



# Impact matrix analysis and cost-benefit calculations to improve management practices regarding health status in organic dairy farming

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## - Deliverable -

### D3.2 - Final monitoring and preventive protocols

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#### Executive Summary

This document provides the final design and recommended use of the two pro-active protocols aimed to be adapted to organic dairy production: the monitoring and the preventive protocols. Stages of development of this tool are described while its effective implementation on-farm is reported in deliverable D3.1.

Dissemination Level		
PU	Public	PU
PP	Restricted to other program participants (including the Commission Services)	
CO	Confidential, only for members of the Consortium (including Commission Services)	



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## Introduction

Preventive strategies, earlier detection of diseases and treatments of diseased animals at an early stage are part of the leading ideas in organic livestock production, and are expected to result in more favourable clinical outcomes and less antibiotic usage. Efforts in regular observations of the herd, data acquisition, data analysis and reactive preventive actions if needed are assumed to result in improved action targeted to diseases occurring along time. That is what we could call a proactive approach.

Regular monitoring is a key component of herd health and production management programs (Brand et al., 2001). Monitoring allows an assessment of whether different elements of the production process are under control and work correctly. This information is obtained by conducting regular programmed observations or measurements of these elements (Noordhuizen et al., 2008).

In the field, we observe a lack of implementation of herd health management practices that prevents improvements in animal health. EFSA' Scientific Opinion recommended that research results should be used to design codes of practices and monitoring protocols addressing the major health threats to dairy cattle welfare, such as mastitis, lameness and leg injuries (EFSA, 2012). For years, a huge amount of knowledge has been gathered on production diseases of dairy cows. Today, one of the main challenges to reduce or prevent disease is to transform the extensive amount of knowledge generated through research on animal health management into tailored, effective and consistently implemented practices on each farm (LeBlanc et al., 2006; Tremetsberger and Winckler, 2015). Insufficient compliance by farmers and advisors with management practices proposed in disease control plans is one reason that these plans fail to improve herd health (Bell et al., 2009; Green et al., 2007). Same authors suggest that herd health management practices need to be farmer and farm-specific to ensure farmer compliance.

Participatory approaches can be used to design farmer and farm-specific tools that are accepted by farmers. A participatory approach includes each concerned person in the decision-making process, including the farmer who will be affected by the decisions taken. This approach acknowledges that farmers possess much more knowledge about their own system than any outside person could ever obtain. The veterinary, on the contrary, would have more knowledge about animal diseases. It creates an environment to reflect on and analyse information (Whay and Main, 2010). Using a participatory approach creates an opportunity for dialogue between farmers and their farm advisor on the farmer's goals and objectives (Vaarst et al., 2011). Decisions remaining to the farmer ensure that the tools are farm-specific, in agreement with the organic production system, and based on the farmer's perception of the problems currently on his farm.

Therefore, we hypothesized that the use of a participatory approach could result in the design of herd health management program which each farm could better integrate into their farm management practices.

## Objectives

The objective of the deliverable 3.2 encompasses the first two tasks of WP3:

- ✓ Developing a pro-active monitoring protocol adapted to organic dairy production to increase effectiveness in treating animals and to reduce the use of chemically allopathic treatments,
- ✓ Developing a pro-active preventive protocol adapted to organic dairy production.

A herd health program was conceived in France and Sweden, and based on the developed monitoring and prevention protocols. In this document the different steps that led to the final versions of the two protocols are described, as well as their structure and content, and their recommended use by the farmers and advisors.

## 1 Material and Methods

### 1.1 Basis for a participatory herd health management program

The first choice we made is to design a herd health management program that takes into account five diseases, group of diseases or disorders. They have been targeted to be monitored in dairy cattle because of their importance in terms of frequency and impact: udder health or mastitis, reproductive disorders, lameness, metabolic disorders and impaired calf health.

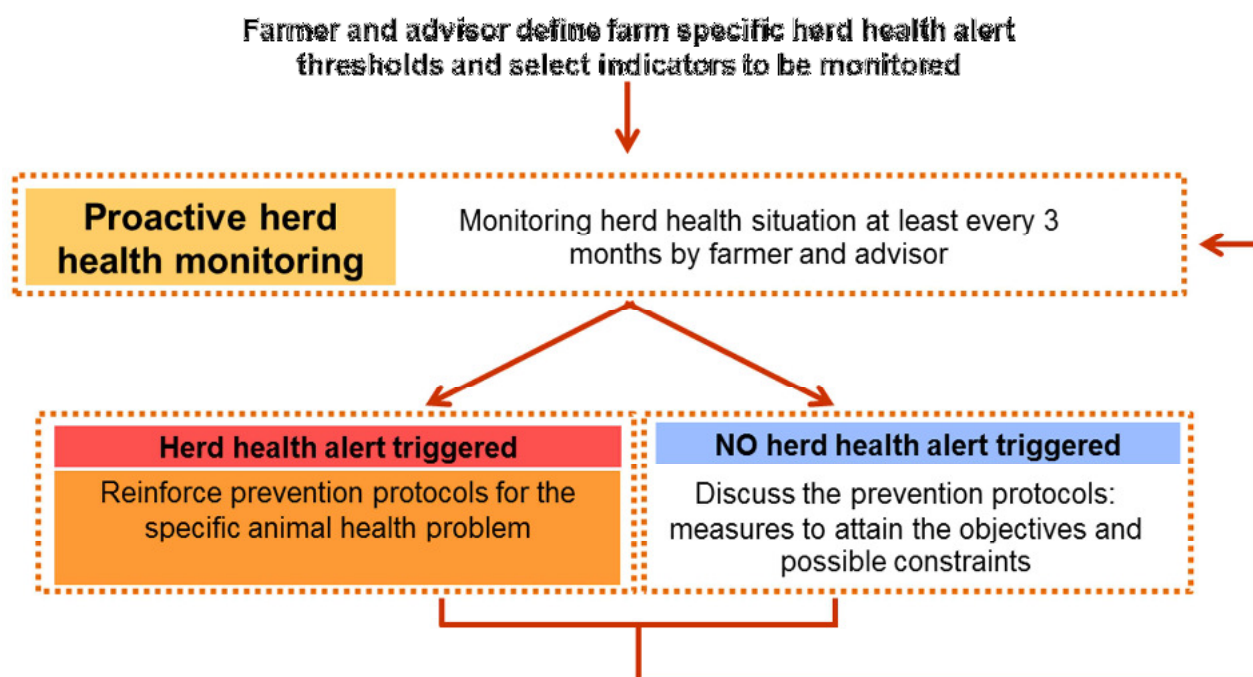
As described in the deliverable 2.5 “Results of on-farm assessments”, udder health is the most common production disease affecting the dairy cow. For the farms in the project, the median prevalence of high somatic cells count (SCC) ranged from 0.27 to 0.36, when using 200 000 cells/ml as a threshold, although a reasonable proportion of the herds, especially in ES and FR, had higher prevalence's.

Reproductive disorders such as cystic ovaries, retained placenta and metritis are important production diseases with a considerable effect on the reproductive performance of the herd. For the farms in the project, the proportion of prolonged calving intervals (> 400 days) varied on average from 0.36 to 0.5. It should be noted, however, that calving intervals are also directly affected by management decisions such as culling and length of voluntary waiting period.

Metabolic disorders such as displaced abomasum, ketosis and SARA can have considerable effects on milk production. The ratio between fat and protein in milk at test-day observations was used to provide a picture of the prevalence of cows at risk of having ketosis and SARA.

On-farm mortality of young calves is considered because it reflects, not only the calves health, but also the health status of the herd, has a major impact and its incidence can thus be used for monitoring purposes.

The pro-active approach adopted here requires a regular surveillance that allows the farmer to anticipate and react before the health situation became severe and a treatment necessary. Along with the monitoring protocol, a preventive protocol gives ways to react correctly in order to avoid the health problem. It is linked to the monitoring protocol, meaning that the indicators lead to a few specific risk factors and not to the entire preventive protocol. The farmer and the farm advisor can also use the preventive protocol as a background for discussion and a decision support. The advisor, thus, has an important role as he helps the farmer making the connection between the monitoring protocol and the preventive protocol, and then with the decisions to take on the farm. The approach functions as a feedback loop where the surveillance leads to the identification of biosecurity measures followed by repeated surveillance in time to see if the taken measures were well adapted and effective in improving herd health. This idea is illustrated in the figure 1 below.



**Figure 1: Outline of the pro-active monitoring and the preventive protocols.**

The main novelty introduced during the conception of the herd health management program is to use a participatory approach. It means that the construction of the tool presented here was initially done within a community of scientists but finalised and made operational by the cooperation of the farmer and the farm advisor. Indeed, it has to be a flexible tool that every farmer can adapt to the farm situation and system.

The other reason to design flexible tools was the necessity of the tool to be used in different countries in the European Union. Although similar in their farming systems, Sweden differs to France in the pre-existing systematic health data recording (National Animal Disease Recording system). We therefore assume that conditions of the acceptance of a monitoring and prevention protocol could be different, as well as the added-value of its implementation across the countries.

## 1.2 Designing the protocols

### *A multi-step conception process*

Firstly, we started designing a first draft of a comprehensive herd health monitoring tool as a set of health indicators, their alert levels and suggested frequency of monitoring. We combined methods for surveillance of the targeted five group of diseases with indicators of the Welfare Quality® protocol for lameness, and observations of cow signals to provide solid indicators on cow and herd level (Green et al., 2012.; UMT Maîtrise de la Santé des troupeaux bovins, 2011).

We also designed the first draft of the preventive protocols, exhaustive in terms of risk factors. Standard prevention protocols based on the previous concepts of Critical Control Point we found in the literature required revision to take into account the main constraints of organic farming (Green et al., 2012; Argenté, 2002; UMT Maîtrise de la Santé des troupeaux bovins, 2011).

Secondly, the consultation of various experts as reviewers, one per disease protocol, and several times, updated the first version of the surveillance protocol. The experts were supposed to validate

the initial protocol, like a pre-test; determining the level of details required. They have complemented also the areas of improvement present in the preventive protocol. These experts were scientists, veterinarians, advisors from France and Sweden, and each one was consulted for the technical relevance of each health topic.

Thirdly, we invited potential users of the protocol in a meeting day to have a feedback on the proposed first draft protocols. Three farmers, five veterinarians and three organic technical advisors in France joined us to discuss this crucial point of the tool compliance. The same meeting took place in Sweden and gathered seven persons: farmers, veterinarians, some persons from the Swedish Board of Agriculture and some from the Swedish dairy organisation. We wished to collect their opinion, according to their experience in the field, on the feasible application of the herd health management program on farm.

These meetings resulted in the identification of the needs for a flexible monitoring tool. It must indeed allow the farmer to use different health indicators than those proposed as long as the indicators measure the same health problem. It remains to the advisor's responsibility to assure this.

To go further, it became clear during the meetings that a farm specific alert threshold would be more suitable than a fixed alert level. In the same time, general reference values should be provided to have a benchmark value.

Two inflexions of the proposed preventive protocol were discussed during the meetings.

On the one hand, they stressed that providing a list of control actions to implement on the farm does not allow any adaptation to the specific farm context. During the discussion, it appears that formulating objectives to attain instead of control actions to implement could be a good alternative.

On the other hand, initially the protocols were structured in 4 domains (milking, housing, feeding and health management), but they mainly expressed their preference towards a structuration in health topic. In fact, the farmer would use the protocols when he is in front of a health problem on the farm; consequently, the farmer may want to find all the recommendations related to this problem in a unique document.

Those two meetings were a very important step in the conception of the protocols as they gave us new and relevant orientations to improve the protocols in a short period of time and gathering the different perspectives (farmers, advisors and vets' point of view). We can expect that the validation of the compliance by 6 farmers picked apart in each country, as proposed initially may not have brought so much information in the same amount of time.

The last step in the conception process consisted in finalizing both monitoring and prevention protocols and constructing the prototypes of the tools to be used on the field.

## **2 Results: content and recommended use of the protocols**

### **2.1 The monitoring protocol**

#### *The protocol prototype*

The farmer co-constructs his/her own monitoring protocol in a discussion with the advisor during the first farm-visit. That means he chooses the indicators suitable to him, the thresholds adapted to his situation and the frequency of monitoring he wants. The advisor can help him to choose but the

decision does not remain to him. The prototype of the monitoring protocol (Table 1) could be used as a support for the discussion, helping the farmer in his choice.

**Table 1: The protocol prototype, suggestions for first level health indicators**

Health domain	Indicators for first level monitoring	Thresholds	Frequency of monitoring
<b>Udder health</b>	<b>Bulk Milk Somatic Cell Count</b>	<250.000 cells/ml >4 months per year	every month
	<b>Average prevalence level</b>	>300.000 cells/ml for <15% of the herd	every month
	<b>Incidence of clinical mastitis cases</b>	<7% of dairy cows	every 3 month
	<b>Percentage of the cows with clinical mastitis that show general signs of disease</b>	<2%	every 3 months
	<i>Number of dry cows treated with antibiotics for mastitis</i>	<15%	
	<i>Open for suggestions</i>		
<b>Claw health</b>	<b>Locomotion score: percentage of cows with serious lameness</b>	<1-2%	every 3 months
	<i>Open for suggestions</i>		
<b>Reproduction</b>	<b>Average age at first calving</b>	24-26 months	every 12 months
	<b>Average calving to first service interval</b>	<82 days (for non-seasonal calving)	every 3 months
	<b>Percentage of abortions per confirmed pregnancy (&lt;210 days of pregnancy)</b>	<1%	every 3 months
	<i>Open for suggestions</i>		
<b>Metabolic disorders</b>	<b>Acidosis prevalence:</b> [ <b>Difference Fat Ratio-Protein Ratio</b> <b>Fat Ratio</b> ]	[ <3 g/kg for <15% of the herd <35g/kg ]	every month
	<b>Ketosis prevalence:</b> [ <b>Fat Ratio</b> <b>Protein Ratio</b> ]	<20% of 90 DIM cows [ >45 g/kg <28 g/kg ]	every month
	<b>Occurrence of a clinical case of milk fever / grass tetany</b>	No case at all	every month and for grass tetany in Spring and Autumn at the start of the grazing season
	<i>Open for suggestions</i>		
<b>Calf health</b>	<b>Calf mortality, 0-24h</b>	<1.25%	every 3 months
	<b>Calf mortality, 1 day-weaning</b>	<1.25%	every 3 months
	<b>Occurrence of episodes of respiratory disease in the last 3 months (yes/no)</b>	<25%	every 3 months
	<i>Open for suggestions</i>		

In Table 1 the first column lists the five health domains. The second column gives some suggestions (from three to six) of potential health indicators. Additional cells are left open for the farmer proposal. The third column gives the thresholds found in the literature; they consist in a reference to interpret the previous indicators. However, the farmer can choose to increase or decrease their value. The last column gives a frequency of monitoring according to the availability of the data and the necessity to control each indicator.



To monitor udder health, milk recordings can be very useful as they give regular results of the quality (somatic cells concentration) in the milk, reflecting the udder health. The first four indicators in the second column are thus related to this data while the number of dry cows treated with antibiotics for mastitis relies on the farmer recording.

Claw health is more difficult to evaluate as the locomotion score is rarely done on farm and the recording of observation during hoof trimming not always implemented. Clinical observations like elongated toes can help, even if they may not be very precocious.

To have access to the reproduction situation, the insemination and calving planning is very important to be constantly updated and the proposed indicators can be calculated using this data.

Then, the fat-ratio and the protein-ratio, again present in the milk recording, can signal metabolic disorders but have to be compiled with another data like urea ratio. Again, observations can be very useful, such as the aspect of the faecal material that was suggested by the farmers.

And finally, calf health is clearly deteriorated when the mortality ratio at calving and until the weaning increases, the most critical period for the calf. The morbidity is also suggested as it may permit to react earlier.

### *The recommended use of the monitoring protocol*

The indicators, the frequency of collecting and analysing the data as well as the farm specific alerts are defined during the first farm visit. The goal of the first farm visit is crucial. The farmer has already chosen the person he considers relevant to advise him in animal health. With his advice, the farmer chooses the indicators he wants to construct his farm-specific monitoring protocol, as described in the Figure 2. When they meet on farm, a discussion takes place regarding the indicators to choose. Per indicators, four options are possible for the farmer: he takes the suggestions from the prototype (Table 1), he changes indicators, he adds new indicators, or he doesn't want to monitor at all certain health domain. Indeed, we assume that farmers would like to prioritize certain health problems to be monitored in the construction of the monitoring tool. They may consider they have no problems on at least a certain health topic. They use their farm-specific (local) knowledge to design indicators that monitor the specific diseases that occur on their farm in a specific disease pattern.

The monitoring indicators consist of data that is or should regularly be (automatically) collected. As soon as they are listed, thresholds must be fixed according to their objectives and the frequency of monitoring according to their situation, e.g data availability. When thresholds are crossed, they provide an indication to guide the farmer/advisors in prioritizing areas for further investigation, such as lameness, mastitis, calf health, reproduction and/or metabolic disorders.



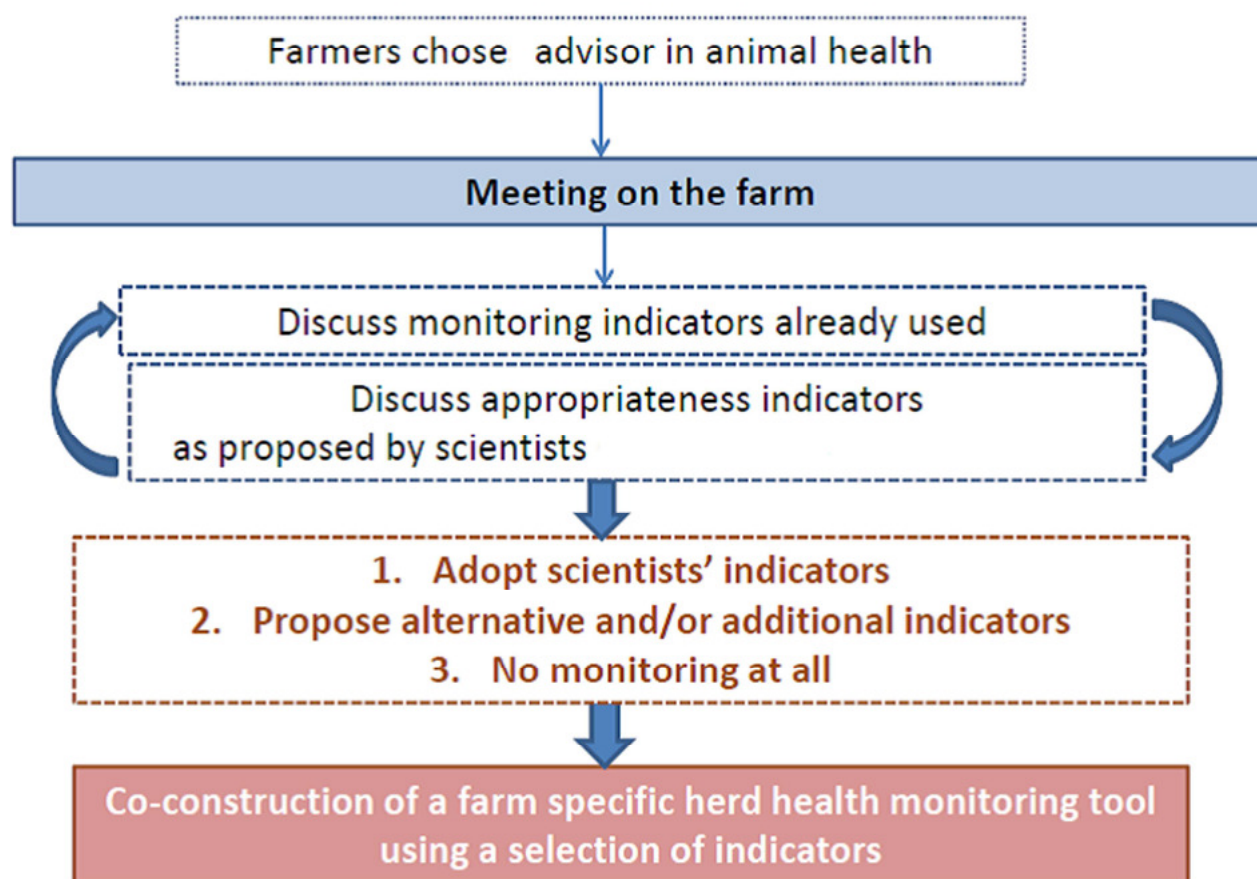


Figure 2: The recommended use: co-construction of monitoring tool.

