for the production and conservation of forage stock to be used out of the grazing season. The problem, the solution and the strategies are similar to those discussed for the intensive dairy farming systems and pass through the conception of feeding stock as a stock of protein and energy, instead of a stock in DM. This change in the approach lead to prefer haylage or silage to traditional haymaking. Hay is often harvested late in the season, especially at the first cut, because of the meteorological risks, which are high in the period in which herbage should be harvested to obtain a high quality forage. Haylage or grass silage need a shorter harvest time and reduce significantly the meteorological risks, assuring a high protein and energy yield (of more than the 50%), thus reducing the need to purchase concentrate or other feedstuff on the market, reinforcing the link between the product and the territory of origin.
On the other hand, on both intensive and extensive dairy farming systems, the increase in the use of grasslands instead of cereal crops generates an increase of work for farmers, that do not always dispose of the internal resources to face to. This leads to the resort to off farm work, which is however largely compensable by the lower feeding and production costs.
The analysis of environmental impacts shows differences between production systems related to the part of grass in the system, the stocking rate and the breeding practices (Dollé, 2013):

. The share of grazed grass in the diets: it limits the inputs of protein concentrates and reduces the GHG emissions thanks to the longer time spent by animal outside.

. The management of the herd: the replacement rate, the sick cows, the age at first calving influence the number of 'unproductive' livestock units and thus the stocking rates.

. The level of inputs (concentrates, mineral fertilizers, fuel). The lack of self-sufficiency creates a strong dependency for energy resources and a high and risky N balance.

Therefore, the milk produced from home-grown forages appears to be correlated to 'other outputs' of the system such as mineral balance and its possible negative impacts on the environment. The intensification level of the production systems must thus be chosen taking these aspects into account in order to limit the risks of possible negative impacts on water or air quality. They will also be driven by the environmental regulations implemented.
In terms of machinery, the implementation is minimal and requires low investments, such as those required for silage bunk or for machinery for haylage, which can be purchased also in collective forms, shared among farms.
The use of grassland derived forages has also a general positive impact on product nutritional and sensor quality (Giaccone et al., 2016; Coppa et al., 2013; Martin et al., 2005).
The differentiation of the activity of a dairy farms by cheese making part of the milk and selling it directly, to start agrotourism activities, or by didactic function, involving schools, as holydays farm, etc. is also an efficient solution to increase the income of a dairy farm. As for the increase of grassland surface, this solution also has a high work requirement and is often economically efficient if the work is provided by the farmer's family, with minimal input form out of the farm. This makes such solutions convenient in particular for the family farming.
In conclusion the dry matter, energy and protein self sufficiency evaluation on farm - calculated as the ratio between the amount of feed DM, energy or protein produced on farm and the total amounts of feed DM, energy, or protein fed daily to lactating cows (Borreani et al., 2013)- ca be introduced as parameters usable as indicators of farm robustness and resilience.

The right type of cow for the right system (Valerie Brocard)
Keywords:

Cow breeds, breeding lines in Holstein population, concentrate use/input, lactation curve, crossbreeding, and milk content

The right type of cow for the right system.

The end of the regulation of the European dairy market through the support to prices since 2008, as well as the end of the quota system in 2015, increase the sensitivity of dairy farms to the perturbations created by a more unstable world market. As a consequence, the fluctuation of the demand of dairy products one the one hand, and the sometimes brutal variations of the costs of inputs and prices of agricultural products on the other hand will reinforce the need for a permanent adaptation of the production systems which should be flexible, reactive and robust in order to remain sustainable. In this background, the animal and its management constitute one of the possible tools to adapt the systems, in particular thanks to its capacity to cope with the conditions of its background. Differences appear among animal (cow) types. As an example, in low energy diets, Holstein cows appear to be much more reactive than Normande ones (Delaby et al, 2009). This quick reactivity to maintain milk production but by losing body condition and reducing reproduction performances makes this breed incompatible with strict and severe feeding conditions as encountered in grass based, low input systems with compact spring calving patterns.