### First results on 40 farms

The co-construction of the monitoring protocol was tested on 20 farms in France and 20 farms in Sweden. When all first farm visits were done, it turned out that forty monitoring protocols were created, each one different from another. In Sweden, where herd health indicators are used widely on a large share of farms and where indicators are provided with reference values, farmers also chose unique sets of indicators for herd health monitoring on their farms. To illustrate the diversity of indicators, the annex 1 gives an example of one monitoring protocol co-constructed by a French farmer and his advisor.

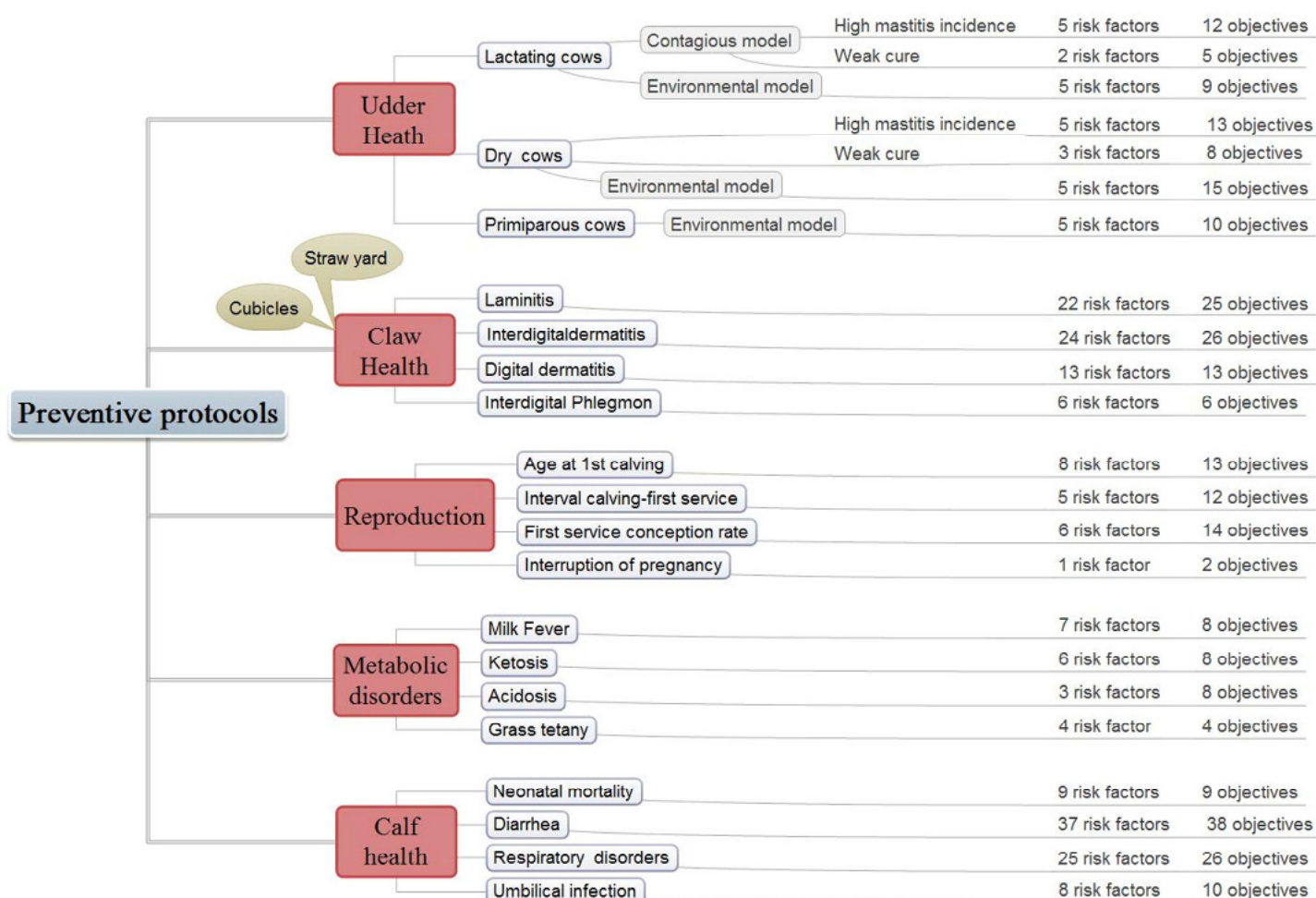
## 2.2 The preventive protocols

### Description of the protocols

The five preventive protocols correspond to the five health topics which allow the farmer to cover nearly all disorders that can impact a herd in production: udder health, claw health, reproduction, metabolic disorders and calf health. The risk factors are not directly related to one health topic, they are related to the several diseases a health topic is declined in.

Mastitis is however differentiated according to the group of animals: lactating, dry or primiparous, and according to the model: contagious or environmental. Moreover, all risk factors are related to a category: housing, feeding, health management, plus milking for udder health and calving for calf health.

The protocols are designed in terms of objectives that should be attained to insure animal health and welfare. No detailed measures have been described such as the exact dimensions of a cubicle but sometimes indications are given. Indeed, during the 'users meeting' it became clear that this kind of information was neither feasible nor asked for by the farmers.



**Figure 3: Structure of the preventive protocols.**

According to the Figure 3, udder health is only related to one disease, mastitis, but we make a difference between lactating, dry and primiparous cows. The next level specifies the model of the mastitis: environmental or contagious whose risk factors differ. For example, the environment hygiene will be prioritized in the first one, the milking hygiene in the second one. And then the incidence and the cure are observed to precise the diagnostic.

Claw health and metabolic disorders are each divided in four diseases. Every disease is associated with some risk factors and objectives. A distinction has been made for cubicles and straw yard as the objectives cannot be expressed in a similar way. For example: claw health problems due to the fact that the cows spend too much time standing on a hard surface could be because of a difficult access to the lying area. Depending of the lying area, the farmer should pay attention to the density in straw yard or to the number of cubicles per cow.

The reproduction topic is divided in four reproductive performance indicators whose values can refer to different disorders.

Calf health is also declined in four diseases (except neonatal mortality). A risk factor can be connected to more than one objective as illustrated in the Table 3 with the colostrum. A first colostrum intake appropriate means sufficient and done whatever the calving time.

Finally, certain risk factors can be common to two or more different diseases. Calf health is again a good example with the colostrum. The first intake of it is crucial to prevent diarrhoea, respiratory diseases, and umbilical infections.

In this Table 3, we give also additional animal observations to help targeting the right risk factor, and recommendations if necessary to take actions.

**Table 2: Details from the preventive protocol of Calf health for Respiratory disease**

Calving and first hours after calving	Nature of the risk factor		Objectives prevention protocol		Additional animal observations than can be conducted to confirm the presence of the risk factor	Suggestions to look into...
	First colostrum intake	Insufficient intake of colostrum of good quality	C4: Ensuring the transfer of passive immunity to the calf	C4.1: by ensuring a sufficient intake under all circumstances: at least 200 g of immunoglobulins in the 6h after calving  C4.2: by ensuring the intake of colostrum by the calf whatever the calving time (calving during the night)	Weigh the colostrum, checking for immunoglobulin quantity: Green zone: very good colostrum > 100g Ig/L Orange zone: fairly good colostrum from 50 to 100g Ig/L Red zone: weak colostrum < 50g Ig/L	Recommendations: 2L in the 2 hours after calving (for a colostrum containing at least 70 of Ig/L) and 2 times 4l in the next 24h after calving. It is recommended to store frozen colostrum in case of none or poor colostrum

### *The recommended use of the preventive protocol*

The preventive protocols are expected to be:

- a general herd health management guide, a discussion support for the duo farmer-advisor; thus a preventive strategy all year round.
- a reactive protocol when the animal health situation deteriorates, serving as a decision support for advisors to reinforce the preventive strategy of the farm.

In both utilisations, farmer and advisor are supposed to target current risk factors present in the farm. The risk factors are initially classified as major (in red in the figure above) and minor risk factors (let in white). As this choice may not correspond to the farmer' vision; it can be an opportunity to discuss it between the farmer and the advisor.

## 3 Discussion

### *A proactive herd health management program*

One leading idea of WP3 concerns the problem of how to be proactive on a farm. The objective was in fact to provide key instrument for the farmer to anticipate a deteriorating health situation. This is when we consider the preventive protocol as a general herd health management guide.

In parallel, when using the monitoring along with the preventive protocol, it may help to react precociously to a deteriorating health situation. This is when we consider the preventive protocol as a reactive protocol.

Herd observation based on clinical signs would mean that the disease is already expressed while indicators more precocious exist in herd monitoring, even if they need data and, sometimes, calculation. The tools presented here attempt to provide a structure to integrate health indicators chosen by the farmer in order to be proactive and more farm-specific.

Some limits which could prevent us to be proactive, e.g. the quality of the data available. Udder health monitoring is based on milk recording data. Nevertheless, not all farmers adhere to it, bringing them less and scarce information. In claw health, a diagnosis from a hoof trimmer can sometimes become unavoidable but not implemented on farm, and the locomotion score not in the farmer's practices. A last example would be the reproductive disorders indicators which only permit to correct the situation for the next reproduction period, as well as calves health problems can only help to resolve those potential of the next generation of calves.

### *Flexible protocols allowed by a participatory approach*

The other leading principle of this work is the farmer adaption of the indicators package. We only described the most frequently accepted indicators from the literature in the monitoring tool, hypothesizing that they may not be chosen by the farmer. They are examples for the design of farm-specific monitoring protocols.

In fact, we assumed that farmers would make use of the possibility to adapt the indicators proposed to the specific situation of their farm. It appeared crucial to us to take into account farmers' experiences when designing farm-specific indicators thinking that it could improve their compliance to monitoring activities. That is why we resort to a participatory approach. Scientists should not aim to provide each individual farmer with a perfect model because scientists will never be able to fully capture how farmers consider the use of the tool in question.

In general, farmers can have a different point of view of technical tools than advisors due to the fact that they live in different social environments and work on a regular basis with these tools. To be able to understand farmers' practices, advisors have to understand the perceptions of farmers which explain and justify their actions. When aiming to design relevant decision support tools for farmers, it is thus essential to understand farmers' visions and goals and to have an understanding of the indicators that motivate their practices (Mathieu et al., 2004). Little research has been done on indicators that farmers use to monitor production diseases and their validity for early disease recognition and prevention.

### *A systemic approach of the farm*

Animal health should be considered as an integral part of the farm system and farmer objectives. An advisor who wants to contribute to farmers' animal health planning activities in general, will have to adopt systemic approaches and consider herd health as a part of the farm system. He or she must not only have profound technical knowledge on strictly health management, but other domains such as feeding and housing as well. And he must take into account the organization of the farm and the farmer's objectives when recommending practices (Brand et al., 2001; LeBlanc et al., 2006; Vaarst, 2011). Developing this idea also leads us not to isolate organic farms as special ones but like an experimental field which can be transferable to conventional farms. In fact the protocols designed here are clearly adapted also to conventional systems, or with small adaptations. The health topics, the diseases targeted, the risk factors and the objectives to attain are the same.

### ***A necessary renouncement of advisors and scientists to compare farms in terms of health situation***

When evaluating a farm health situation, the advisor must interpret certain indicators on the basis of references validated by the scientific community. Scientists, in general, analyse data from many herds. Sometimes they use complex conceptual frameworks to make sense of this data, which is used in general to make between-herd comparisons. The indicators proposed by scientists are well described in the literature; they have been transferred to the advisors to be used on the field and easy to interpret. But they are overall indicators, sometimes based on the milk recordings not all farmers have, sometimes based on method farmers do not adopt (e.g locomotion score).

In fact, farmers use data for decision making on a daily basis. They have more data than scientists on events that are not recorded in databases. They have considerable but different information about what happens in their own herds; thus they adopt different indicators for herd health. These indicators can be unusual to the advisor whose lack of references will prevent him to evaluate correctly the health situation of the farm.

Therefore, scientist and advisors must accept to revise their method in order to improve the compliance to a herd health management program and integrate the farmer in his construction, whatever the indicators he would choose.

## **4 Conclusion**

The herd health management program we propose here can be qualified as innovative as it adopts a proactive, participatory and systemic approach. It has been developed to be used jointly by the farmer and the advisor from the co-construction of the monitoring protocol to the use of both monitoring and preventive protocol on farm visits. It is supposed to allow them a regular surveillance of five health domains: udder health, reproduction, metabolic disease, claw health, and calf health. And if necessary, they can reinforce the preventive strategy of the farm on the basis of the risk factors and objectives listed in the preventive protocols.

Forty farms have been integrated during the project in this herd health management program as a test during one year, twenty in each country, France and Sweden. The results of their appropriation and appreciation by the users of the tool will be described in the deliverable 3.1.



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## Appendix

### *Annex 1: A monitoring protocol co-constructed by a farmer and his advisor*

Health domain	Indicators for first level monitoring	Threshold	Frequency of monitoring
<b>Udder health</b>	<b>Bulk Milk Somatic Cell Count</b>	2 consecutive milk controls above >250.000 cells/ml	every month
	<b>Number of cows with an individual somatic cell count &gt;300.000 cells/ml</b>	>6 cases per month (=15%)	every month
	<b>Number of clinical mastitis cases</b>	>1 case per month	every month
	<b>Checking foremilk</b>	<i>"New way of using day to day monitoring that will be installed. They will try out if it is not too time consuming and effective"</i>	every months
<b>Claw health</b>	<b>Number of lame cows</b>	>3-4 cases per year	every 3 months
<b>Reproduction</b>	<b>Average age heifers at first fecund insemination</b>	>21 months	every 12 months
	<b>Percentage of cows with an interval calving - first service &gt; 100 days</b>	>50% of the inseminated cows	every 3 months
	<b>Number of cows with an interval calving - first heat &gt; 60 days</b>	>3-4 animals	every 12 months
	<b>Average number of artificial inseminations per pregnancy</b>	>1,5	every 6 months
	<b>Cases of metritis</b>	>2 consecutive cases	every 3 months
<b>Metabolic disorders</b>	<b>Number of cases of Milk Fever</b>	>2 cases per year	every month
	<b>Appearance of the faecal material, eyes and coat</b>	If changes occurred on different animals at the same time	after every diet change
	<b>Lipolysis</b>	>0,89	every month
	<b>Milk fat and milk protein levels</b>	Just checked: no alert level set since they haven't changed over several years.	every month
<b>Calf health</b>	<b>Calf mortality female calves up to one month old, cases that cannot be explained excluding mortality due to calving</b>	>2 unexplained cases	every 3 months
	<b>Number of cases of diarrhoea (all types included)</b>	>2 cases in a short period of time	every 3 months
	<b>Number of cases of respiratory problems</b>	>2 cases in a short period of time	every 3 months
	<b>Number of cases of an umbilical infection</b>	>2 cases in a short period of time	



## Annex 2: Preventive protocols

### Annex 2.1 Udder Health

#### LACTATING COWS: Contagious model, high incidence

Risk factor	Objectives preventive protocol		Observations to confirm occurrence of risk factor	Look in more detail at
Milking machine and environment	<b>M1:</b> Prevent development of teat lesions	<b>M1.1:</b> by ensuring that the milking machine functions properly without damaging the teats	Teat lesions score after milking (focus on lesions other than those who are the result of crushing the teats)	Check the results of the milking machine check-up; date and recommendations made. And/ or check the assembly and state of the teat liners
	<b>M2:</b> Prevent transmission of pathogens during milking from one cow to another	<b>M2.1:</b> by using undamaged teat liners		Frequency of replacement of teat liners in this farm and observe the current state of the teat liners
	<b>M21:</b> Prevent stressful situation in the milking parlour	<b>M21:</b> by ensuring to have a calm environment during milking		Evaluate the attitude of the milker during milking. Verify that the grounding system of the electricity of the milking equipment is well installed and functioning. Be careful with electric fences interfering (should be at least 25 m from the building)
Pre-milking technique (hygiene prior to attachment teat cups)	<b>M3:</b> Prevent transmission of pathogens during milking from the environment or from cow to cow	<b>M3.1:</b> by aiming for a good level of hygiene of the milkers' hands and arms during the whole milking run		It is recommended to use clean with water and soap of the hands and forearms of the milker, dry hands with a clean cloth. Or use gloves for milking. Cover lesions on the hands and/or forearms. When hands are getting dirty while milking they should be cleaned again.
		<b>M3.2:</b> by aiming for clean and dry teats before application of the milking cluster	Observe the cleanliness of the teats after cleaning	Preparation of the udder and teats before milking. Recommended to use per cow a single-use wiping cloth/paper and to dry the teats before attachment of the teat cups.
		<b>M3.3:</b> by using premilking teat dip to disinfect the udder	Observe the disinfection process of teats during milking	Use of premilking dips to disinfect the skin of the teats. Check whether the product is meant to be used for the purpose of disinfection prior to milking, whether other products are used to this effect and check how it is applied (leave it at least 30 seconds on the clean skin for it to be effective and use of a clean holder for the disinfectant).
Milking technique during milking	<b>M4:</b> Prevent transmission of pathogens during milking from one udder quarter to another and the development of teat lesions	<b>M4.1:</b> by ensuring to prevent vacuum fluctuations, over-milking, drop of cluster without loss of vacuum	Observe milking technique during milking and teat lesions score after milking (focus on lesions other than those who are the result of crushing the teats)	Check whether differences appear in vacuum levels during milking, how vacuum is cut off at the end of milking and whether or not the teats are humid (which can be caused by fluctuations in vacuum levels)
Milking technique at the end of milking	<b>M5:</b> Prevent transmission of pathogens during milking from one cow to another	<b>M5.1:</b> By aiming to clean and disinfect the teat cups and teat cup holder after each cow	Observe the milking protocols during milking	Hygiene measures during milking. It is recommended to remove the dung immediately after cows have defecated. And to disinfect the milking cluster after each cow.
		<b>M5.2:</b> by aiming to clean and disinfect the cloths, milking equipment and milking parlor after each milking run		Cleaning the milking parlor with an appropriate cleaning product, using water at 40°C at the end of the cleaning and assure to rinse well the exterior of the milking clusters.
	<b>M6:</b> Prevent transmission of pathogens by reducing pathogen load on the teats	<b>M6.1:</b> by aiming for disinfection of the teats after milking of a cow		Post milking teat disinfection protocol. It is recommended to apply a disinfection product on all cows at the end of milking. Check whether the product used is intended to be used for post-milking disinfection of the teats. Check whether the technique is correct (the product covering 75% of the teat) and used on all cows.
Cow characteristics	<b>M18:</b> Prevent high number of cows in the herd with characteristics related to high risk of mastitis	<b>M18.1:</b> by ensuring not to have more than 50% of cows with risk factors for the development of mastitis (3rd or higher lactation number, lesions at the teat ends, negative CEL index)		Culling strategy of the farm, criteria used for culling decision
		<b>M18.2:</b> by removing cows that are a source of pathogens from the herd		



### PREVENTIVE PROTOCOL LACTATING COWS: contagious model, weak cure during lactation

Risk factor	Objectives preventive protocols	Observations to confirm occurrence of risk factor	Look in more detail at
Treatment strategy during lactation	M15: Aim for an early detection of mastitis cases and effective treatment strategies during lactation	M15.1: by ensuring early detection of mastitis cases	Detection during milking, possibility to use the California Mastitis Test
		M15.2: by ensuring an adapted treatment strategy	Identify the criteria used to treat a cow or not at drying off with antibiotics (alerts used by the robot in case of robotic milking). The duration of the treatments. And the criteria used to determine whether a cow is cured of a clinical case. Recommended criteria cure: improvement of clinical signs within 48h after the beginning of the treatment and disappearance of all clinical signs 5 days after the beginning of the treatment.
		M15.3: by using a good treatment technique (hygienic)	Recommended to disinfect the teat end prior to (and after) the application of the treatment. If alcohol is used for disinfection the skin must be left to dry prior to the application of the udder treatment.
		M15.4: by using the right criteria to determine whether a cow is cured to prevent applying unnecessary treatment	Recommended definition of a cured clinical mastitis cases: amelioration of the clinical signs 48h after the start of the treatment and no more clinical signs 5d after the start of the treatment
Culling strategy	M17: Prevent treatment failure that could have been predicted	M17.1: by removing incurable cows from the herd	Recommendation is to cull when a cow stays infected during 2 or more lactations. An animal that was dried off with a iSCC of >300.000 cells/ml and that stays infected after calving should be considered as incurable

### DRY COWS: weak cure during dry period

Risk factor	Objectives preventive protocols	Observations to confirm occurrence of risk factor	Look in more detail at
Culling strategy	M17: Prevent treatment failure that could have been predicted	M17.1: by removing incurable cows from the herd	Recommendation is to cull when a cow stays infected during 2 or more lactations. An animal that was dried off with a iSCC of >300.000 cells/ml and that stays infected after calving should be considered as incurable
Therapeutic strategy at drying off	M16: Aim for effective therapeutic strategies (for subclinical mastitis) during the dry period	M16.1: by ensuring an adapted curative treatment	Investigate the treatment strategy used: identify criteria to treat a cow or not at drying off.
		M16.2: by using good treatment technique (hygienic) for intra-mammary treatments	Recommended to disinfect the teat end prior to (and after) the application of the treatment. If alcohol is used for disinfection the skin must be left to dry prior to the application of the udder treatment.
		M16.3: by using preventive strategies at drying off	Investigate the preventive strategy used: identify criteria to apply to a cow/ udder quarter a teat sealant or not at drying off. Other preventive measures taken.
Treatment strategy during dry period	M15: Aim for an early detection of mastitis cases and effective treatment strategies during dry period	M15.1: by ensuring early detection of mastitis cases	Palpate the udder after milking to check for abnormalities of the udder.
		M15.2: by ensuring an adapted treatment strategy	Identify the criteria used to treat a cow or not at drying off with antibiotics (alerts used by the robot in case of robotic milking).
		M15.3: by using a good treatment technique (hygiene)	Recommended to disinfect the teat end prior to (and after) the application of the treatment. If alcohol is used for disinfection the skin must be left to dry prior to the application of the udder treatment.
		M15.4: by using the right criteria to determine whether a cow is cured to prevent applying unnecessary treatment	Recommended definition of a cured clinical mastitis cases: amelioration of the clinical signs 48h after the start of the treatment and no more clinical signs 5days after the start of the treatment

LACTATING COWS: environmental model				
Risk factor	Objectives preventive protocols		Observations to confirm occurrence of risk factor	Look in more detail at
Milking machine	M1: Prevent development of teat lesions	M1.1: by ensuring that the milking machine functions properly without damaging the teats	Teat lesions score after milking (focus on lesions other than those who are the result of crushing the teats)	Check the results of the milking machine check-up; date and recommendations made. And/ or check the assembly and state of the teat liners
	M2: Prevent transmission of pathogens during milking from one cow to another	M2.2: by using undamaged teat liners		Frequency of replacement of teat liners in this farm and observe the current state of the teat liners
Pre-milking technique (hygiene prior to attachment teat cups)	M3: Prevent transmission of pathogens during milking from the environment or from cow to cow	M3.1: by aiming for a good level of hygiene of the milkers' hands and arms during the whole milking run	Observe milking technique during milking	It is recommended to use clean with water and soap of the hands and forearms of the milker, dry hands with a clean cloth. Or use gloves for milking. Cover lesions on the hands and/or forearms. When hands are getting dirty while milking they should be cleaned again.
		M3.2: by aiming for clean and dry teats before application of the milking cluster	Observe the cleanliness of the teats after cleaning	Preparation of the udder and teats before milking. Recommended to use per cow a single-use wiping cloth/paper and to dry the teats before attachment of the teat cups.
Milking technique during milking	M4: Prevent transmission of pathogens during milking from one udder quarter to another and the development of teat lesions	M4.1: by ensuring to prevent vacuum fluctuations, over-milking, drop of cluster without loss of vacuum	Observe milking technique during milking and teat lesions score after milking (focus on lesions other than those who are the result of crushing the teats) (page 54)	Check whether differences appear in vacuum levels during milking, how vacuum is cut off at the end of milking and whether or not the teats are humid (which can be caused by fluctuations in vacuum levels)
Milking technique at the end of milking	M5: Prevent transmission of pathogens during milking from one cow to another	M5.2: by aiming to clean and disinfect the cloths, milking equipment and milking parlor after each milking run	Observe the milking protocols during milking	Cleaning milking parlor. Cleaning the milking parlor with an appropriate cleaning product, using water at 40°C at the end of the cleaning and assure that the rinse well the exterior of the milking clusters.
	M6: Prevent transmission of pathogens by reducing pathogen load on the teats	M6.1: by aiming for disinfection of the teats after milking of a cow		Post milking teat disinfection protocol. It is recommended to apply a disinfection product on all cows at the end of milking. Check whether the product used is intended to be used for post-milking disinfection of the teats. Check whether the technique is correct (the product covering 75% of the teat) and used on all cows.
Housing conditions	M7: Prevent transmission of pathogens from the lying area by reducing its pathogen load	M7.1: by ensuring that the dimensions of housing and the animal density permit all cows to rest properly in the lying area.	Observe the distribution of cows in the barn and their lying position	Firstly, adaptation of the dimensions of the cubicles to the size of the largest animals in the herd. Secondly, the number of cubicles must correspond to the size of the herd (recommendation: at least one cubicle per housed cow). For deep litter stalls the surface used for lying must correspond to the size of the herd. Recommendation: 6-8 m <sup>2</sup> surface available per cows for a rectangular area, max. 8-12 m deep and accessible along the entire length.
		M7.2: by ensuring good maintenance of the lying areas in contact with the udder (clean and dry)	Cleanliness score udders cows + observation of the distribution of cows in the barn	Frequency of mulching/ cleaning out the lying areas, quantity of straw, stocking of the bedding material in a clean and dry place, maintenance of the cubicle mattresses/ carpets, surveillance of the temperature of the bedding (>36°C development of bacteria)
		M7.3: by ensuring good ventilation of the housing to prevent conditions that are favourable to the development of bacteria		Appreciation of the position of the housing with regard to the most important wind directions, sun and whether or not other buildings/object that might alter the ventilation of the housing. Quality of the air: volume of air per animal, renewal of air (measure humidity of the air), air speed (occurrence of drafts)
		M7.4: by considering the time grazing. When the time spent grazing is important attention should be paid to the fact that cows shouldn't lay too long on the same area (e.g. around drinking area or under trees).		Rotation of the grazing paddocks, animal density on pasture.
		M7.5: by ensuring appropriate calving conditions; using a calving pen which is near the lactating cows to prevent stress due to isolation and that is only used as a calving pen, not as a sick box if possible.		Cleaning frequency of the isolation pen. Recommended to cure the pen after each animal that leaves the pen.
		M8: Prevent the exposition of the teats to the lying area just after milking	M8.1: by preventing cows from lying down for half an hour after milking to allow the teat ends to close again after milking	Check how cows are prevented from lying down: locked at the head gate, closing off of the lying area with a thread, using gates to block cows when they leave the robot preventing them to go to the lying area.
		M9: Prevent an increase in the risk of traumatizing the teats	M9.1: by ensuring good floor quality (of the walking area, waiting areas and lying areas) to prevent cows from slipping, falling and/or scrape on the floor thereby traumatizing teats.	Teat lesions score, focus on lesions due to crushing of the teat Quality of the walking areas, should not be slippery. Quality of the lying area; in case of mattresses they should be at least 3cm thick, have the right dimensions, be clean, not slippery and whole. Cubicles without mattresses need at least 3kg of straw per day, with a mattress 1.5 kg is recommended to ensure cow comfort.

DRY COWS: high incidence				
Risk factor	Objectives preventive protocols		Observations to confirm occurrence of risk factor	Look in more detail at
Transition management	M10: Insure good transition management from lactation to dry period	M10.1: by separating the cows immediately after their last milking to be able to manage them correctly		Observation of drying of techniques; separation of cows and monitor cows that have been dried of for milk losses. Use of dry off strategies; criteria used to apply drying of strategies, level of hygiene (clean udder before and after application of treatment, use clean materials).
		M10.2: by gradually reducing the feeding of energy rich feeds at the end of lactation		Discuss the feeding transition management
Housing conditions	M7: Prevent transmission of pathogens from the lying area by reducing its pathogen load	M7.1: by ensuring that the dimensions of housing and the animal density permit all cows to rest properly in the lying area	Observe the distribution of cows in the barn and their lying position	Firstly, adaptation of the dimensions of the cubicles to the size of the largest animals in the herd. Secondly, the number of cubicles must correspond to the size of the herd (recommendation: at least one cubicle per housed cow). For deep litter stalls the
		M7.2: by ensuring good maintenance of the lying areas in contact with the udder (clean and dry)	Cleanliness score udders cows + observation of the distribution of cows in the barn	Frequency of mulching/ cleaning out the lying areas, quantity of straw, stocking of the bedding material in a clean and dry place, maintenance of the cubicle mattresses/ carpets, surveillance of the temperature of the bedding (>36°C development of bacteria)
		M7.3: by ensuring good ventilation of the housing to prevent conditions that are favourable to the development of bacteria		Appreciation of the position of the housing with regard to the most important wind directions, sun and whether or not other buildings/object that might alter the ventilation of the housing. Quality of the air: volume of air per animal, renewal of air (measure humidity of the air), air speed (occurrence of drafts)
		M7.4: by considering the time grazing. When the time spent grazing is important attention should be paid to the fact that cows shouldn't lay too long on the same area (e.g. around drinking area or under trees)		Rotation of the grazing paddocks, animal density on pasture.
		M7.5: by ensuring appropriate calving conditions; using a calving pen which is near the lactating cows to prevent		The box should measure about 15-20m <sup>2</sup> . Dry and clean bedding that is completely replaced after each usage.
Nutrition during dry period and peripartum period multiparous cows	M11: Aim for good feeding practices to prevent udder oedema, a risk factor for developing mastitis	M11.1: by preventing diet that contains too much sodium or potassium during the dry period (origin could be forage and/or foin grazing)		
	M12: Prevent mineral and vitamin deficiencies important in the immune defence mechanisms of the cow	M12.1: by ensuring supply of minerals and vitamins during the dry period		Vitamins A and E, $\beta$ -carotene, selenium, zinc, iron and copper levels should be insured as they play an important role in the immune defence mechanisms.
	M13: Prevent nutritional imbalances that lead to diarrhea, which will increase the pathogen load in the environment of the cows.	M13.1: by assuring a transition period for feed especially when the roughage differs from that of the lactating cows.		Transition management from dry period to lactating, possibility to make feeding groups in the group of dry cows. It is also recommended that the amount of concentrates fed to be distributed in low quantities (+1 kg max every 4 days)
Health multiparous cows during dry period and peripartum period	M14: Prevent diseases peripartum that will increase the lying period of cows	M14.1: by reducing the risk of occurrence of these diseases		Check for the occurrence of metabolic diseases, acute metritis (within 21 post-calving) and calving difficulties. Check their specific risk factors and act accordingly.
Cow characteristics	M18: Prevent high number of cows in the herd with characteristics related to high risk of mastitis	M18.1: by ensuring not to have more than 50% of cows with risk factors for the development of mastitis (3rd or higher lactation number, lesions at the teat ends, negative CEL index)		Culling strategy of the farm, criteria used for culling decision
		M18.2: by removing cows that are a source of pathogens from the herd		



PRIMIPAROUS COWS				
Risk factor	Objectives preventive protocols		Observations to confirm occurrence of risk factor	Look in more detail at
Conditions from birth to last months prior to calving	M19: Optimal growing conditions to start the first lactation healthy and in time	M19.1: by preventing calves from suckling on udders of the heifers.		
Housing conditions	M7: Prevent transmission of pathogens from the lying area by reducing its pathogen load	M7.1: by ensuring that the dimensions of housing and the animal density permit all cows to rest properly in the lying area.	Observe the distribution of cows in the barn and their lying position	Firstly, adaptation of the dimensions of the cubicles to the size of the largest animals in the herd. Secondly, the number of cubicles most correspond to the size of the herd (recommendation: at least one cubicle per housed cow). For deep litter stalls the surface used for lying most correspond to the size of the herd. Recommendation: 6-8 m <sup>2</sup> surface available per cows for a rectangular area, max. 8-12 m deep and accessible along the entire length.
		M7.2: by ensuring good maintenance of the lying areas in contact with the udder (clean and dry)	Cleanliness score udders cows + observation of the distribution of cows in the barn	Frequency of mulching/ cleaning out the lying areas, quantity of straw, stocking of the bedding material in a clean and dry place, maintenance of the cubicle mattresses/ carpets, surveillance of the temperature of the bedding (>36°C development of bacteria)
		M7.3: by ensuring good ventilation of the housing to prevent conditions that are favourable to the development of bacteria		Appreciation of the position of the housing with regard to the most important wind directions, sun and whether or not other buildings/object that might alter the ventilation of the housing. Quality of the air: volume of air per animal, renewal of air (measure humidity of the air), air speed (occurrence of drafts)
		M7.4: by considering the time grazing. When the time spent grazing is important attention should be paid to the fact that cows shouldn't lay too long on the same area (e.g. around drinking area or under		Rotation of the grazing paddocks, animal density on pasture.
		M7.5: by ensuring appropriate calving conditions; using a calving pen which is near the lactating cows to prevent stress due to isolation and that is only used as a calving pen, not as a sick box if possible.		The box should measure about 15-20m <sup>2</sup> . Dry and clean bedding that is completely replaced after each usage.
Nutrition during last two months prior to calving and during the peripartum period	M12: Prevent mineral and vitamin deficiencies important in the immune defence mechanisms of the cow	M12.1: by ensuring supply of minerals and vitamins before calving		Vitamins A and E, $\beta$ -carotene, selenium, zinc, iron and copper levels should be insured as they play an important role in the immune defence mechanisms.
	M13: Prevent nutritional imbalances that lead to diarrhea, which will increase the pathogen load in the environment of the cows.	M13.1: by assuring a transition period for feed especially when the roughage differs from that of the lactating cows.		Discuss the transition of the feeding of the heifers to the lactating herd. And is it recommended that the amount of concentrates fed to be distributed in low quantities (+1 kg max every 4 days)
Health primiparous cows during peripartum period	M14: Prevent diseases peripartum that will increase the lying period of cows	M14.1: by reducing the risk of occurrence of these diseases		Check for the occurrence of metabolic diseases, acute metritis (within 21 post-calving) and calving difficulties. Check their specific risk factors and act accordingly.
Preparation transition to lactating herd	M20: Prevent primiparous cows from lying outside the cubicles in the group of the lactating herd	M20.1: by ensuring a good transition with regards to the lying area of the lactating herd	Observe aggressive behaviour of the multiparous cows to the primiparous cows and observe whether or not the primiparous cows lay down in the cubicles	Learn primiparous cows to use cubicles prior to their integration to the lactating herd. Or by forcing them to stay in the cubicles attaching them in the cubicles.

## Annex 2.2 Claw health

### a. Cubicles

#### LAMINITIS

Nature of the risk factor			Objectives prevention protocol		Additional animal observations	Suggestions to look into...
housing	Claw health problems due to the fact that the cows spent too much time standing on a hard surface	comfort of the lying area	L1: Prevent that the time spend standing on a hard surface is too important	L1.1: by ensuring that the cows can lie down easily in the cubicles	Check for abnormal movements when cows are lying down/getting up, abnormal positions while lying down and integument lesions that suggest that the cows cannot lie down easily.	Check whether the dimensions of the cubicles are suited for the size of the cows.
				L1.2: by ensuring that the cows can lie down on a comfortable surface	Check for abnormal movements when cows are lying down/getting up and for integument lesions on the tarsi.	Ensure a sufficient quantity of straw: minimum of 3 kg per cubicle per day. Or 1.5 kg per cubicle per day plus a carpet or mattress. Ensure sufficient quantity of straw at the end of the cubicle to prevent lesions. Recommendations for carpet and mattress: thickness of 3 cm, the surface should not be slippery (sufficiently rough without being abrasive), covered by a little bit bedding to absorb humidity.
		difficult access to the lying area		L1.3: by permitting all the cows to lie down in a cubicle	Check for cows lying down outside the cubicle and a possible heterogeneous distribution of cows over the cubicles in the building.	Number of cubicles must correspond to the size of the herd. Recommendation: at least one cubicle per housed cow. Check, when cows are not homogeneously distributed over the cubicles, the cause of this.
		duration of the milking and fixation at the head gate		L1.4: by limiting the time cows spend standing before and during-milking and the time the animals spend fixed at the head locks		Time spent blocked at the-head locks per day. Recommendation: time needed for milking less than 1hour and 30 minutes and time spent at the head locks less than an hour.
		repartition of the time spent indoors and on pasture		L1.5: by limiting the time the animals spend under indoor housing conditions over the year		Time spent at pasture night and day and during the day only. The more the animals spent time indoors, the more important are the risk factors related to the housing conditions. Remoteness of the pastures: the remoteness of the pastures can inhibit the positive effects of pasturing on the claw health of the cows when the pastures are far away.



	claw health problems due to traumatism obtained while the cows are moving	spatial organization of the exercise area	<b>L2:</b> Prevent that cows obtain traumatism while moving	<b>L2.1:</b> by ensuring that the cows can move around without struggling to get past each other or fight each other	Check for aggressive behavior of the cows towards one another when they pass each other, when they are resting or when they are looking for access to feed or water.	Often situations where animals have to compete for access to a resource of limited availability are at the origin (area to lie down, access to feed/water....) of fights/struggles between animals. Other situations at risk are: pathways with a small dimension (two cows should be able to cross each other in the exercise area, without disturbing one another and be able to pass behind the cow blocked at the head gate), areas where the animals can get trapped/one-way situations or obstacles. The level of aggressiveness can be exacerbated in herd where (some) cows have horns.
		quality of the walking areas of the building		<b>L2.2:</b> by limiting slippery floors and the presence of stairs in the exercise areas	Check for cows slipping, having an unsure gait (cows taking small steps, head down), difficulties taking steps	Prevent floors that are slippery (absence of sufficient grooves of good quality of the floor), abrasive floors, steep floors, irregularities and steps in areas where cows can be pushed around (exercise areas, waiting areas, milking parlour and the passageway returning the cows from the milking parlour to the lying areas)
		conception of the access to the feeding area		<b>L2.3:</b> by ensuring easy access to the feeding area, minimizing standing positions while feeding that are traumatizing to the claws of the cows.	Check the position of the cows when they are accessing the trough	Prevent position forcing the cows to have most of the wait on the front feet (the trough should be 15-20 cm higher than the feet of the cows), presence of a step in front of the head gate
		neutralisation of the concrete floors		<b>L2.4:</b> by ensuring chemical neutrality of the floors		Recommendation: the neutralisation of the concrete floors should be done within the four weeks after casting the lining of the floor and ten days before entering the animals
		conditions of the paths giving access to the pastures		<b>L2.5:</b> by maintaining the access paths to the pastures non deteriorated		Check the quality of the pathways that give access to pasture for deterioration, stones and obstacles. The road has to be able to bear the wait of the herd. Preferably use roads made of sans on a bed of rocks or use woven textile or concrete. Take into account the remoteness of the parcels when assessing the risk.
nutrition	subacute ruminal acidosis	lack of fibrosity in the diet of the lactating cows	<b>L4:</b> Prevent the development of subacute ruminal acidosis	<b>L4.1:</b> by ensuring a diet for the lactating herd containing sufficient fibers to stimulate salivation and rumination	See also the preventive protocol for metabolic diseases, chapter for subacute ruminal acidosis	Check whether the distributed diet is sufficiently fibrous by using a sieve. If not sufficiently fibrous, check whether sufficient buffers are provided in the diet.
		diet of the lactating cows is too easily fermentable		<b>L4.2:</b> by ensuring a diet for the lactating herd that is not too easily fermentable		Evaluate whether the nature and the format (size of the particles) of the easily fermentable diet is not a risk for the development of acidosis