Until recently, the main paradigm in dairy production was the following: imagine and choose your production system to express the dairy genetic merit of the animals, in particular where land is ploughable and usable to produce crops (Peyraud et al, 2009). But the market management via the quota system, the relatively stable milk prices before 2015, the increasing size of the farms, the need to decrease the production costs as well as the wish of farmers to improve their quality of life have given birth to a huge diversity of production systems and breeding options. It is thus not necessary or relevant to maximize dairy production in systems aiming for the maximal production from grazed grass with a limited resort to concentrates (Brunschwig *et al.*, 2001). Experiments made in Ireland on low input grass based systems with block calving clearly showed the great difficulty to maintain a sustainable production system with high genetic merit Holstein cows which were mainly selected on dairy production-volume, but face major reproductive problems in such situations (Horan *et al.*, 2004; Dillon *et al.*, 2006). Moreover, it is now clearly shown that Holstein breed is facing a risk of inbreeding because of the limited number of sires used for selection; this situation is jeopardizing the genetic variability (Mattalia *et al.*, 2006). This statement clearly puts to the fore the relevant issue of properly choosing the genetic type of the animal in accordance to the type of production system desired on the farm. The dairy specialized breeds may not be the most adapted for productive, but low input and self-sufficient systems.

Still the current genetic merit of the animals enables them to produce quite high amounts of milk from good quality forages. Many experiments from Ireland or France show that it is possible to reach 7,000 kg of milk per lactation with Holstein type cows, on a grass based system, with spring calvings, and with less than 500 kg of concentrates (O'Donovan et al, 2016; Brocard et al, 2008). The possible non expression of the dairy genetic merit in order to limit production costs still does not suppress the interest on relying on high genetic, high intake capacity animals. Actually, when breeding and economic conditions are favorable to an increase in dairy production, this animal should be able to efficiently response to an increase in the nutrition inputs thanks to concentrate deliveries. Moreover, it would remain interesting to aim for a type of animal with a relatively "flat" peak of production to limit the mobilization of body reserves in early lactation and all the health troubles that are related to it, in particular reproduction problems (Rotz, 2005).

Mixed breeds could be a more relevant choice in some regions, in order to implement more sustainable and well balanced production systems (Peyraud, 2009). At farm level, these breeds also can produce relatively high production levels with one calf per year, mostly with grass and hay based systems. This way they can secure and stabilize the farmer's profits in particular in low input systems. Moreover the breeding systems for such breeds can be relatively flexible with low replacement rates thanks to the good reproductive performances and the better breeding qualities of these animals. Finally, these mixed breeds usually produce a milk with higher protein content and thus more suitable for cheese making. Many regions using such mixed breeds produce under PDO signs and many of these products include that cow type as part of the compulsory specifications; it also keeps the link between these breeds and their geographic origin and territory.

As shown by Dezetter in 2016, crossbreeding appears in many production systems as a profitable and technically feasible option. As the global economic context for dairy operations is quite volatile with an unfavorable trend, crossbreeding appears also to be a possible way to improve Holstein farms profitability.

As a conclusion, the search for the maximal efficiency challenges the issue of the adaptation of the cow type to the production system. In the future we may use the genetic diversity to a wider extent; the increase in the genetic merit for the sole dairy volume is no longer the option, in particular for Holstein cows. The selection on functional traits as now implemented will have to be reinforced (in particular on fertility). The resort to mixed breeds remain an option in many grass based regions. And crossbreeding dairy breeds also appears as economically profitable in many scenarios. The milk composition will also have to be taken into account in relation to the dairy processing chain requirements and the industry should not be forgotten when defining the breeding purposes.

Herd Management (Anna Liimatainen)

Keywords:

Education, Cow-how, cowmanship, Farm goals, animal health and ist economic value, strategic decisions, use of modern (sensor) technology, Evaluation of the enterprise, continuing education, optimise herd management, cooperation between farms, education of staff

Herd and animal management has become one of the most important tasks on expanding dairy farms, who want to develop the production and profitability. Volatile markets and prices, globalization and all kind of activities over borders and overseas in dairy production bring new challenges and hopefully also new possibilities. Farmers can get new ideas, open their eyes, learn from others and see how the colleagues work in other regions. To learn more about herd management is very often the main reason when visiting other dairy farms even the word is not used as motivation. Herd management is a wide collection of attitudes, knowledge, information and actions to recognize. Cow-how is the key question to be answered.