				L4.3: by distributing easily fermentable feed (concentrates rich in energy) evenly during the day		Check the supply of energy rich concentrates in the diet. - full diet: ensure proper mixing of forages and concentrates preventing sorting out the concentrates. Multiply the number of meals if necessary - semi-complete diet: multiply the number of feedings to prevent the ingestion of more than 1.5 kg of concentrates per feeding. before ingesting concentrates cows should have eaten a more fibrous feed. - automatic concentrate dispenser: check for a correct amount of concentrates per turn, dispense the feed over a number of meal per day and prevent its use before the ingestion of more fibrous feed. But be careful not to disturb too much the cows' rhythm of ingestion-rumination-rest cycles by offering too many meals per day.
				L4.4: by managing the feed transitions at late gestation and lactation, and the transitions during lactation.		Check the changes of diet for the <b>resemblance</b> of the forages that are distributed with respect to the plant species used, in particular between diets in the middle of the dry period and those in early lactation. Check if there is a gradual increase of concentrates (less than 1 kg every 3-4 days).
	negative energy balance	cows too fat at calving (body condition score too high)	L5: prevent the occurrence of a negative energy balance	L5.1: by controlling the body condition of cows during the dry period and attain a body condition score of about 3.5 (on a scale of 5)	Evaluate <u>retrospectively</u> the ratio milk fat/ milk protein if >1.5 in 20% of the cows during the 1st month in lactation. Or <u>instantaneously</u> by a body condition score of >4 at calving	The diet during the dry period should prevent cows to be too fat at calving (recommended body condition score = 3.5) this by using a specific diet for the dry cows adapted to their body condition score at the end of lactation. To stimulate the appetite and the digestion after calving it is recommended to supply an important amount of straw or hay and some concentrates during the two weeks before calving.
		strong loss of body condition in early lactation		L5.2: by limiting the loss of body condition during early lactation (prevent a score of less than 2) by providing a diet which is sufficiently rich in energy	Evaluate <u>retrospectively</u> the ratio milk fat/ milk protein, if >1.5 in 15% of the cows during the 2nd-4th month of lactation. Or <u>instantaneously</u> by a body condition score < 2.5 after 2 months of lactation	Check whether the cows eat their feed during lactation; availability of feed (objective 5% refusals), quality of the feed (tasteful and well preserved), number of places at the trough per number of cows should be sufficient and the access comfortable. Check the body condition score at calving. Check for cows with acidosis or other disease that could cause a loss of appetite in early lactation. Check the energy richness of the feed during lactation in relation to the production level of the cows.
	important mineral deficiencies	insufficient distribution of minerals and vitamins	L6: Prevent the occurrence of mineral and vitamin deficiencies	L6.1: by ensuring a daily distribution that covers the needs of minerals and vitamins		Check if at least 100 g/days/cow of mineral and vitamins are supplemented during lactation. Or calculate the total amount of minerals and vitamins in the diet.

health management	preventive measures are non-existent or non-adapted	hoof trimming as a preventive measure	<b>L7:</b> Prevent the occurrence of complications of subacute lesions of laminitis and pododermatitis	<b>L7.1:</b> by ensuring preventive hoof trimming of the cows at a frequency that is adapted to the risk of claw problems of the herd	Observation of the shape of the hoofs	The preventive measures taken for lameness. Recommendation: hoof trimming of all the cows at least every 5-6 months that the cows are housed indoors, preferably before they go out on pasture.
		regular disinfection of the claws of all the lactating cows	<b>L8:</b> Reduce the impact of interdigital dermatitis and digital dermatitis by an early treatment	<b>L8.1:</b> by disinfecting all the claws of the all the cows with a frequency adapted to the risk level of the herd to pododermatitis and digital dermatitis		Disinfection protocol of the claws. Recommendation: at least 2 days every 2 weeks after cleaning of the claws. Respecting the terms of usage of the disinfectant. And with a system adapted to the farm conditions (liquid footbath, dry footbath, foam, systematic pulverisation).
		Apply a period of quarantine when after purchase of a cows and on return from shows	<b>L9:</b> Prevent the introduction of digital dermatitis on the farm	<b>L9.1:</b> by checking for digital dermatitis lesions when buying cattle and treat them. Plus, disinfect the claws of cattle that has been bought or return to the herd after visiting a show for example.		Estimate the average number of animals that has been bought every year or goes to shows. Identify the measures taken by the farmer when (re)introducing them to the herd.
	treatments are non-existent or not adapted	early detection of lame cows	<b>L10:</b> Ensure health care adapted to the lame cows	<b>L10.1:</b> by recognising at an early stage lame cows to prevent complications and having to cull the cows.	Identify severely lame cows, a sign of intervening too slow when cows are lame.	Making the farmer aware and give skills to identify lame cows at an early stage.
		recognition of the claw lesions causing lameness by the farmer		<b>L10.2:</b> by identifying the claw lesions causing lameness		Training of the farmer on hoof trimming or invite expertise from outside the farm
		applying of early and adapted treatment		<b>L10.3:</b> by treating rapidly, using treatments adapted to the identified claw disease (curative hoof trimming, therapeutic treatments)		Check the protocols used on the farm to treat lame cows. Availability of hoof trimming equipment on the farm. Training of the farmer on hoof trimming or invite expertise from outside the farm
		disinfection of the claws of all the lactating cows		<b>L10.4:</b> by disinfecting all the claws of the all the cows with a frequency adapted to the risk level of the herd to interdigital dermatitis and digital dermatitis		Disinfection protocol of the claws. Recommendation: at least 2 days every 2 weeks after cleaning of the claws. Respecting the terms of usage of the disinfectant. And with a system adapted to the farm conditions (liquid footbath, dry footbath, foam, pulverization).

# INTERDIGITAL DERMATITIS

Nature of the risk factor		Objectives prevention protocol	Additional animal observations	Suggestions to look into...
housing	Claw health problems due to the fact that the cows spent too much time standing on a hard surface	L1: Prevent that the time spend standing on a hard surface is too important	L1.1: by ensuring that the cows can lie down easily in the cubicles	Check for abnormal movements when cows are lying down/getting up, abnormal positions while lying down and integument lesions that suggests that the cows cannot lie down easily.
			L1.2: by ensuring that the cows can lie down on a comfortable surface	Check for abnormal movements when cows are lying down/getting up and for integument lesions on the tarsi.
			L1.3: by permitting all the cows to lie down in a cubicle	Check for cows lying down outside the cubicle and a possible heterogeneous distribution of cows over the cubicles in the building.
			L1.4: by limiting the time cows spend standing before and during milking and the time the animals spend fixed at the head locks	Time spent blocked at the head gate per day. Recommendation: time needed for milking less than 1 hour and 30 minutes and time spent at the head gate less than a hour.
			L1.5: by limiting the time the animals spend under indoor housing conditions over the year	Time spent at pasture night and day and during the day only. The more the animals spent time indoors, the more important are the risk factors related to the housing conditions. Remoteness of the pastures: the remoteness of the pastures can inhibit the positive effects of pasturing on the claw health of the cows when the pastures are far away.
	Claw health problems due to the occurrence of traumatism obtained while the cows are moving	L2: Prevent that cows obtain traumatism while moving	L2.1: by ensuring that the cows can move around without struggling to get past each other or fight each other	Check for aggressive behaviour of the cows towards other cows when they pass each other, when they are resting or when they are looking for access to feed or water.

						horns.
	quality of the walking areas of the building		L2.2: by limiting slippery floors and the presence of stairs in the exercise areas	Check for cows slipping, an unsure gait (cows taking small steps, head down), difficulties taken the steps	Prevent floors that are slippery (absence of sufficient grooves of good quality of the floor), abrasive floors, steep floors, irregularities and steps in areas where cows can be pushed around (exercise areas, waiting areas, milking parlour and the passageway returning the cows from the milking parlour to the lying areas)	
	conception of the access to the feeding area		L2.3: by ensuring easy access to the feeding area, minimizing standing positions while feeding that are traumatizing to the claws of the cows.	Check the position of the cows when they are accessing the trough	Prevent position forcing the cows to have most of the wait on the front feet (the trough should be 15-20 cm higher than the feet of the cows), presence of a step in front of the head gate	
	neutralisation of the concrete floors		L2.4: by ensuring chemical neutrality of the floors		Recommendation: the neutralisation of the concrete floors should be done within the four weeks after casting the lining of the floor and ten days before entering the animals	
	conditions of the paths giving access to the pastures		L2.5: by maintaining the access paths to the pastures non deteriorated		Check the quality of the pathways that give access to pasture for deterioration, stones and obstacles. The road has to be able to bear the wait of the herd. Take into account the remoteness of the parcels when assessing the risk.	
claw health problems due to humidity and defaults in hygiene in the living areas of the cows, these are conditions favourable to the development of bacteria	cleanliness and humidity of the floors	L3: Prevent humidity and defaults in hygiene in the living areas of the cows	L3.1: by ensuring dry and clean floors; as dry as possible without areas where water or feces accumulates, in particular around water troughs or feeding racks	Observe the cleanliness of the feet and thighs of the cows	Verify that all the floors are regularly maintained; check for dirty areas (excreta or water) in the buildings. CONCEPTION Assure a good conception of the cubicles. Recommendation: the floor should have a slight slope to facilitate the evacuation of juices (slope of 2-3%). If the slope is not made of concrete it should still be draining. Prevent the use of materials like carpet or other absorbing textile. Verify whether the mattresses are well fixed, wrong fixation could prevent the evacuation of excreta to the corridors.	
	ventilation		L3.2: by ensuring a good ventilation of the housing of the cows		Observe the roofs of the building. Check for black spots on the ridges of beams and areas with a smell of ammonia. These observations indicate an under-ventilation of the building which favors the development of bacteria.	

		<div>maintenance sleeping area</div> <div>maintenance exercise area</div> <div>conditions of the paths giving access to the pastures</div>		<p><b>L3.3:</b> by ensuring dry and clean sleeping areas</p> <p><b>L3.4:</b> by limiting the pollution of the exercise area</p> <p><b>L3.5:</b> by maintaining the roads giving access to pasture clean</p>		<p>Cleanliness of the bedding; identify cleaning and mulching methods. Recommendation: mulching the extremity of the cubicle at least one time per day. management liquid manure: max. 1.5 kg straw per day to only 0.5-0.8 kg per cubicle per day when slatted floor. Cubicles management of more solid manure: minimum of 3 kg per cubicle per day with regular mulching.</p> <p>Identify the methods of scraping the dung (and surveillance in case of automatic scraping) or cleansing with water... And its efficacy</p> <p>Check the quality of the pathways that give access to pasture for deterioration, stones and obstacles. The road has to be able to bear the wait of the herd. The more the animals go on pasture during the year the more the risk factors linked to the quality of the access roads to pasture become important in the development of claw problems.</p>
nutrition	negative energy balance	cows too fat at calving (body condition score too high)	<b>L5:</b> prevent the occurrence of a negative energy balance	<b>L5.1:</b> by controlling the body condition of cows during the dry period and attain a body condition score of about 3.5 (on a scale of 5)	Evaluate <u>retrospectively</u> the ratio milk fat/ milk protein if >1.5 in 20% of the cows during the 1st month in lactation. Or <u>instantaneously</u> by a body condition score of >4 at calving	The diet during the dry period should prevent cows to be too fat at calving (recommended body condition score = 3.5) this by using a specific diet for the dry cows adapted to their body condition score at the end of lactation. To stimulate the appetite and the digestion after calving it is recommended to supply an important amount of straw or hay and some concentrates during the two weeks before calving.
		strong loss of body condition in early lactation		<b>L5.2:</b> by limiting the loss of body condition during early lactation (prevent a score of less than 2) by providing a diet which is sufficiently rich in energy	Evaluate <u>retrospectively</u> the ratio milk fat/ milk protein, if >1.5 in 15% of the cows during the 2nd-4th month of lactation. Or <u>instantaneously</u> by a body condition score < 2.5 after 2 months of lactation	Check whether the cows eat their feed during lactation; availability of feed (objective 5% refusals), quality of the feed (tasteful and well preserved), number of places at the trough per number of cows should be sufficient and the access comfortable. Check the body condition score at calving. Check for cows with acidosis or other disease that could cause a loss of appetite in early lactation. Check the energy richness of the feed during lactation in relation to the production level of the cows.
	important mineral deficiencies	insufficient distribution of minerals and vitamins	<b>L6:</b> Prevent the occurrence of mineral and vitamin deficiencies	<b>L6.1:</b> by ensuring a daily distribution that covers the needs of minerals and vitamins		Check if at least 100 g/days/cow of mineral and vitamins are supplemented during lactation. Or calculate the total amount of minerals and vitamins in the diet.
health management	preventive measures are non-existent or non-adapted	hoof trimming as a preventive measure	<b>L7:</b> Prevent the occurrence of complications of subacute lesions of laminitis and pododermatitis	<b>L7.1:</b> by ensuring preventive hoof trimming of the cows at a frequency that is adapted to the risk of claw problems of the herd	Observation of the shape of the hoofs	The preventive measures taken for lameness. Recommendation: hoof trimming of all the cows at least every 5-6 months that the cows are housed indoors, preferably before they go out on pasture.

	disinfection of the claws of all the lactating cows	<b>L8:</b> Reduce the impact of interdigital dermatitis and digital dermatitis by an early treatment	<b>L8.1:</b> by disinfecting all the claws of the all the cows with a frequency adapted to the risk level of the herd to pododermatitis and digital dermatitis		Disinfection protocol of the claws. Recommendation: at least 2 days every 2 weeks after cleaning of the claws. Respecting the terms of usage of the disinfectant. And with a system adapted to the farm conditions (liquid footbath, dry footbath, foam, systematic pulverisation).
		Apply a period of quarantine when after purchase of a cows and on return from shows	<b>L9:</b> Prevent the introduction of digital dermatitis on the farm	<b>L9.1:</b> by checking for digital dermatitis lesions when buying cattle and treat them. Plus, disinfect the claws of cattle that has been bought or return to the herd after visiting a show for example.	Estimate the average number of animals that has been bought every year or goes to shows. Identify the measures taken by the farmer when (re)introducing them to the herd.
	early detection of lame cows	treatments are non-existent or not adapted	<b>L10:</b> Ensure health care adapted to the lame cows	<b>L10.1:</b> by recognising at an early stage lame cows to prevent complications and having to cull the cows.	Identify severe lame cows, a sign of intervening too slow when cows are lame.
				<b>L10.2:</b> by identifying the claw lesions causing lameness	Training of the farmer on hoof trimming or invite expertise from outside the farm
				<b>L10.3:</b> by treating rapidly, using treatments adapted to the identified claw disease (curative hoof trimming, therapeutic treatments)	Check the protocols used on the farm to treat lame cows. Availability of hoof trimming equipment on the farm. Training of the farmer on hoof trimming or invite expertise from outside the farm
				<b>L10.4:</b> by disinfecting all the claws of the all the cows with a frequency adapted to the risk level of the herd to interdigital dermatitis and digital dermatitis	Disinfection protocol of the claws. Recommendation: at least 2 days every 2 weeks after cleaning of the claws. Respecting the terms of usage of the disinfectant. And with a system adapted to the farm conditions (liquid footbath, dry footbath, foam, systematic pulverisation).
	recognition of the claw lesions causing lameness by the farmer				
	applying of early and adapted treatment				
	disinfection of the claws of all the lactating cows				

### DIGITAL DERMATITIS

Nature of the risk factor		Objectives prevention protocol		Additional animal observations	Suggestions to look into...
housing	claw health problems due to humidity and defaults in hygiene in the living areas of the cows, these are conditions favourable to the development of bacteria	cleanliness and humidity of the floors	<b>L3:</b> Prevent humidity and defaults in hygiene in the living areas of the cows	<b>L3.1:</b> by ensuring dry and clean floors; as dry as possible without areas where water or feces accumulates, in particular around water troughs or feeding racks	Observe the cleanliness of the feet and thighs of the cows
					Verify that all the floors are regularly maintained; check for dirty areas (excreta or water) in the buildings. CONCEPTION Assure a good conception of the cubicles. Recommendation: the floor should have a slight slope to facilitate the evacuation of juices (slope of 2-3%). If the slope is not made of concrete it should still be draining. Prevent the use of materials like carpet or other



						absorbing textile. Verify whether the mattresses are well fixed, wrong fixation could prevent the evacuation of excreta to the corridors.
		ventilation		L3.2: by ensuring a good ventilation of the housing of the cows		Observe the roofs of the building. Check for black spots on the ridges of beams and areas with a smell of ammonia. These observations indicate an under-ventilation of the building which favors the development of bacteria.
		maintenance sleeping area		L3.3: by ensuring dry and clean sleeping areas		Cleanliness of the bedding; identify cleaning and mulching methods. Recommendation: mulching the extremity of the cubicle at least one time per day. management liquid manure: max. 1.5 kg straw per day to only 0.5-0.8 kg per cubicle per day when slatted floor. Cubicles management of more solid manure: minimum of 3 kg per cubicle per day with regular mulching.
		maintenance exercise area		L3.4: by limiting the pollution of the exercise area		Identify the methods of scraping the dung (and surveillance in case of automatic scraping) or cleansing with water... And its efficacy
		conditions of the paths giving access to the pastures		L3.5: by maintaining the roads giving access to pasture clean		Check the quality of the pathways that give access to pasture for deterioration, stones and obstacles. The road has to be able to bear the wait of the herd. Preferably use roads made of sand on a bed of rocks or use woven textile or concrete. The more the animals go on pasture during the year the more the risk factors linked to the quality of the access roads to pasture become important in the development of claw problems.
nutrition	important mineral deficiencies	insufficient distribution of minerals and vitamins	L6: Prevent the occurrence of mineral and vitamin deficiencies	L6.1: by ensuring a daily distribution that covers the needs of minerals and vitamins		Check if at least 100 g/days/cow of mineral and vitamins are supplemented during lactation. Or calculate the total amount of minerals and vitamins in the diet.
health management	preventive measures are non-existent or non-adapted	hoof trimming as a preventive measure	L7: Prevent the occurrence of complications of subacute lesions of laminitis and pododermatitis	L7.1: by ensuring preventive hoof trimming of the cows at a frequency that is adapted to the risk of claw problems of the herd	Observation of the shape of the hoofs	The preventive measures taken for lameness. Recommendation: hoof trimming of all the cows at least every 5-6 months that the cows are housed indoors, preferably before they go out on pasture.
		disinfection of the claws of all the lactating cows	L8: Reduce the impact of interdigital dermatitis and digital dermatitis by an early treatment	L8.1: by disinfecting all the claws of the all the cows with a frequency adapted to the risk level of the herd to pododermatitis and digital dermatitis		Disinfection protocol of the claws. Recommendation: at least 2 days every 2 weeks after cleaning of the claws. Respecting the terms of usage of the disinfectant. And with a system adapted to the farm conditions (liquid footbath, dry footbath, foam, systematic pulverisation).

		Apply a period of quarantine when after purchase of a cows and on return from shows	<b>L9:</b> Prevent the introduction of digital dermatitis on the farm	<b>L9.1:</b> by checking for digital dermatitis lesions when buying cattle and treat them. Plus, disinfect the claws of cattle that has been bought or return to the herd after visiting a show for example.		Estimate the average number of animals that has been bought every year or goes to shows. Identify the measures taken by the farmer when (re)introducing them to the herd.
		early detection of lame cows		<b>L10.1:</b> by recognising at an early stage lame cows to prevent complications and having to cull the cows.	Identify severe lame cows, a sign of intervening too slow when cows are lame.	Making the farmer aware and give skills to identify at an early stage lame cows.
		recognition of the claw lesions causing lameness by the farmer		<b>L10.2:</b> by identifying the claw lesions causing lameness		Training of the farmer on hoof trimming or invite expertise from outside the farm
	treatments are non-existent or not adapted	applying of early and adapted treatment	<b>L10:</b> Ensure health care adapted to the lame cows	<b>L10.3:</b> by treating rapidly, using treatments adapted to the identified claw disease (curative hoof trimming, therapeutic treatments)		Check the protocols used on the farm to treat lame cows. Availability of hoof trimming equipment on the farm. Training of the farmer on hoof trimming or invite expertise from outside the farm
		disinfection of the claws of all the lactating cows		<b>L10.4:</b> by disinfecting all the claws of the all the cows with a frequency adapted to the risk level of the herd to interdigital dermatitis and digital dermatitis		Disinfection protocol of the claws. Recommendation: at least 2 days every 2 weeks after cleaning of the claws. Respecting the terms of usage of the disinfectant. And with a system adapted to the farm conditions (liquid footbath, dry footbath, foam, systematic pulverisation).

### INTERDIGITAL PHLEGMONA

	Nature of the risk factor		Objectives prevention protocol		Additional animal observations	Suggestions to look into...
housing	claw health problems due to the occurrence of traumatism obtained while the cows are moving	conditions of the paths giving access to the pastures	<b>L2:</b> Prevent the occurrence of traumatism of the claws while the cows are moving	<b>L2.5:</b> by maintaining the access paths to the pastures non deteriorated		Check the quality of the pathways that give access to pasture for deterioration, stones and obstacles. The road has to be able to bear the weight of the herd. . Take into account the remoteness of the parcels when assessing the risk.
	claw health problems due to humidity and defaults in hygiene in the living areas of the cows, these are conditions favorable to the development of bacteria	conditions of the paths giving access to the pastures	<b>L3:</b> Prevent humidity and defaults in hygiene in the living areas of the cows	<b>L3.5:</b> by maintaining the roads giving access to pasture clean	Observe the cleanliness of the feet and thighs of the cows	Check the quality of the pathways that give access to pasture for deterioration, stones and obstacles. The road has to be able to bear the weight of the herd. . Take into account the remoteness of the parcels when assessing the risk.
management	treatments are non-existent or not adapted	early detection of lame cows	<b>L10:</b> Ensure health care adapted to the lame cows	<b>L10.1:</b> by recognizing at early stage lame cows to prevent complications and having to cull the cows.	Identify severe lame cows, a sign of intervening too slow when cows are lame.	Making the farmer aware and give skills to identify at early stage lame cows.

		recognition of the claw lesions causing lameness by the farmer		L10.2: by identifying the claw lesions causing lameness		Training of the farmer on hoof trimming or invite expertise from outside the farm
		applying of early and adapted treatment		L10.3: by treating rapidly, using treatments adapted to the identified claw disease (curative hoof trimming, therapeutic treatments)		Check the protocols used on the farm to treat lame cows. Availability of hoof trimming equipment on the farm. Training of the farmer on hoof trimming or invite expertise from outside the farm
		disinfection of the claws of all the lactating cows		L10.4: by disinfecting all the claws of the all the cows with a frequency adapted to the risk level of the herd to interdigital dermatitis and digital dermatitis		Disinfection protocol of the claws. Recommendation: at least 2 days every 2 weeks after cleaning of the claws. Respecting the terms of usage of the disinfectant. And with a system adapted to the farm conditions (liquid footbath, dry footbath, foam, systematic pulverization).

### b. Straw yard

#### LAMINITIS

Nature of the risk factor			Objectives prevention protocol		Additional animal observations	Suggestions to look into...
housing	Claw health problems due to the fact that the cows spent too much time standing on a hard surface	comfort of the lying area	L1: Prevent that the time spent standing on a hard surface is too important	L1.1: by ensuring that all the cows can lie down easily on the deep litter lying area	Check for cows that are lying down outside the deep litter area	Surface available/ cow on the deep litter area (animal density). Recommendation: 6-8 m <sup>2</sup> surface available per cow, when the deep litter area is rectangular with a maximum depth of 8-12 m, and accessible along the whole length.
				L1.2: by ensuring that the cows can lie down on a comfortable surface		Quantity of straw. Recommendation: 1 kg of straw per m <sup>2</sup> and per day, double the quantity of straw the first day after cleaning out the litter. Ensure enough comfort, the comfort can be insufficient if the litter is cured out very often (daily to weekly)
		difficult access to the lying area (especially, if the area is segmented)		L1.3: by permitting all the cows to lie down dispersed homogeneously over the different lying areas	Check for a heterogeneous repartition of the cows in the deep litter area	Preferences for lying areas: cows prefer to stay together, even though this means that they cannot lie down due to lack of space
		duration of the milking and fixation at the head gate		L1.4: by limiting the time cows spend standing before and during milking and the time the animals spend fixed at the head locks		Time spent blocked at the-head locks per day. Recommendation: time needed for milking less than 1hour and 30 minutes and time spent at the head locks less than a hour.
		repartition of the time spent indoors and on pasture		L1.5: by limiting the time the animals spend under indoor housing conditions over the year		Time spent at pasture night and day and during the day only. The more the animals spent time indoors, the more important are the risk factors related to the housing conditions. Remoteness of the pastures: the remoteness of the pastures can inhibit the positive effects of

					pasturing on the claw health of the cows when the pastures are far away.
Claw health problems due to traumatism obtained while the cows are moving	spatial organization of the exercise area	L2: Prevent that cows obtain traumatism while moving	L2.1: by ensuring that the cows can move around without struggling to get past each other or fight each other	Check for aggressive behaviour of the cows towards one another when they pass each other, when they are resting or when they are looking for access to feed or water	Often situations where animals have to compete for access to a resource of limited availability are at the origin (area to lie down, access to feed/water....) of fights/struggles between animals. Other situations at risk are: pathways with a small dimension (two cows should be able to cross each other in the exercise area, without disturbing one another and be able to pass behind the cow blocked at the head gait), areas where the animals can get trapped/one-way situations or obstacles. The level of aggressiveness can be exacerbated in herds where (some) cows have horns. Partial dehorning increases the consequences of fights for feed, one should limit the competition for feed.
	quality of the walking areas of the building		L2.2: by limiting slippery floors and the presence of stairs in the exercise areas	Check for cows slipping, an unsure gait (cows taking small steps, head down), difficulties taking steps	Prevent floors that are slippery (absence of sufficient grooves of good quality of the floor), abrasive floors, steep floors, irregularities and steps in areas where cows can be pushed around (exercise areas, waiting areas, milking parlour and the passageway returning the cows from the milking parlour to the lying areas)
	design of the access to the feeding area		L2.3: by ensuring easy access to the feeding area, minimizing standing positions while feeding that are traumatizing to the claws of the cows.	Check the position of the cows when they are accessing the trough	Prevent position forcing the cows to have most of the weight on the front feet (the trough should be 15-20 cm higher than the feet of the cows), presence of a step in front of the head gate
	neutralization of the concrete floors		L2.4: by ensuring chemical neutrality of all the floors		Recommendation: the neutralization of the concrete floors should be done within the four weeks after casting the lining of the floor and ten days before entering the animals
	conditions of the paths giving access to the pastures		L2.5: by maintaining the access paths to the pastures undeteriorated		Check the quality of the pathways that give access to pasture for deterioration, stones and obstacles. The roads should be . The road has to be able to bear the weight of the herd. Preferably use roads made of stones on a bed of rocks or use woven textile or concrete. Take into account the remoteness of the parcels when assessing the risk.
nutrition	subacute ruminal acidosis	L4: Prevent the development of subacute ruminal acidosis	L4.1: by ensuring a diet for the lactating herd containing sufficient fibers to stimulate salivation and rumination	See also the preventive protocol for metabolic diseases, chapter for subacute ruminal acidosis	Check whether the distributed diet is sufficiently fibrous by using a sieve. If not sufficiently fibrous, check whether sufficient buffers are provided in the diet.
			L4.2: by ensuring a diet for the lactating herd that is not too easily fermentable		Evaluate whether the diet's nature and format (size of the particles) are a risk of developing acidosis.

				L4.3: by distributing easily fermentable feed (concentrates rich in energy) evenly during the day and accompanied with fibrous feed		Check the supply of energy rich concentrates in the diet. - full diet: ensure proper mixing of forages and concentrates preventing sorting out the concentrates. Multiply the number of meals if necessary - semi-complete diet: multiply the number of feedings to prevent the ingestion of more than 1.5 kg of concentrates per feeding. Before ingesting concentrates cows should have eaten a more fibrous feed. - automatic concentrate dispenser: check for a correct amount of concentrates per turn, dispense the feed over a number of meal per day and prevent its use before the ingestion of more fibrous feed. But be careful not to disturb too much the cows' rhythm of ingestion-rumination-rest cycles by offering too many meals per day.
				L4.4: by managing the feed transitions at late gestation and lactation, and the transitions during lactation.		Check the changes of diet for the <b>resemblance</b> of the forages that are distributed with respect to the plant species used, in particular between diets in the middle of the dry period and those in early lactation. Check if there is a gradual increase of concentrates (less than 1 kg every 3-4 days).
	negative energy balance	cows too fat at calving (body condition score too high)	L5: prevent the occurrence of a negative energy balance in early lactation	L5.1: by controlling the body condition of cows during the dry period and attain a body condition score of about 3.5 (on a scale of 5)	Evaluate <u>retrospectively</u> the ratio milk fat/ milk protein if >1.5 in 20% of the cows during the 1st month in lactation. Or <u>instantaneously</u> by a body condition score of >4 at calving	The diet during the dry period should prevent cows to be too fat at calving (recommended body condition score = 3.5) this by using a specific diet for the dry cows adapted to their body condition score at the end of lactation. To stimulate the appetite and the digestion after calving it is recommended to supply an important amount of straw or hay and some concentrates during the two weeks before calving.
		strong loss of body condition in early lactation		L5.2: by limiting the loss of body condition during early lactation (prevent a score of less than 2) by providing a diet which is sufficiently rich in energy	Evaluate <u>retrospectively</u> the ratio milk fat/ milk protein, if >1.5 in 15% of the cows during the 2nd-4th month of lactation. Or <u>instantaneously</u> by a body condition score < 2.5 after 2 months of lactation	Check whether the cows eat their feed during lactation; availability of feed (objective 5% refusals), quality of the feed (tasteful and well preserved), number of places at the trough per number of cows should be sufficient and the access comfortable. Check the body condition score at calving. Check for cows with acidosis or other disease that could cause a loss of appetite in early lactation.
						Check the energy richness of the feed during lactation in relation to the production level of the cows.
	important mineral deficiencies	insufficient distribution of minerals and vitamins	L6: Prevent the occurrence of mineral and vitamin deficiencies	L6.1: by ensuring a daily distribution that covers the needs of minerals and vitamins		Check if at least 100 g/days/cow of mineral and vitamins are supplemented during lactation. Or calculate the total amount of minerals and vitamins in the diet.

health management	preventive measures are non-existent or non-adapted	hoof trimming as a preventive measure	<b>L7:</b> Prevent the occurrence of complications of subacute lesions of laminitis and interdigital dermatitis	<b>L7.1:</b> by ensuring preventive hoof trimming of the cows at a frequency that is adapted to the risk of claw problems of the herd	Observation of the shape of the hoofs	The preventive measures taken for lameness. Recommendation: hoof trimming of all the cows at least every 5-6 months that the cows are housed indoors, preferably before they go out on pasture.
		regular disinfection of the claws of all the lactating cows	<b>L8:</b> Reduce the impact of interdigital dermatitis and digital dermatitis by an early treatment	<b>L8.1:</b> by disinfecting all the claws of the all the cows with a frequency adapted to the risk level of the herd to interdigital dermatitis and digital dermatitis		Disinfection protocol of the claws. Recommendation: at least 2 days every 2 weeks after cleaning of the claws. Respecting the terms of usage of the disinfectant. And with a system adapted to the farm conditions (liquid footbath, dry footbath, foam, systematic pulverization).
		Apply a period of quarantine when after purchase of a cows and when cows return from shows	<b>L9:</b> Prevent the introduction of digital dermatitis on the farm	<b>L9.1:</b> by checking for digital dermatitis lesions when buying cattle and treat them. Plus, disinfect the claws of cattle that has been bought or return to the herd after visiting a show for example.		Estimate the average number of animals that has been bought every year or goes to shows. Identify the measures taken by the farmer when (re)introducing them to the herd.
	treatments are non-existent or not adapted	early detection of lame cows	<b>L10:</b> Ensure health care adapted to the lame cows	<b>L10.1:</b> by recognizing at early stage lame cows to prevent complications and having to cull the cows.	Identify severely lame cows, a sign of intervening too slow when cows are lame.	Making the farmer aware and give skills to identify lame cows at an early stage.
		recognition of the claw lesions causing lameness by the farmer		<b>L10.2:</b> by identifying the type of claw lesions causing lameness		Training of the farmer on hoof trimming or invite expertise from outside the farm
		applying of early and adapted treatment		<b>L10.3:</b> by treating rapidly, using treatments adapted to the identified claw disease (curative hoof trimming, therapeutic treatments)		Check the protocols used on the farm to treat lame cows. Availability of hoof trimming equipment on the farm. Training of the farmer on hoof trimming or invite expertise from outside the farm
		disinfection of the claws of all the lactating cows		<b>L10.4:</b> by disinfecting all the claws of the all the cows with a frequency adapted to the risk level of the herd to interdigital dermatitis and digital dermatitis		Disinfection protocol of the claws. Recommendation: at least 2 days every 2 weeks after cleaning of the claws. Respecting the terms of usage of the disinfectant. And with a system adapted to the farm conditions (liquid footbath, dry footbath, foam, systematic pulverisation).

## INTERDIGITAL DERMATITIS

Nature of the risk factor			Objectives prevention protocol		Additional animal observations	Suggestions to look into...
housing	Claw health problems due to the fact that the cows spent too much time standing on a hard surface	comfort of the lying area	L1: Prevent that the time spent standing on a hard surface is too important	L1.1: by ensuring that the cows can lie down easily on the deep litter lying area	Check for cows that are lying down outside the deep litter area	Surface available/ cow on the deep litter area (animal density). Recommendation: 6-8 m² surface available per cow, when the deep litter area is rectangular with a maximum depth of 8-12 m, and accessible along the whole length.
				L1.2: by ensuring that the cows can lie down on a comfortable surface		Quantity of straw. Recommendation: 1 kg of straw per m² and per day, double the quantity of straw the first day after cleaning out the litter. Ensure enough comfort, the comfort can be insufficient if the litter is cured out very often (daily to weekly)
		difficult access to the lying area (especially, if the area is segmented)		L1.3: by permitting all the cows to lie down dispersed homogenously over the different lying areas	Check for a heterogeneous repartition of the cows in the deep litter area	Preferences for lying areas: cows prefer to stay together, even though this means that they cannot lie down due to lack of space
		duration of the milking and fixation at the head gate		L1.4: by limiting the time cows spend standing before and during milking and the time the animals spend fixed at the head locks		Time spent blocked at the head gate per day. Recommendation: time needed for milking less than 1 hour and 30 minutes and time spent at the head gate less than a hour.
		repartition of the time spent indoors and on pasture		L1.5: by limiting the time the animals spend under indoor housing conditions over the year		Time spent at pasture night and day and during the day only. The more the animals spent time indoors, the more important are the risk factors related to the housing conditions. Remoteness of the pastures: the remoteness of the pastures can inhibit the positive effects of pasturing on the claw health of the cows when the pastures are far away.
	claw health problems due to the occurrence of traumatisms obtained while the cows are moving	spatial organization of the exercise area	L2: Prevent that cows obtain traumatisms while moving	L2.1: by ensuring that the cows can move around without struggling to get past each other or fight each other	Check for aggressive behaviour of the cows towards other cows when they pass each other, when they are resting or when they are looking for access to feed or water.	Often situations where animals have to compete for access to a resource of limited availability are at the origin (area to lie down, access to feed/water....) of fights/struggles between animals. Other situations at risk are: pathways with a small dimension (two cows should be able to cross each other in the exercise area, without disturbing one another and be able to pass behind the cow blocked at the head gait), areas where the animals can get trapped/one-way situations or obstacles. The level of aggressiveness can be exacerbated in herds where (some) cows have horns. Partial dehorning increases de consequences of fights for feed, one should limit the competition for feed.