Every farm has its own management implementation

Since the herd size continues to grow in all parts of Europe, we have to be well aware of the impacts and consequences on production and animal welfare and on the other hand of the risks to deal with. Small herds on remote areas have very different problems to manage than big herds with thousands of cows on areas with high density of farms. Farms can be categorized in many ways, high yielding-low yielding-bioproduction-hay based-family farm-cooperative-special breeding- and so on, but they all have in common that the herd and individual animals have to be managed in one way or another to achieve the goals of the farm.

Issues to manage on dairy farms

On growing dairy farms management concerns rather animal groups in different age or lactation stage than individual animals. The farmer has to develop a system to prevent diseases, increase the longevity of cows and losses of the milk production. Fertility, udder and hoof health are today important themes on dairy farms, which cause often huge economic losses (and grey hair) for farmers. They are strongly connected to animals themselves, circumstances in the barn and how feeding and care of animals is organized. On the other hand, infection diseases spreading from farm to farm and carried by people, cattle itself, birds, rats, insects, feed stuffs and so on cause nowadays very big losses around the world. Wide use of antibiotics and other medicals has grown to an enormous problem with negative impacts allover.

What is herd management?

Managing the herd and animal welfare means a wide range of tasks and actions on dairy farms. Dairy farmers have to set up their strategy and goals for the herd, have plans for production, breeding, health, feeding etc. organize the work, check and analyze the results and most of all make the decisions to improve the operation. e.g.. health issues depend on various factors, infection diseases need other means to manage than those caused by conditions, feeding or other external factors. It is a question to find for every risk factor effective preventing means and methods, which are available for the farmer to help managing the herd.

Herd management is strongly based on numeral data provided by milk control, heat detection, health control, breed development, robotic milking, technical it-based equipment and automatics in barns, which collect numerous (hundreds and thousands!) key figures of production, health and fertility. The modern it-technology with various sensors is already there to identify factors which indicate issues on health and welfare. There is also a lot of benchmark information nationally and internationally to take advantage of. Often it is more a question, how to find the best indicators to use and analyze the information for decision making and necessary changes in herd management to improve the results. Farmers should know, where they stand and what are the most critical factors they should improve in the own farm.

Besides modern technology to help managing the herd it is important to understand animal behavior, even more important in bigger herds. “Cattle-eye” or cowmanship is a necessary quality for those who take care and are responsible for animal welfare. Ability to read the animal helps to create better conditions in handling cattle. Declining numbers of dairy farms means, that there will be less people with cattle-eye.

Cattle feeding is one of the key matters in herd management, feeding costs are about 50% of all costs in milk production. Today’s calf is tomorrow’s cow means that a herd manager has to be well aware of all biological, economical and also environmental matters around feeding. The quality and quantity of the on farm produced and bought feed stuffs and feeding process of each animal group have to be controlled carefully. Raising calves to heifers and cows include many different periods and special attention has to be given when bigger changes are ahead. Benchmark between other farms with same kind and size of production reveals the weaknesses and strengths in this area.

Cow comfort has been discussed for years and there are many kind of equipment and solutions for all sorts of welfare issues. There is always something that farmers can do better, even for free or reasonably cheap. If they have to invest a lot of money in buildings or new technology it is a question of economy. Successful herd management includes the improvement of cow comfort based on checking the behavior and significant symptoms of the animals. Minimizing the stress factors is most important in every aspect.

Cooperation with other farmers in certain matters, for example heifer growers or feed suppliers, affects directly the production results in the barn. In these cases the herd management extends wider and demands extra attention on communication means.

The question of communication raises up strongly when working with employers. Herd management includes the continuing training of those who work daily with the animals. Everyone has to recognize the tasks and measures in the barn and be part of the production.