		quality of the walking areas of the building		L2.2: by limiting slippery floors and the presence of stairs in the exercise areas	Check for cows slipping, an unsure gait (cows taking small steps, head down), difficulties taken the steps	Prevent floors that are slippery (absence of sufficient grooves of good quality of the floor), abrasive floors, steep floors, irregularities and steps in areas where cows can be pushed around (exercise areas, waiting areas, milking parlour and the passageway returning the cows from the milking parlour to the lying areas)
		design of the access to the feeding area		L2.3: by ensuring easy access to the feeding area, minimizing standing positions while feeding that are traumatizing to the claws of the cows	Check the position of the cows when they are accessing the trough	Prevent position forcing the cows to have most of the wait on the front feet (the trough should be 15-20 cm higher than the feet of the cows), presence of a step in front of the head gate
		neutralisation of the concrete floors		L2.4: by ensuring chemical neutrality of all the floors		Recommendation: the neutralisation of the concrete floors should be done within the four weeks after casting the lining of the floor and ten days before entering the animals
		conditions of the paths giving access to the pastures		L2.5: by maintaining the access paths to the pastures non deteriorated		Check the quality of the pathways that give access to pasture for deterioration, stones and obstacles. The road has to be able to bear the wait of the herd. Preferably use roads made of sans on a bed of rocks or use woven textile or concrete. Take into account the remoteness of the parcels when assessing the risk.
	claw health problems due to humidity and defaults in hygiene in the living areas of the cows, these are conditions favourable to the development of bacteria	humidity of the floors	L3: Prevent humidity and defaults in hygiene in the living areas of the cows	L3.1: by ensuring dry and clean floors; as dry as possible without areas where water or feces accumulates, in particular around water troughs or feeding racks	Observe the cleanliness of the feet and thighs of the cows	Verify that all the floors are regularly maintained; check for dirty areas (excreta or water) in the buildings and verify if the water point are near the deep litter area (water points touching the lying area should be deduced from the available area) DESIGN recommendations floors of the lying area: should have a light slope for the evacuation of juices (slope of 2-3%) with a clear demarcation between deep litter area and the exercise area to ensure that is a sufficient quantity of straw even on the edges of the deep litter area.
		ventilation		L3.2: by ensuring a good ventilation of the housing of the cows		Observe the roofs of the building. Check for black spots on the ridges of beams and areas with a smell of ammonia. These observations indicate an under-ventilation of the building which favours the development of bacteria.
		maintenance lying areas		L3.3: by ensuring clean and dry lying areas		Cleanliness of the bedding. Identify the cleaning method for cleaning and mulching the bedding. Recommendation: remove completely the bedding before it gets to hot (>39°C) or every 3-6 weeks. Mulching should be carried out at least 1 time per day. Quantity of straw: 1-1.2kg of straw per m <sup>2</sup> deep litter/day (or 7-8.5 kg per cow per dag or 10-12 kg in case of complete deep litter). And 2-2.5 kg per m <sup>2</sup> first time after cleaning

						out the litter completely.
		maintenance exercise area		L3.4: by limiting the dirtiness of the exercise area		Identify the methods of scraping the dung (and surveillance in case of automatic scraping) or cleansing with water... And its efficacy
		conditions of the paths giving access to the pastures		L3.5: by maintaining the roads giving access to pasture clean		Check the quality of the pathways that give access to pasture for deterioration, stones and obstacles. The road has to be able to bear the weight of the herd. Preferably use roads made of sand on a bed of rocks or use woven textile or concrete. The more the animals go on pasture during the year the more the risk factors linked to the quality of the access roads to pasture become important in the development of claw problems.
nutrition	negative energy balance	cows too fat at calving (body condition score too high)	L5: prevent the occurrence of a negative energy balance	L5.1: by controlling the body condition of cows during the dry period and attain a body condition score of about 3.5 (on a scale of 5)	Evaluate <u>retrospectively</u> the ratio milk fat/ milk protein if >1.5 in 20% of the cows during the 1st month in lactation. Or <u>instantaneously</u> by a body condition score of >4 at calving	The diet during the dry period should prevent cows to be too fat at calving (recommended body condition score = 3.5) this by using a specific diet for the dry cows adapted to their body condition score at the end of lactation. To stimulate the appetite and the digestion after calving it is recommended to supply an important amount of straw or hay and some concentrates during the two weeks before calving.
		strong loss of body condition in early lactation		L5.2: by limiting the loss of body condition during early lactation (prevent a score of less than 2) by providing a diet which is sufficiently rich in energy	Evaluate <u>retrospectively</u> the ratio milk fat/ milk protein, if >1.5 in 15% of the cows during the 2nd-4th month of lactation. Or <u>instantaneously</u> by a body condition score < 2.5 after 2 months of lactation	Check whether the cows eat their feed during lactation; availability of feed (objective 5% refusals), quality of the feed (tasteful and well preserved), number of places at the trough per number of cows should be sufficient and the access comfortable. Check the body condition score at calving. Check for cows with acidosis or other disease that could cause a loss of appetite in early lactation.
	important mineral deficiencies	insufficient distribution of minerals and vitamins	L6: Prevent the occurrence of mineral and vitamin deficiencies	L6.1: by ensuring a daily distribution that covers the needs of minerals and vitamins		Check the energy richness of the feed during lactation in relation to the production level of the cows.
						Check if at least 100 g/days/cow of mineral and vitamins are supplemented during lactation. Or calculate the total amount of minerals and vitamins in the diet.
health management	preventive measures are non-existent or non-adapted	hoof trimming as a preventive measure	L7: Prevent the occurrence of complications of subacute lesions of laminitis and interdigital dermatitis	L7.1: by ensuring preventive hoof trimming of the cows at a frequency that is adapted to the risk of claw problems of the herd	Observation of the shape of the hoofs	The preventive measures taken for lameness. Recommendation: hoof trimming of all the cows at least every 5-6 months that the cows are housed indoors, preferably before they go out on pasture.

	disinfection of the claws of all the lactating cows	<b>L8:</b> Reduce the impact of interdigital dermatitis and digital dermatitis by an early treatment	<b>L8.1:</b> by disinfecting all the claws of the all the cows with a frequency adapted to the risk level of the herd to interdigital dermatitis and digital dermatitis		Disinfection protocol of the claws. Recommendation: at least 2 days every 2 weeks after cleaning of the claws. Respecting the terms of usage of the disinfectant. And with a system adapted to the farm conditions (liquid footbath, dry footbath, foam, systematic pulverization).
	Apply a period of quarantine when after purchase of a cows and when cows return from shows	<b>L9:</b> Prevent the introduction of digital dermatitis on the farm	<b>L9.1:</b> by checking for digital dermatitis lesions when buying cattle and treat them. Plus, disinfect the claws of cattle that has been bought or return to the herd after visiting a show for example.		Estimate the average number of animals that has been bought every year or goes to shows. Identify the measures taken by the farmer when (re)introducing them to the herd.
	treatments are non-existent or not adapted	<b>L10:</b> Ensure health care adapted to the lame cows	<b>L10.1:</b> by recognizing at early stage lame cows to prevent complications and having to cull the cows.	Identify severe lame cows, a sign of intervening too slow when cows are lame.	Making the farmer aware and give skills to identify at early stage lame cows.
			<b>L10.2:</b> by identifying the type of claw lesions causing lameness		Training of the farmer on hoof trimming or invite expertise from outside the farm
			<b>L10.3:</b> by treating rapidly, using treatments adapted to the identified claw disease (curative hoof trimming, therapeutic treatments)		Check the protocols used on the farm to treat lame cows. Availability of hoof trimming equipment on the farm. Training of the farmer on hoof trimming or invite expertise from outside the farm
			<b>L10.4:</b> by disinfecting all the claws of the all the cows with a frequency adapted to the risk level of the herd to interdigital dermatitis and digital dermatitis		Disinfection protocol of the claws. Recommendation: at least 2 days every 2 weeks after cleaning of the claws. Respecting the terms of usage of the disinfectant. And with a system adapted to the farm conditions (liquid footbath, dry footbath, foam, systematic pulverization).
	early detection of lame cows				
	recognition of the claw lesions causing lameness by the farmer				
	applying of early and adapted treatment				
	disinfection of the claws of all the lactating cows				

## DIGITAL DERMATITIS

Nature of the risk factor			Objectives prevention protocol		Additional animal observations	Suggestions to look into...
housing	claw health problems due to humidity and defaults in hygiene in the living areas of the cows, these are conditions favourable to the development of bacteria	humidity of the floors	L3: Prevent humidity and defaults in hygiene in the living areas of the cows	L3.1: by ensuring dry and clean floors; as dry as possible without areas where water or faeces accumulates, in particular around water troughs or feeding racks	Observe the cleanliness of the feet and thighs of the cows	Verify that all the floors are regularly maintained; check for dirty areas (excreta or water) in the buildings and verify if the water point are near the deep litter area (water points touching the lying area should be deduced from the available area) DESIGN recommendations floors of the lying area: should have a light slope for the evacuation of juices (slope of 2-3%) with a clear demarcation between deep litter area and the exercise area to ensure that is a sufficient quantity of straw even on the edges of the deep litter area.
		ventilation		L3.2: by ensuring a good ventilation of the housing of the cows		Observe the roofs of the building. Check for black spots on the ridges of beams and areas with a smell of ammonia. These observations indicate an under-ventilation of the building which favours the development of bacteria.
		maintenance lying areas		L3.3: by ensuring clean and dry lying areas		Cleanliness of the bedding. Identify the cleaning method for cleaning and mulching the bedding. Recommendation: remove completely the bedding before it gets to hot (>39°C) or every 3-6 weeks. Mulching should be carried out at least 1 time per day. Quantity of straw: 1-1.2kg of straw per m <sup>2</sup> deep litter/day (or 7-8.5 kg per cow per dag or 10-12 kg in case of complete deep litter). And 2-2.5 kg per m <sup>2</sup> first time after cleaning out the litter completely.
		maintenance exercise area		L3.4: by limiting the dirtiness of the exercise area		Identify the methods of scraping the dung (and surveillance in case of automatic scraping) or cleansing with water... And its efficacy
		conditions of the paths giving access to the pastures		L3.5: by maintaining the roads giving access to pasture clean		Check the quality of the pathways that give access to pasture for deterioration, stones and obstacles. The road has to be able to bear the weight of the herd. Preferably use roads made of sans on a bed of rocks or use woven textile or concrete. The more the animals go on pasture during the year the more the risk factors linked to the quality of the access roads to pasture become important in the development of claw problems.
nutrition	important mineral deficiencies	insufficient distribution of minerals and vitamins	L6: Prevent the occurrence of mineral and vitamin deficiencies	L6.1: by ensuring a daily distribution that covers the needs of minerals and vitamins		Check if at least 100 g/days/cow of mineral and vitamins are supplemented during lactation. Or calculate the total amount of minerals and vitamins in the diet.

health management	preventive measures are non-existent or non-adapted	hoof trimming as a preventive measure	<b>L7:</b> Prevent the occurrence of complications of subacute lesions of laminitis and interdigital dermatitis	<b>L7.1:</b> by ensuring preventive hoof trimming of the cows at a frequency that is adapted to the risk of claw problems of the herd	Observation of the shape of the hoofs	The preventive measures taken for lameness. Recommendation: hoof trimming of all the cows at least every 5-6 months that the cows are housed indoors, preferably before they go out on pasture.
		disinfection of the claws of all the lactating cows	<b>L8:</b> Reduce the impact of interdigital dermatitis and digital dermatitis by an early treatment	<b>L8.1:</b> by disinfecting all the claws of the all the cows with a frequency adapted to the risk level of the herd to interdigital dermatitis and digital dermatitis		Disinfection protocol of the claws. Recommendation: at least 2 days every 2 weeks after cleaning of the claws. Respecting the terms of usage of the disinfectant. And with a system adapted to the farm conditions (liquid footbath, dry footbath, foam, systematic pulverization).
		Apply a period of quarantine when after purchase of a cows and when cows return from shows	<b>L9:</b> Prevent the introduction of digital dermatitis on the farm	<b>L9.1:</b> by checking for digital dermatitis lesions when buying cattle and treat them. Plus, disinfect the claws of cattle that has been bought or return to the herd after visiting a show for example.		Estimate the average number of animals that has been bought every year or goes to shows. Identify the measures taken by the farmer when (re)introducing them to the herd.
	treatments are non-existent or not adapted	early detection of lame cows	<b>L10:</b> Ensure health care adapted to the lame cows	<b>L10.1:</b> by recognising at early stage lame cows to prevent complications and having to cull the cows.	Identify severe lame cows, a sign of intervening too slow when cows are lame.	Making the farmer aware and give skills to identify at early stage lame cows.
		recognition of the claw lesions causing lameness by the farmer		<b>L10.2:</b> by identifying the type of claw lesions causing lameness		Training of the farmer on hoof trimming or invite expertise from outside the farm
		applying of early and adapted treatment		<b>L10.3:</b> by treating rapidly, using treatments adapted to the identified claw disease (curative hoof trimming, therapeutic treatments)		Check the protocols used on the farm to treat lame cows. Availability of hoof trimming equipment on the farm. Training of the farmer on hoof trimming or invite expertise from outside the farm
		disinfection of the claws of all the lactating cows		<b>L10.4:</b> by disinfecting all the claws of the all the cows with a frequency adapted to the risk level of the herd to interdigital dermatitis and digital dermatitis		Disinfection protocol of the claws. Recommendation: at least 2 days every 2 weeks after cleaning of the claws. Respecting the terms of usage of the disinfectant. And with a system adapted to the farm conditions (liquid footbath, dry footbath, foam, systematic pulverization).

### INTERDIGITAL PHLEGMONA

Nature of the risk factor			Objectives prevention protocol		Additional animal observations	Suggestions to look into...
housing	claw health problems due to the occurrence of traumatism obtained while the cows are moving	conditions of the paths giving access to the pastures	<b>L2:</b> Prevent the occurrence of traumatism of the claws while the cows are moving	<b>L2.5:</b> by maintaining the access paths to the pastures undeteriorated		Check the quality of the pathways that give access to pasture for deterioration, stones and obstacles. The road has to be able to bear the weight of the herd. Preferably use roads made of sand on a bed of rocks or use woven textile or concrete. Take into account the remoteness of the parcels when assessing the risk.
	claw health problems due to humidity and defaults in hygiene in the living areas of the cows, these are conditions favorable to the development of bacteria	conditions of the paths giving access to the pastures	<b>L3:</b> Prevent humidity and defaults in hygiene in the living areas of the cows	<b>L3.5:</b> by maintaining the roads giving access to pasture clean	Observe the cleanliness of the feet and thighs of the cows	Check the quality of the pathways that give access to pasture for deterioration, stones and obstacles. The road has to be able to bear the weight of the herd. Preferably use roads made of sand on a bed of rocks or use woven textile or concrete. The more the animals go on pasture during the year the more the risk factors linked to the quality of the access roads to pasture become important in the development of claw problems.
health management	treatments are non-existent or not adapted	early detection of lame cows	<b>L10:</b> Ensure health care adapted to the lame cows	<b>L10.1:</b> by recognizing at early stage lame cows to prevent complications and having to cull the cows.	Identify severe lame cows, a sign of intervening too slow when cows are lame.	Making the farmer aware and give skills to identify at early stage lame cows.
		recognition of the claw lesions causing lameness by the farmer		<b>L10.2:</b> by identifying the type of claw lesions causing lameness		Training of the farmer on hoof trimming or invite expertise from outside the farm
		applying of early and adapted treatment		<b>L10.3:</b> by treating rapidly, using treatments adapted to the identified claw disease (curative hoof trimming, therapeutic treatments)		Check the protocols used on the farm to treat lame cows. Availability of hoof trimming equipment on the farm. Training of the farmer on hoof trimming or invite expertise from outside the farm
		disinfection of the claws of all the lactating cows		<b>L10.4:</b> by disinfecting all the claws of the all the cows with a frequency adapted to the risk level of the herd to interdigital dermatitis and digital dermatitis		Disinfection protocol of the claws. Recommendation: at least 2 days every 2 weeks after cleaning of the claws. Respecting the terms of usage of the disinfectant. And with a system adapted to the farm conditions (liquid footbath, dry footbath, foam, systematic pulverisation).



## Annex 2.3 Reproductive disorders

### AGE AT FIRST CALVING TOO HIGH

	Risk factor	Objectives preventive protocol		Observations to confirm occurrence of risk factor	Look in more detail at
Heifer management	Growth retardation heifers	R1: Prevent growth retardation heifers	R1.1: by ensuring good feeding management during the first year	check weight of heifers	Feeding management, including the quality of the pastures of the youngstock
			R1.2: by ensuring good animal health level heifers, in particular for respiratory diseases		Occurrence of disease of the youngstock, in particular respiratory diseases and the parasite burden. Pasture management in the first year.
	Nutrition	R2: Prevent poor expression of heat heifers or weak fertility	R2.1: by ensuring heifers in good body condition (not too thin or too fat) at the start of the reproduction (this could results in a delayed ovulation)	body condition score heifers at start of the reproduction	Be especially vigilant in cases of a diet based on grass solely
			R2.2: by preventing an excess of soluble nitrogen in the diet, which have a negative effect on embryo survival and growth		
	Animal health		R2.3: by preventing the occurrence of disease that hinder good expression of heat, e.g. lameness	Lame heifers in the herd	
Monitoring of heats	Heat detection and record keeping	R6: Have good quality of heat detection and record keeping	R6.1 by ensuring that the all the personnel involved in heat detection has the required knowledge. Preferably one person should be responsible for heat detection	In more than 5% intervals an insemination interval of <18 days after the last insemination can be an indicator for failure in heat detection	Check the knowledge and practices on the farm regarding heat detection routines: at which moment during the day, for how long, how often and based on the right signs of heat.
			R6.2: by ensuring that the conditions for heat detection are good and the technique used is effective, including when heifers are on pasture		Check criteria for heat detection, enough light in the building for identification of heifers in heat, ensure detection when heifers are on pasture (use of mecanic/ automatic measures of heat or extra time for heat detection). Recommendation for heat detection at least two times 20 minutes per day when cows are at rest
			R6.3: by ensuring that the heat detection is well recorded by all persons involved and that a provisional planning is used		Check the recording process; recording assured all days of the week, use of a predictive planning for reproduction.
insemination	Insemination technique and managemen t farmer	R7: Using good insemination techniques and managemen	R7.1: by ensuring the right timing for insemination	Number of AI per pregnancy	Insemination routines. Education and training of all persons involved in insemination of cows.
			R7.2: by ensuring the use of a good technique and		

		t (when the farmer is inseminating the cows)	immobilisation techniques		
	Bull (natural mating)	<b>R8:</b> Using a bull which is apt for reproduction	<b>R8.1:</b> by ensuring the use of a bull that is fertile, in good health and right size (producing small calves)	behavior of the bull, semen analysis	Check the bull for fertility, general health (including claw health/ability to jump). Be careful with high temperatures in the two months preceding the use of the bull
health	Interruption of gestation	<b>R11:</b> Prevent conditions that lead to foetal death and/ or abortion	See table 'interruption of pregnancy'		See tab 'interruption of pregnancy'
Decision making	Management decisions farmer	<b>R14:</b> Reproduction results are in line with farmers objectives	<b>R14.1:</b> by identifying the farmers objectives with regard to reproduction		Identify whether the farmer aims for seasonal calving or restricted breeding period, it might influence starting age for reproduction and thus age at first calving. Heifers might have been seen in heat but were not inseminated.

### PROLONGED INTERVAL CALVING-FIRST SERVICE

Risk factor	Objectives preventive protocol		Observations to confirm occurrence of risk factor	Look in more detail at
Nutrition	<b>R3:</b> Limit the loss of body condition in early lactation	<b>R3.1:</b> by ensuring that cows are not too fat at calving (this could result in a delayed ovulation)	Body condition score at the end of the dry period	Check the diet and body condition of dry cows. Prevent too strong negative energy balance early in lactation, this is a major risk factor for anoestrus after calving. Check also the protocol for metabolic diseases for more details.
		<b>R3.2:</b> by limiting too important (too strong or too long) energy deficiencies in early lactation (this could result in a delayed ovulation). In particular paying attention to the high producing cows	Observe loss of body condition during the first weeks of lactation (until 60 DIM) and/or check the level of milkprotein	Analyse the feeding management early lactation and prevent the loss of body condition to 1,5, without dropping below a score of 2 (out of 5)
	<b>R4:</b> Prevent mineral and trace element deficiencies	<b>R4.1:</b> by ensuring supplementation of minerals, vitamins and trace elements when necessary (this could result in a delayed		Analyse the feeding management

		ovulation)		
Heat detection and record keeping	R6: Have good quality of heat detection and record keeping	R6.1 by ensuring that all the personnel involved in heat detection has the required knowledge. Preferably one person should be responsible for heat detection	In more than 5% intervals an insemination interval of <18 days after the last insemination can be an indicator for failure in heat detection	Check the knowledge and practices on the farm regarding heat detection routines: at which moment during the day, for how long, how often and based on the right signs of heat. Use of automatic measures of heat; podometers/ progesterone measurements in milk...
		R6.2: by ensuring that the conditions for heat detection are good and the technique used is effective, including when cows are on pasture		Check criteria for heat detection, enough light on the building for identification of cows in heat, ensure detection when cows are on pasture (automatic detection or extra time for heat detection) Use of a predictive planning for reproduction. Recommendation for heat detection at least two times 20 minutes per day when cows are at rest (not during feeding or milking)
		R6.3: by ensuring that the heat detection is well recorded by all persons involved and a provisional planning is made		Check the recording process; recording assured all days of the week. Record cows in heat, return into heat and inseminations. Record also the cows that do not come into to heat.
Animal health	R9: Prevent diseases that influence the expression of heat in particular metritis	R9.1: by reducing the risk of reproduction diseases	Percentage of cows with reproductive disorder in particular metritis, percentage of cows treated for reproduction problems	Management of animal health and look in detail at reproduction (problems starting up e.g. cysts, induction of heat when necessary) after parturition. Occurrence of disease after parturition. Check hygiene measures during calving and ask whether the farmer intervenes a lot at calving since this is a risk factor for metritis.
		R9.2: by reducing the risk of dystocia which is a risk factor for the development of diseases after parturition		Look at the preventive protocol on calf health for risk factors dystocia
		R9.3: by ensuring a good level of animal health regarding diseases having an indirect influence on reproductive performances	Percentage of cows with a health problem, percentage of cows treated, notably for lameness and mastitis	

		(metabolic and claw disorders, udder health)		
Housing	R13: Prevent housing conditions that inhibit the expression of heat	R13.1: by ensuring good housing conditions that allow the expression of heat		Animal density, prevent the occurrence of slippery floors or with a strong slope, light in the barn, prevent too high temperatures, access to exercise area.
		R13.2: by ensuring housing conditions that allow socially for a stable group of cows		Prevent changes in group composition at an untimely moment
Management decisions farmer	R14: Reproduction results are in line with farmers objectives	R14.1: by identifying the farmers objectives with regard to the delay to start of reproduction after calving and whether the farmer aims for seasonal calving		Identify whether the farmer aims for seasonal calving or restricted breeding period. Or a long voluntary waiting period.

### POOR 1ST SERVICE CONCEPTION RATE

Risk factor	Objectives preventive protocol		Observations to confirm occurrence of risk factor	Look in more detail at
Heat detection and record keeping	R6: Have good quality of heat detection and record keeping	R6.1 by ensuring that all the personnel involved in heat detection has the required knowledge. Preferably one person should be responsible for heat detection	In more than 5% intervals an insemination interval of <18 days after the last insemination can be an indicator for failure in heat detection	Check the knowledge and practices on the farm regarding heat detection routines: at which moment during the day, for how long, how often and based on the right signs of heat. Use of automatic measures of heat; podometers/ progesterone measurements in milk...Check the interval between the heat detection and the moment that the inseminator is called upon.
		R6.2: by ensuring that the conditions for heat detection are good and the technique used is effective, including when cows are on pasture		Check criteria for heat detection, enough light in the building for identification of cows in heat, ensure detection when cows are on pasture (automatic detection or extra time for heat detection) Use of a predictive planning for reproduction. Recommendation for heat detection at least two times 20 minutes per day when cows are at rest (not during feeding or milking)
		R6.3: by ensuring that the heat detection is well		Check the recording process; recording assured all days of the week

		recorded by all persons involved and a provisional planning is used		
Insemination technique and management	<b>R7:</b> Using good insemination techniques and management (when the farmer is inseminating the cows)	<b>R7.1:</b> by ensuring the right timing for insemination <b>R7.2:</b> by ensuring the use of a good technique	Number of AI per pregnancy	Insemination routines, check the interval used between the moment that the cow is seen in heat and the moment the inseminator is called. Education and training of all persons involved in insemination of cows
Bull (natural mating)	<b>R8:</b> Using a bull which is apt for reproduction	<b>R8.1:</b> by ensuring the use of a bull that is fertile, in good health and appropriate size (producing calves that are not too big)		Check the bull for fertility, general health (including claw health/ability to jump). Be careful with high temperatures in the two months preceding the use of the bull
Nutrition	<b>R3:</b> Prevent loss of body condition in early lactation	<b>R3.1:</b> by ensuring that cows are not too fat at calving	Body condition score at the end of the dry period	Check the diet and body condition of dry cows. Prevent too strong negative energy balance early in lactation, this is a major risk factor for anoestrus after calving. Check also the protocol for metabolic diseases for more details.
		<b>R3.2:</b> by preventing energy deficiencies in early lactation	Observe loss of body condition during the first weeks of lactation (until 60 DIM) and/or check the level of milkproteins	
	<b>R4:</b> Prevent mineral and trace element deficiencies	<b>R4.1:</b> by ensuring supplementation of minerals, vitamins and trace elements when necessary		Analyse the feeding management
	<b>R5:</b> Prevent conditions that lead to embryonic death	<b>R5.1:</b> by limiting the intake of high dietary proteins (above all soluble proteins) by the cows which have a negative effect on embryo survival and growth		Analyse the feeding management. Check for too abrupt feeding transitions, notably when the cows are turned out on pasture in autumn
Animal health	<b>R10:</b> Prevent health conditions that disfavour the conception rate, in particular metritis	<b>R10.1:</b> by ensuring a hygienic conditions at (assisted) calving		hygiene calving box (cleaning and disinfection routines between calving), hygiene of persons assisting at the calvings (personal hygiene and material)
		<b>R10.2:</b> by reducing the risk of dystocia which is a risk factor for the development of diseases after parturition	Percentage of difficult/ assisted calvings	Check the preventive protocol calf health for risk factors dystocia
		<b>R10.3:</b> by treating timely conditions as a delayed uterine involution,	Percentage of cows with disease (endometritis e.g.), percentage of cows treated and/ or culled due to	morbidity rates after parturition, treatment protocols for reproduction disorders

		dystocia-retained-placenta-metritis complex	reproduction failure	
Management decisions farmer	<b>R14:</b> Reproduction results are in line with farmers objectives	<b>R14.2:</b> by accepting that when using sexed semen the success rate of the insemination will go down		Check whether the farmer uses sexed semen

### RISK FACTORS INTERRUPTION OF PREGNANCY

Risk factor	Objectives preventive protocol		Observations to confirm occurrence of risk factor	Look in more detail at
Foetal death and abortion	<b>R12:</b> Prevent conditions that lead to foetal death	<b>R12.1:</b> by limiting the occurrence of viral, bacterial and protozoal diseases or mycotoxins causing foetal death (BVD, Q Fever, Neosporosis...)	Interval return to service shifted	check the infection status of the herd for transmissible diseases causing abortion. This can be done by using serologic tests at herd level and systematic analysis of animals that enter the herd. However, in the cases of abortion or foetal mortality; sampling of the aborted material or placenta. Managing a infectious disease causing abortion requires also the implementation of hygienic measures and if necessary the culling of animals or vaccination. Irregular returns to service might also be the result of false detection of heat that leads to insemination at the wrong time. This might look like a shift in the cycle of the cow because she comes back into heat at an unexpected moment in time.
		<b>R12.2:</b> by limiting the occurrence of accidents, mainly falls and/ or blows by other cows	animal behaviour (agressive behaviour amongst cows)	Prevent remixing of groups of pregnant animals



## Annex 2.4 Metabolic disorders

### MILK FEVER

	Nature risk factor	Objectives preventive protocol		Additional observations to confirm diagnosis	Look in detail at
management dry	Dry cows in too fat body condition	<b>A1:</b> Prevent too fat body condition at calving	<b>A1.1 :</b> by controlling the body condition before drying off cows and adjust the diet of the dry cows to prevent them to be too fat at calving		Body condition scoring at drying off, end of dry period and in early lactation: should be between 3-3.5 out of 5
	Calcium excess in diet	<b>A2:</b> Limit the supply of calcium at the end of the dry period	<b>A2.1 :</b> by limiting the amount of calcium before calving in the diet to stimulate the intestinal absorption of calcium and reabsorption of calcium from bone tissues after calving		Not more than 50 g of calcium/day/cow in the last month of gestation (recommended supply of calcium: 2 g absorbable calcium/kg DM of the total diet). A typical situation at risk: dry cows on pastures that have a important proportion of leguminous plants (clover) rich in calcium
Feed transition at the end of the dry period	Phosphor excess in the diet	<b>A3:</b> Limit the supply of phosphor in the diet, in particular for cows early in lactation	<b>A3.1 :</b> by limiting the amount of phosphor in the diet		Check the supply of phosphor (recommended supply of phosphor: 2 g of phosphor/ kg DM of the total diet)
	Magnesium deficiency	<b>A4:</b> Prevent magnesium deficiency at the end of the dry period	<b>A4.1 :</b> by ensuring a sufficient supply of magnesium in the diet which favours the mobilisation of calcium from bone tissue		Check the supply of magnesium (recommended supply of magnesium: 50 mg/kg DM of the total diet)
	Positive dietary cation-anion difference (DCAD = K+Na - Cl-S)	<b>A5:</b> Favor a negative DCAD in the 8-10 days after calving	<b>A5.1 :</b> by favoring the supply of chloride and sulfur	Analyse de diet, in particular the supply of potassium	Favor grasses over leguminous plants. If necessary, advise to supply of acidifying salt like chloride and magnesium sulphate.
	Limited feed ingestion	<b>A7:</b> Guarantee a good feed intake, in particular for cows in early lactation	<b>A7.1 :</b> by ensuring a sufficient number of feeding places at the feeding rack and ensuring ad libitum intake forage <b>A7.2 :</b> by preventing stress or health problems that limit a cow her access to the feeding spot (e.g. lameness, acidosis)	Behaviour cows: behaviour dominant cows towards lower ranked cows with regard to a continuous access to the feed	Accessibility of the feed: one headlock per cow or 60 cm par cow if no head locks are used but a bar at the high of the withers or 35 cm per cow when no restraints are used at all
Feeding management in early lactation	Calcium deficiency	<b>A8:</b> Prevent calcium deficiency in particular for cows in the beginning of lactation	<b>A8.1 :</b> by ensuring a sufficient supply of calcium in the diet in early lactation to cover the growing needs of calcium due to sudden important losses of calcium due to the started milk production		Check the supply of calcium (recommended supply of calcium: 6,5-7,2 g/kg DM of the total diet)

### KETOSIS

Nature risk factor	Objectives preventive protocol	Additional observations to confirm diagnosis	Look in detail at
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management dry	Dry cows in too fat body condition	<b>A1</b> : Prevent too fat body condition at calving	<b>A1.1</b> : by controlling the body condition before drying off cows and adjust the diet of the dry cows to prevent them to be too fat at calving		Body condition scoring at drying off, end of dry period and in early lactation: should be between 3-3.5 out of 5
Feed transition at the end of the dry period	Abrupt feed transition between the dry period and lactation	<b>A6</b> : Facilitate the adaptation of the ruminal bacterial flora to diet changes (at the end of dry period/ beginning lactation)	<b>A6.1</b> : by ensuring a gradual transition of diet instead of abrupt transitions		Distribute the main components of the forage at least 3 weeks prior to calving to the dry cows. Favor roughage
			<b>A6.2</b> : by re-introducing or gradually increase the quantity of concentrates in the diet at the end of the dry period		For dry cows fed with grass and/or hay it is recommended to re-introduce gradually concentrates in the diet (maximum of 1kg per week at the beginning to 3 kg/day at the end of the dry period)
Feeding management in early lactation	Limited feed ingestion	<b>A7</b> : Guarantee a good feed intake, in particular for cows in early lactation	<b>A7.1</b> : by ensuring a sufficient number of feeding places at the feeding rack and ensuring ad libitum intake forage		Accessibility of the feed: one headlock per cow or 60 cm par cow if no head locks are used but a bar at the high of the withers or 35 cm per cow when no restraints are used at all
			<b>A7.2</b> : by preventing stress or health problems that limit a cows access to the feeding spot (e.g. lameness, acidosis)		Behaviour cows: behaviour dominant cows towards lower ranked cows with regard to a continuous access to the feed
	Energy input insufficient by the diet	<b>A9</b> : Assure the needs in terms of energy of the cows, in particular for cows in the beginning of lactation	<b>A9.1</b> : by ensuring sufficient supply of energy through the forage and concentrates until the peak of the lactation is reached	Observe whether the reproduction of the herd is affected; e.g. expression of heat, interruption cyclicity. Additional diagnostics could be the measurements of ketone bodies in urine and milk.	Check for negative energy balance in early lactation and at the peak of lactation, mainly of the cows with a high milk production. Prevent the loss of body condition of >1.5 points and not going below 2 on a scale of 5.
	Milk Fever	<b>A10</b> : Prevent from the risk of milk fever	See table 'Milk Fever'		
Supplementation of minerals	Important mineral deficiencies, in particular cobalt	<b>A11</b> : Prevent the occurrence of mineral deficiencies, in particular cobalt	<b>A11.1</b> : by ensuring a daily distribution of sufficient minerals and vitamins in the diet		Check the coherence between mineral and vitamin supply the production system and the geographical location

## ACIDOSIS

	Nature risk factor	Objectives preventive protocol	Additional observations to confirm diagnosis	Look in detail at
Feed transition at the end of the dry period	Abrupt feed transition between the dry period and lactation	<b>A6:</b> Facilitate the adaptation of the ruminal bacterial flora to diet changes (at the end of dry period/ beginning lactation)	<p><b>A6.1 :</b> by ensuring a gradual transition of diet instead of abrupt transitions</p> <p><b>A6.2 :</b> by re-introducing or gradually turn up the quantity of concentrates in the diet at the end of the dry period</p>	<p>Distribute the main components of the forage at least 3 weeks prior to calving to the dry cows. Favor roughage</p> <p>For dry cows fed with grass and/or hay it is recommended to re-introduce gradually concentrates in the diet (maximum of 1kg per week at the beginning to 3 kg/day at the end of the dry period)</p>
Quality and balance of the lactating cows diet	Surplus of easily fermentable components in the diet	<b>A12 :</b> Limit the drop in pH in the rumen	<b>A12.1 :</b> by limiting the amount of easily fermentable glycosides in the diet	Check the nature and content of easily fermentable glycosides in the diet. The fermentability also depends on the nature of the diet (from most to least fermentable): concentrates (wheat, barley, rye, triticale> corn) > corn silage > grass (in all its appearances) > hay> coarse hay> straw.
			<b>A12.2 :</b> by checking the size of the particles, which influence fermentation	Check the size of the particles, the fermentability depends on the size of the ration from most to less fermentable): Flour> homogenate> Grains flattened
			<b>A12.3:</b> by distributing the concentrates (rich in energy) multiple times in lower amounts during the day and ensuring that the cows have always access to forage.	Check to supply of concentrates rich in energy; -in case of a complete diet: ensure that forage and concentrates are well mixed to prevent animals to pick out the concentrates. Divide the feeding over the day. - in case of a semi complete diet: divide the feeding over the day to assure that the intake of concentrates is at a maximum of 1,5 kg per meal (preventing peaks of acidity in the rumen). Before starting the distribution of concentrates it is recommended that cows ingest fibrous components of their diet first. - in case of the use of an automatic concentrates dispenser; check whether the level of concentrates is correct at per individual cow. And divide the number of distribution over the day. Prevent the distribution of concentrates before the intake of roughage. Be careful not to disturb the rhythm of the herd (eating-rumination-resting cycle) by too many meals.
			<b>A12.4 :</b> by ensuring transition periods for each change of main component in the forage	
	A lack of fibrosity in the diet	<b>A13 :</b> Ensure the function of saliva to act as a buffer	<b>A13.1 :</b> by ensuring that the diet with a fibrosity to stimulate rumination and thus salivation	Check the size of the fibres (not too fin, too much cut): prevent strands that are too short , 2 – 3 cm for corn silage, 5 cm for hay. <i>Fibrosity different components (from high to low):</i> straw (wheat and barley) > Alfalfa hay > meadow hay > green forage and grass silage > corn silage If necessary supplement substances that act like a buffer like sodium bicarbonate Take into account the period when it was harvested: an early harvest is good for fermentability of the feed, but has a negative effect on the fibrosity
			<b>A13.2 :</b> by providing cows with lick stones (salt) to stimulate salivation	

## Grass tetany

	Nature risk factor	Objectives preventive protocol		Additional observations	Look in detail at
Pasturing management, in particular when cows are turned out on pasture in spring and during the regrowth of grass in autumn	Magnesium deficiency	<b>A4:</b> Prevent magnesium deficiency at the end of the dry period	<b>A4.1 :</b> by ensuring a sufficient supply of magnesium in the diet		Check the supply of magnesium (recommended supply of magnesium: 50 mg/kg DM of the total diet)
	An abrupt feed transition	<b>A14 :</b> Facilitate the transition between the winter diet and the spring diet	<b>A14.1 :</b> by progressively modifying the diet of the lactating cows during the first weeks on pasture		It is recommended to have a transition period of 3 weeks (during which the two first week cows are going outside for 2-3 hours in the afternoon, when the rumen is already filled). Letting the cows on pasture early in Spring (from February onwards also allows a gradual adaptation to young grass which will start growing a lot early May on average
	Access to pastures with a high risks	<b>A15 :</b> Prevent the ingestion of excessive amounts of green lush grass, which will speed up the transition and limit the absorption of magnesium	<b>A15.1 :</b> by preventing to feed the cows only in paddocks full of green lush grass (in particular grass family)		Composition of the paddocks: be careful with green grass with a big proportion of leaves. These are rich in water, potassium and soluble nitrogen, but poor in celluloses, sodium and magnesium. Adapt the surface of the paddocks to the size of the herd to force cows to eat also the stems.
	Unfavourable climatic conditions	<b>A16 :</b> Prevent stress due to unfavourable climatic conditions	<b>A16.1 :</b> by avoiding cold and rainy days or choosing paddocks where the cows can find shelter		Be careful with frost at the start of the pasturing season

## Annex 2.5 Calf health

### RISK FACTORS FOR NEONATAL MORTALITY (<24h after birth)

	Nature of the risk factor		Objectives prevention protocol		Additional animal observations	Look in detail at...
Preparation mother and choice father	Size of the calf not compatible with the size of the pelvis mother	Earliness of the start of the reproduction of the heifers	<b>C1:</b> Prevent difficult calvings	<b>C1.1:</b> by inseminating heifers that are sufficiently developed	Check the growth/weight of the heifers	Aim for 60% of the adult weight for a calving at 2 years and for 70% of the adult weight for a calving at 3 years. Or a chest circumference of 169 cm for Holstein Frisian cows at the age of the start of the reproduction
		Choice of the bull		<b>C1.2:</b> by choosing a bull known to produce calves that have no difficulties at calving		
	Preparation late gestation	Vitamin and trace element deficiencies (vitamin A, D, E & Cu, Zn, Se)	<b>C2:</b> Ensure a cow in good health at the end of gestation and production of	<b>C2.1:</b> by ensuring sufficient supply of vitamins and trace elements to the cows during the middle and end of gestation		Importance of selenium supply in the last month of the gestation. It allow to have vigorous calves at birth that drink rapidly their colostrum

		Weak immune system	colostrum of good quality	C2.2: by preventing disease conditions that weaken the cow (mastitis, parasitism, ...)	Somatic cell count cows at drying of. Treating cows at drying- off when necessary based on the individual somatic cell count.	A nitrogen deficit can have a negative impact on the antibody production for the colostrum
		Presence of infectious agents in the herd that can provoke abortion (BVD, Q Fever, Neosporosis...)		C2.4: by limiting the occurrence of viral, bacterial and protozoal diseases or mycotoxins causing foetal death (BVD, Q Fever, Neosporosis...)		
		Changing the composition of the groups with pregnant cows		C2.5: by preventing accidents, mainly due to falls and/or blows from another cow	aggressive behaviour in group of cows in late gestation	prevent the change in composition of groups with pregnant cows
	Calving conditions	Body condition of the cow at calving	C3: Prevent the occurrence of calvings that present a risk for calf and cow	C3.1: by ensuring that cows do not calf with a body condition that is too thin or too fat	Body condition score	Objective for a good body condition score 2.5-3.5 (on a scale of 5)
		Surveillance and help at calving		C3.2: by ensuring surveillance during calving and intervention in case of calving difficulties	Long duration of the calving, purplish mucus membranes, water with blood	In case of forced extraction, check the position of the calf and that the passage way (when dilated) is of sufficient size and not ruptured.
		Care taking of the new born calf		C3.3: by ensuring to help the calf breath and/ or resuscitating the calf after birth		