Summary/Conclusion (Cynthia Verwer)

In the global context of an increasing demand for dairy products worldwide, with a more limited resort to natural resources, coupled with a competition with human food, one of the major challenges of European dairy production will be to produce more with less inputs and resources. In the same time, the triple performance (economic, social and environmental) of the sector has to be improved. To meet the challenges of global change adaptation of agricultural systems, to increase and secure food production, the solutions could be: i) designing farming systems based on biological regulations and interactions between the components of the farm, ii) increasing local feed resources and inputs self-sufficiency, iii) working with local actors (Cerf et al, 2006).

Self-sufficiency, especially feeding self-sufficiency, is a major goal for dairy farming, so as to deal with the ups and downs of input costs and of climatic hazards, to improve the traceability of feed and to reduce the dependence to imported proteins. More than the question of self-sufficiency in terms of dry matter, energy or proteins, the question of competition between proteins available for food and feed is important, and puts the notion of edible proteins into the fore (Wilkinson, 2011). Reconsidering dairy farming systems, starting from crop setting, to reinforce the use of non-human-edible feedstuffs and to reduce inputs and improve self-sufficiency have to be a priority issue to increase robustness and resilience of a dairy farm. Dry matter, energy and protein self-sufficiency evaluation on farm - calculated as the ratio between the amount of feed DM, energy or protein produced on farm and the total amounts of feed DM, energy, or protein fed daily to lactating cows (Borreani et al., 2013) can be introduced as parameters usable as indicators of farm robustness and resilience.

Producing forages targeted for the requirement of the herd instead of traditional products will have positive implications on animal health and welfare, reducing the outbreak of subclinical metabolic disorders, reducing veterinary costs, contributing to make the cow productive life longer, and improving fertility, with a consequent increased profitability of the dairy farm (Comino et al., 2015). The introduction of grasslands for forage production in the crop rotation, reaching about 50% of the farm agricultural surface, will have positive implications in the reduction of pesticides, improving cooperation between a dairy farm and the farms producing cereal or forages located in a neighbouring territory. It also contributes to the specificity and the image of dairy products for consumers.

Next to (feeding) self-sufficiency, the animal and its management constitute one of the possible tools to adapt the dairy production systems. The genetic type of the animal should be properly chosen in accordance to the type of production system desired on the farm. Some dairy specialized breeds may not be the most adapted for productive, but low input and self-sufficient systems. Mixed breeds could be a more relevant choice in some regions, in order to implement more sustainable and well balanced production systems (Peyraud, 2009). When defining breeding purposes also milk composition should be taken into account in relation to the dairy processing chain requirements.

Other strategies that can be followed to support and maintain a robust and resilient dairy operation, are;

1. Joining a professional (economic) advice- and working group to exchange knowledge. These have been proven as efficient tools to develop the single enterprise and to improve performance and sustainability. One can think of involving/joining local collective organizations (machinery coops, shared workers, buying groups, shared rotations of fields), discussion groups with advisers and citizens or partnerships with financiers, providers, buyers, consumers, etc.
2. Developing the "soft skills" of the "farm managers", like one's own behavior towards employees and coworkers, social competence, human resources management, as these skills will become more important to balance and to consolidate a dairy farm enterprise.
3. To make choices and decisions based on figures and not on feelings.
4. To aim for clear communication and understanding between advisors and farmers as they have different ideas and different understanding of resilience. Farmers also favor

different resilience factors then the ones known from an economic point of view. Combining the farmers' and economic point of views results in the following strategies to enhance resilience at the dairy farm enterprise and dairy chain;

- Aim for VOLUME: labour productivity, well calculated investments, financing capacity preserved.
- Aim for a LOW INPUT SYSTEM: mastering the production costs, self-sufficiency, well measured extension of the farm.
- Aim for ADDED VALUE: high prices, a greater self-sufficiency, production under specifications (PDO, organic milk etc…), increase grazing in the system.

The risks in the above mentioned strategies are 1) to reach a sufficient level of labour productivity, 2) to master a complex production system and 3) to find the market. Other risks are the high dependency towards inputs, the amount of labour and a risk of excess of investments.
"We cannot solve the problems we have created with the same thinking that created them!"

[Albert Einstein]

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