## DIARRHEA

		Nature of the risk factor	Objectives prevention protocol		Additional animal observations	Suggestions to look into...
Preparation mother and choice father	Size of the calf not compatible with the size of the pelvis mother	Earliness of the start of the reproduction of the heifers	C1: Prevent difficult calvings	C1.1: by inseminating heifers that are sufficiently developed	Check the growth/ weight of the heifers	Aim for 60% of the adult weight for a calving at 2 years and for 70% of the adult weight for a calving at 3 years. Or a chest circumference of 169 cm for Holstein Frisian cows at the age of the start of the reproduction
		Choice of the bull		C1.2: by choosing a bull known to produce calves that have no difficulties at calving		1) Index of birth facility 2) Avoid crossing with a beef bull

	Preparation late gestation	Vitamin and trace element deficiencies (vitamin A, D, E & Cu, Zn, Se)	C2: Ensure a cow in good health at the end of gestation and production of colostrum of good quality	C2.1: by ensuring sufficient supply of vitamins and trace elements to the cows during the middle and end of gestation		Importance of selenium supply in the last month of the gestation. It allow to have vigorous calves at birth that drink rapidly their colostrum
		Weak immune system		C2.2: by preventing disease conditions that weaken the cow (mastitis, parasitism, ...)	Somatic cell count cows at drying of. Treating cows at drying- off when necessary based on the individual somatic cell count.	A nitrogen deficit can have a negative impact on the antibody production for the colostrum
		Lack of specific antibodies		C2.3: by vaccinating cows to reinforce the richness in specific antibodies towards pathogens causing neonatal gastro-enteritis, if possible		
Calving conditions	Care taking of the new born calf	Hampered breathing calf (to anoxia)	C3: Prevent the occurrence of calvings that present a risk for calf and cow	C3.3: by ensuring to help the calf breath and/ or resuscitating the calf after birth.		
	First colostrum intake	Insufficient intake of colostrum of good quality	C4: Ensuring the transfer of passive immunity to the calf	C4.1: by ensuring a sufficient intake under all circumstances: at least 200 g of immunoglobulins in the 6h after calving C4.2: by ensuring the intake of colostrum by the calf whatever the calving time (calving during the night)	Weigh the colostrum, checking for immunoglobulin quantity: Green zone: very good colostrum > 100g Ig/L Orange zone: fairly good colostrum from 50 to 100g Ig/L Red zone: weak colostrum < 50g Ig/L	Recommendations are: 2L in the 2 hours after calving (for a colostrum containing at least 70 Ig/L) and then 2 times 4l in the next 24h after calving. It is recommended to store frozen colostrum in case of none or poor colostrum.
	Calving pen hygiene	Lack of hygiene in the calving pen	C5: Prevent calf to acquire infections with pathogens at a very early stage in life	C5.1: by using for the calving an area which is cured out, cleaned and disinfected after each calving		Including the material used for calving (such as ropes) and the material to transport the calf
Housing of the calves	Grouping of calves	Animal density	C6: Limit the transfer of pathogens between calves	C6.1: by keeping the calves during their first week of life in individual huts and transferring them later to group housing with a surface that is adapted to the number of calves		Recommendation: 1,5 - 1,8 m <sup>2</sup> /calf, depending on the size of the calf
		Grouping together calves of different ages		C6.2: by limiting the difference of age between calves in the same group to 3 weeks to 1 month (ideal is 8-15 days)		Recommendation: 8-9 calf per group max.



	Housing conditions favourable to the development of pathogens	Cleanliness of the housing	C7: Prevent the development of pathogens in the housing of the calves. Reduce the bacterial, viral and parasite burden in the housing.	C7.1: by curing out and cleaning the housing with a pressure hose after the calf and/or group of calves leaves		If possible use a hose with high water pressure over hot water, this is more efficient against coccidiosis and cryptosporidiosis
		Disinfection of the housing		C7.2: by emptying the housing completely at least once per year: cure out, clean and disinfect. Ideal would be 1 month without animals, if not possible 8 days is better than nothing.		Pay attention to the pipes and the lower parts of the walls, parts that are favoured by the calf to lick.
	Housing conditions unfavourable to the resistance of the calves	Humidity housing conditions	C8: Provide calves with housing conditions that assure their thermal comfort	C8.1: by ensuring, in the case of a closed building, sufficient renewal of air to evacuate the humidity from the animals and the bedding.	Optimal body temperature calf = 39.5 °C, optimal temperature housing between 7-25 °C	Have at least one ventilation by using the chimney effect or use a ventilation rotating system.
		Ventilation of the housing conditions		C8.2: by preventing fast air movements (drafts) at calf level (notably arising from the ridgepole)		Wind speed measurements by an expert. In case of drafts one could use wind breakers (e.g. extra roof)
		Loss of heat due to a humid bedding		C8.3: by mulching every day the housing of the calves	Calves should be dry. Test with the knee. Sit down on your knee on the bedding for 30 seconds. The knee should remain dry.	1-2 kg straw/ calf/ day
		Loss of heat due to cold walls		C8.4: by preventing the use of materials that are cold and not isolating much (concrete e.g.) and use 'warm' materials for the walls that are in contact with the calves (wood, straw, brick walls)	Observe how the calves distribute themselves over the area (homogeneous or heterogeneous) and the way that they are lying (when feet not visible= good resting position)	
	Air quality	Harmful gases- carbon, ammonia - (fermentation of excreta)	C9: Provide for sufficient renewal of air in the building	C9.1: by ensuring a good ventilation of the building without drafts (see objectives above)	Monitor the temperature of the bedding (fermentation) and check for bad odours	Clean out the bedding material when the temperature rises above 36°C
Nutrition	Whole milk quality	Fat content milk	C10: Provide calves with good quality milk	C10.1: by preventing to provide the calves milk with a fat content that is too elevated and/or with very varying milk fat levels		
		Safety milk, concerning residues of antibiotics		C10.2: by providing milk that doesn't contain antibiotic residues since that harms the bacterial flora of the rumen and can lead to antibiotic resistance		

	Milk distribution technique	Number of meal per day	C11: Prevent indigestions due to harmful milk distribution techniques	C11.1: by giving multiple meals during the day		It is recommended not to give more than 4l of milk per meal since this is the maximum capacity of the abomasum
		Milk temperature		C11.2: by providing milk with a temperature of 38 °C		
	Nutritional supplies for maintenance and undisturbed growth of the calves	Insufficient supply of proteins and energy	C12: Obtain a good growth rate (objective 900 g/day)	C12.1: by ensuring to respect the equilibrium between energy and nitrogen supply for 1 kg of dry matter per calf (max amount of concentrates 2kg ; ad libitum access to hay)	Observe whether calves of similar age are of equal size and weight	
		Insufficient supply of minerals and vitamins		C12.2: by providing sufficient Na, Ca (growth skeleton) and P (bacterial flora); and trace elements (Se); and vitamins (A)	Observe whether calves lick pipes and/or the bottom of the walls	
		Insufficient supply of water		C12.3: by ensuring that calves have sufficient clean water at their disposition (at least 3-4L/kg of DM intake)		
	Water quality	Bad water quality, contamination with bacteria	C13: Prevent the ingestion of bacteria	C13.1: by checking regularly the drinking water quality on the presence of bacteria	Water analysis	
	Quality of the solid feed	Fibrosity of the hay	C14: Allow a good development of the rumen and the rumen papillae	C14.1: by providing the calves from the 3rd week of life appetizing feed with sufficient fibrosity		
		Choice of concentrates		C14.2: by providing concentrates that are tasteful, coarse (grains flattened or not), rich in energy and balanced in terms of nitrogen		
	Hygiene feeding material	Cleanliness of the tube to give colostrum and of the drinking nipples	C15: Prevent contamination of calves through dirty feeding materials	C15.1: by disinfecting the tube for colostrum feeding and/ or the drinking nipples after each use		
		Cleanliness buckets		C15.2: by cleaning the buckets after each meal and let them dry completely before piling them up		
		Cleanliness automatic milk dispenser		C15.3: by regular cleaning the drinking nipples of the automatic milk dispenser and their surroundings		

Health management	Quality of the surveillance	Failure in the detection of ill calves	C16: Early detection of ill calves	C16.1: by ensuring to check on all the calves at least twice a day, if possible by the same person	Check for clinical signs of disease	
		Introduction of an ill bought calf into the herd		C16.2: by placing the bought calves in quarantine (without any contact with other animals) until its health status is known, if possible by the use of diagnostic tests	Check the papers of the bought calves that describe health status of the herd of origin and if available tests that have been performed on the individuals	Ensure that all calves before entering the farm are part of disease identification programs, especially for those diseases that are common in the geographic area
	Care and treatments	Care taking of ill calves	C17: Ensure cure of ill calves	C17.1: by checking whether the calf is warm enough and eats/drinks well		
		Treatment not adapted to the disease or start treatment too late		C17.2: by ensuring early and adapted treatment (adapted to the type of pathogen causing disease; viral, bacterial or digestive problem)	Consult veterinarian	Provide calves with clay
	Transfer of pathogen through contacts with ill calf	Keeping ill calves with other calves	C18: Prevent disease transmission between calves	C18.1: by isolating the ill calf from the rest of the group		
	Transfer of pathogens through the contact with staff or equipment	No hygienic precaution when nursing ill calves		C18.2: by taking care of the ill calves after nursing the calves in good health		Keep specific equipment apart only for the use of nursing ill animal and use protective clothing
	Transfer of pathogens through the contact with material from outside of the farm	Lack hygienic precaution regarding staff and equipment coming from outside of the farm	C20: Prevent contamination from outside of the farm	C20.1: by hygienic measures for entering and leaving the farm		Use of a footbath and disinfection of the hand for visitors that represent a high risk due to their frequent contact with other farms (veterinarians, animal traders, technicians, traders, farmers...). Prevent exchanging equipment with other farms that are in contact with animals (if used by other; wash and disinfect after usage. Use a platform for the disposal of dead animals apart from the farm buildings.

## RESPIRATORY DISORDERS

	Nature of the risk factor		Objectives prevention protocol		Additional animal observations	Suggestions to look into...
Calving conditions	First colostrum intake	Insufficient intake of colostrum of good quality	C4: Ensuring the transfer of passive immunity to the calf	C4.1: by ensuring a sufficient intake under all circumstances: at least 200 g of immunoglobulins in the 6h after calving	Weigh the colostrum, checking for immunoglobulin quantity: Green zone: very good colostrum > 100g Ig/L Orange zone: fairly good colostrum from 50 to 100g Ig/L Red zone: weak colostrum < 50g Ig/L	Recommendations are: 2L in the 2 hours after calving (for a colostrum containing at least 70 of Ig/L) and then 2 times 4l in the next 24h after calving. It is recommended to store frozen colostrum in case of none or poor colostrum
				C4.2: by ensuring the intake of colostrum by the calf whatever the calving time (calving during the night)		
Housing of the calves	Grouping of calves	Animal density	C6: Limit the transfer of pathogens between calves	C6.1: by keeping the calves during their first week of life in individual huts and transferring them later to group housing with a surface that is adapted to the number of calves	Observe whether calves of similar age are of equal size and weight	Recommendation: 1,5 - 1,8 m <sup>2</sup> /calf, depending on the size of the calf
		Grouping together calves of different ages		C6.2: by limiting the difference of age between calves in the same group to 3 weeks to 1 month (ideal is 8-15 days)		Recommendation: 8-9 calf per group max.
	Housing conditions that are favourable to the development of pathogens	Cleanliness of the housing	C7: Prevent the development of pathogens in the housing of the calves. Reduce the bacterial, viral and parasite burden in the housing by disruption of their life cycle	C7.1: by curing out and cleaning the housing with a pressure hose after the calf and/or group of calves leaves		
		Disinfection of the housing		C7.2: by emptying the housing completely at least ones per year: cure out, clean and disinfect. Ideal would be 1 month without animals, if not possible 8 days is better than nothing.		Pay attention to the pipes and the lower parts of the walls, parts that are favored by the calf to lick
	Housing conditions unfavourable to the resistance of the calves	Humidity housing conditions	C8: Provide calves with housing conditions that assure their thermal comfort	C8.1: by ensuring, in the case of a closed building, sufficient renewal of air to evacuate the humidity from the animals and the bedding.	Optimal body temperature calf = 39.5 °C, optimal temperature housing between 7-25 °C	Have at least one ventilation by using the chimney effect or use a ventilation rotating system.

		Ventilation of the housing conditions		<b>C8.2:</b> by preventing fast air movements (drafts) at calf level (notably arising from the ridgepole); one could use wind breakers (e.g. extra roof)		Wind speed measurements by an expert. In case of drafts one could use wind breakers (e.g. extra roof)
		Loss of heat due to a humid bedding		<b>C8.3:</b> by mulching every day the housing of the calves	Calves should be dry. Test with the knee. Sit down on your knee on the bedding for 30 seconds. The knee should remain dry.	1-2 kg straw/ calf/ day
		Loss of heat due to cold walls		<b>C8.4:</b> by preventing the use of materials that are cold and not isolating much (concrete e.g.) and use 'warm' materials for the walls that are in contact with the calves (wood, straw, brick walls)	Observe how the calves distribute themselves over the area (homogeneous or heterogeneous) and the way that they are lying (when feet not visible= good resting position)	
	Air quality	Harmful gases- carbon, ammonia - (fermentation of excreta)	<b>C9:</b> Provide for sufficient renewal of air in the building	<b>C9.1:</b> by ensuring a good ventilation of the building without drafts (see objectives above)	Monitor the temperature of the bedding (fermentation) and check for bad odours	Clean out the bedding material when the temperature rises above 36°C
	Nutrition	Fat content milk	<b>C10:</b> Provide calves with good quality milk	<b>C10.1:</b> by preventing to provide the calves milk with a fat content that is too elevated and/or with very varying milk fat levels		
		Safety milk, concerning residues of antibiotics		<b>C10.2:</b> by providing milk that doesn't contain antibiotic residues since that harms the bacterial flora of the rumen and can lead to antibiotic resistance		
		Insufficient supply of proteins and energy	<b>C12:</b> Obtain a good growth rate (objective 900 g/day)	<b>C12.1:</b> by ensuring to respect the equilibrium between energy and nitrogen supply for 1 kg of dry matter per calf (max amount of concentrates 2kg ; ad libitum access to hay)	Observe whether calves of similar age are of equal size and weight	
		Insufficient supply of minerals and vitamins		<b>C12.2:</b> by providing sufficient Na, Ca (growth skeleton) and P (bacterial flora); and trace elements (Se); and vitamins (A)	Observe whether calves lick pipes and/or the bottom of the walls	

Health management		Insufficient supply of water		<b>C12.3:</b> by ensuring that calves have sufficient clean water at their disposition (at least 3-4L/kg of DM intake)		
	Hygiene feeding material	Cleanliness of the tube to give colostrum and of the drinking nipples	<b>C15:</b> Prevent contamination of calves through dirty feeding materials	<b>C15.1:</b> by disinfecting the tube for colostrum feeding and/ or the drinking nipples after each use		
		Cleanliness buckets		<b>C15.2:</b> by cleaning the buckets after each meal and let them dry completely before piling them up		
		Cleanliness automatic and/or collective milk dispenser		<b>C15.3:</b> by regular cleaning the drinking nipples and their surrounding of the automatic milk dispenser		
	Quality of the surveillance	Failure in the detection of ill calves	<b>C16:</b> Early detection of ill calves	<b>C16.1:</b> by ensuring to check on all the calves at least twice a day, if possible by the same person		
		Introduction of an ill bought calf into the herd		<b>C16.2:</b> by placing the bought calves in quarantine (without any contact with other animals) until its health status is known, if possible by the use of diagnostic tests	Check the papers of the bought calves that describe health status of the herd of origin and if available tests that have been performed on the individuals	
	Care and treatments	Care taking of ill calves	<b>C17:</b> Ensure cure of ill calves	<b>C17.1:</b> by checking whether the calf is warm enough and eats/drinks well		
		Treatment not adapted to the disease or start treatment too late		<b>C17.2:</b> by ensuring early and adapted treatment	Consult veterinarian	
	Transfer of pathogen through contacts with ill calf	Keeping ill calves with other calves	<b>C18:</b> Prevent disease transmission between calves	<b>C18.1:</b> by isolating the ill calf from the rest of the group		



Transfer of pathogens through the contact with material from outside of the farm	Lack hygienic precaution regarding staff and equipment coming from outside of the farm	<b>C20:</b> Prevent contamination from outside of the farm	<b>C20.1:</b> by hygienic measures for entering and leaving the farm		Use of a footbath and disinfection of the hand for visitors that represent a high risk due to their frequent contact with other farms (veterinarians, animal traders, technicians, traders, farmers...). Prevent exchanging equipment with other farms that are in contact with animals (if used by other,; wash and disinfect after usage. Use a platform for the disposal of dead animals apart from the farm buildings.
Failing defense mechanisms immune systems of the calf	Unvaccinated calves in the case of suspected viral infection	<b>C19:</b> Improve the defense mechanisms of the immune system of the calves	<b>C19.1:</b> by vaccination of the calves when appropriate		

### NAVEL INFECTIONS

	Nature of the risk factor		Objectives prevention protocol		Additional animal observations	Suggestions to look into...
Calving conditions	First colostrum intake	Insufficient intake of colostrum of good quality	<b>C4:</b> Ensuring the transfer of passive immunity to the calf	<b>C4.1:</b> by ensuring a sufficient intake under all circumstances: at least 200 g of immunoglobulins in the 6h after calving	Weigh the colostrum, checking for immunoglobulin quantity: Green zone: very good colostrum > 100g Ig/L Orange zone: fairly good colostrum from 50 to 100g Ig/L Red zone: weak colostrum < 50g Ig/L	Recommendations are: 2L in the 2 hours after calving (for colostrum containing at least 70 of Ig/L) and then 2 times 4l in the next 24h after calving. It is recommended to store frozen colostrum in case of none or poor colostrum. Heat colostrum 'au bain Marie' not in the microwave
				<b>C4.2:</b> by ensuring the intake of colostrum by the calf whatever the calving time (calving during the night)		
	Calving hygiene	Lack of hygiene at calving	<b>C5:</b> Prevent calf to acquire infections with pathogens at a very early stage in life	<b>C5.1:</b> by using for the calving an area which is cured out, cleaned and disinfected after each calving		
				<b>C5.2:</b> by disinfection of the belly button dipping it in an iodine solution soon after calving (not go over 1h)		Disinfection can be done after having emptied the blood from the umbilical cord. But emptying should be done under strict hygienic procedures, including wearing gloves.

Housing	Housing conditions favourable to the development of pathogens	Cleanliness of the housing	<b>C7:</b> Prevent the development of pathogens in the housing of the calves. Reduce the bacterial, viral and parasite burden in the housing by disruption of their life cycle	<b>C7.1:</b> by curing out and cleaning the housing with a pressure hose after the calf and/or group of calves leaves		
		Disinfection of the housing		<b>C7.2:</b> by emptying the housing completely at least ones per year: cure out, clean and disinfect. Restock after 8 days during which no animals were in the building.		Pay attention to the pipes and the lower parts of the walls, parts that are favored by the calf to lick
	Housing conditions unfavourable to the resistance of the calves	Loss of heat due to a humid bedding	<b>C8:</b> Provide calves with housing conditions that assure their thermal comfort	<b>C8.3:</b> by mulching every day the housing of the calves	Calves should be dry. Test with the knee. Sit down on your knee on the bedding for 30 seconds. The knee should remain dry.	1-2 kg straw/ calf/ day
Health management	Quality of the surveillance	Failure in the detection of ill calves	<b>C16:</b> Early detection of ill calves	<b>C16.1:</b> by ensuring to check on all the calves at least twice a day, if possible by the same person	Clinical signs of navel infection	
	Care and treatments	Care taking of ill calves	<b>C17:</b> Ensure cure of ill calves	<b>C17.1:</b> by checking whether the calf is warm enough and eats/drinks well		
		Treatment not adapted to the disease or start treatment too late		<b>C17.2:</b> by ensuring early and adapted treatment	Consult veterinarian	