Transform
Dairy
Net

Deliverable 3.1.

Report on knowledge and gaps

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[11] **Type** [1] **R**=Document, report; **DEM**=Demonstrator, pilot, prototype; **DEC**=website, patent fillings, videos, etc.; **OTHER**=other_
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Revisions

List of Acronyms

CCC	Cow-calf contact
DIM	Days in milk
EU	European Union
ICAR	International Committee for Animal Recording
NNF	National Network Facilitators
NIP	National Innovation Practice Hub
TDN	Transform Dairy Net
WP	Work Package

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Keywords list

- Cow-calf contact
- Welfare
- Health
- Housing
- Animal breeding
- Cattle
- Cow
- Calf
- Dairy
- Performance
- Stakeholder attitude
- Best practice

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1. Executive summary

This report provides an overview of the current European knowledge landscape on cow-calf contact (CCC) systems. It draws on the practical experience of farmers who have tried out and developed these systems on their farms, as well as knowledge gathered through projects involving farmers, scientists and advisors, and scientific studies examining the fundamentals of CCC systems from a variety of perspectives. The review of available material (guides, reports, websites, scientific literature, etc.) was supplemented by project-internal workshops, interviews and group discussions. The overall aim was to compile the existing knowledge and to identify knowledge as well as dissemination gaps that need to be addressed to further promote CCC in the dairy sector.

While there is no reliable data on the exact number of CCC farms within the individual TDN partner countries, the available sources show that there is a great variation in the adoption level of CCC practices between countries, with most farms currently being found in Germany, Austria, Norway and Sweden, Denmark, the UK and France. Next to the number of farms, there is also variation in the types of used CCC systems, as these systems have developed in practice and therefore under very specific conditions. Within our TDN partner countries not only the preferred form of calf contact – dams or foster cows – varies, but also the conditions under which CCC is mainly practised: in France, for example, there are many farms practising foster cow rearing in combination with extensive grazing, while in Norway, CCC is commonly practised in combination with milking robots.

Despite these differences, the NIPs shared common key challenges for implementation of CCC systems in their country for which there is a greater need for knowledge and support. These, included foremost barn construction and equipment, economic viability and marketing as well as suitable weaning and separation methods. While the latter topic is already being investigated in scientific experiments along with other important aspects of animal welfare, there is a comparable lack of scientific studies on the economics, stakeholder attitude and sustainability of CCC systems. More scientific evidence on all these aspects is however necessary in order to facilitate a reasoned decision on common standards for CCC systems, which are currently lacking. One particular challenge in this regard seems to be the definition of a minimum period that calves and cows should spend together in order to be classified as a CCC system, as was demonstrated by the internal project workshop on this subject.

Nevertheless, we could identify 108 scientific studies that are currently available for investigating the effects of prolonged CCC on animal welfare, performance, economics, and stakeholder attitude, with increasing publications each year. Considering the ‘grey’ literature and further online sources, there are currently nine extensive guides available, which encompass general recommendations for important aspects of CCC systems, while numerous fact sheets, videos and webinars on specific CCC relevant topics are available as well. In sum, there is thus already a very good basis of information from a wide variety of information sources. However, these materials are often only available in the national language and need to be translated and better promoted in order to make them accessible to a wider range of stakeholders in the different countries. Additionally, many guides and project reports are aimed directly at farmers, with very little material designed specifically for other stakeholders. In order for CCC to become more widespread and accepted by all stakeholders along the value chain, it is important to take action at this point.

2. Introduction

2.1. General Introduction

Efforts to restore calf-cow contact (CCC) in dairy farming began at both the theoretical and practical levels. The increasing focus on animal welfare in livestock farming, in particular, promoted scientific studies, while farmers who questioned the early separation of cows and calves as well as artificial rearing of calves began to explore alternative approaches and changed procedures on their farms, often without reporting it. When compiling existing knowledge on CCC methods, both areas must therefore be taken into account, bearing in mind that scientific studies aim at general validity, whereas practical knowledge is based on experience gained under very specific conditions and may not necessarily be universally transferable. This is particularly true for agriculture, where the conditions under which it is practised are determined by a wide variety of factors, e.g., climate, geography, politics and culture. At the same time, this diversity promotes the development of a wide variety of approaches and implementation strategies in agricultural practice, which are valuable to exchange between countries. This report aims to combine both areas in order to create a comprehensive and cohesive map of the current knowledge landscape in partner countries and across Europe, to identify proven and recommended methods for CCC, as well as highlighting knowledge gaps that should be addressed by science and farmers in the near future.

This report compiles publicly available empirical knowledge sources and draws on the practical experience that the National Innovation Practice Hubs (NIPs) bring to the project. This is supplemented by insights from an internal project workshop and best-practice interviews with experienced farmers in which specific topics were addressed. A systematic review of the scientific literature on CCC will be published in a separate scientific review paper at a later date. Nevertheless, information gaps identified during the scientific review process, are already highlighted here.

In addition to gathering this information, an online survey was created to target stakeholders, ranging from farmers and veterinarians to advisors, breeding organisations, processors and retailers. The aim was to gain their specific views on CCC, as well as to identify best practices and/or obstacles not mentioned in the analysed material. The survey is available in ten languages. However, as the survey outcomes cannot be evaluated until this report has to be submitted, the outcomes will be presented separately at a later date.

Finally, in addition to presenting the knowledge landscape, the report also highlights gaps in knowledge transfer, which will then be addressed during the course of the project through targeted activities such as webinars, fact sheets and explanatory videos.

2.2. Methodology

To identify the existing knowledge and gaps relating to CCC practices the scientific literature was reviewed and grey literature, including guidelines, factsheets and videos, were screened. In addition, from within the consortium, each of the 11 NIP groups conducted an exercise to identify key CCC issues, a workshop was held at the General Assembly and interviews were conducted with individual farmers from four different NIPs of countries with established CCC systems.

2.2.1. Screening scientific and 'grey' literature

The **systematic review of scientific literature** investigates the effects of prolonged CCC, defined as calf and dam/foster cow kept together for at least 2 weeks after calving, on the domains (1) animal welfare, (2) performance, (3) farm economics, and (4) stakeholder attitudes in dairy cattle and water buffaloes. The review follows PRISMA-P guidelines (Moher et al., 2015; Shamseer et al., 2015) and spans from September 2024 to November 2025.

Included studies were empirical, published in peer-reviewed journals in English language and with full-text availability. The population comprised domestic cattle and domestic water buffaloes (cows and calves), and stakeholders, such as farmers and consumers. To be included, studies must have compared at least two CCC interventions, addressing one or more of the following: type of cow (dam, foster, hybrid or mixed), physical contact (full, partial), daily contact duration (whole-day, part-time, restricted suckling), CCC period (short: 2–12 weeks long: >12 weeks), resource allocation to calves (exclusive, shared with cow(s)), and initiator of contact (cow-driven, calf-driven, human-driven). Survey studies must have explored attitudes toward CCC or cow-calf separation.

Literature searches were conducted in Scopus and Web of Science (Sep–Dec 2024) using a structured set of keywords targeting CCC practices and outcomes across the four domains. Search terms were adapted from prior reviews (Beaver et al., 2019; Meagher et al., 2019). A total of 13 benchmark studies were used to validate search sensitivity. Search results were managed in the systematic review tool Covidence (Veritas Health Innovation, Melbourne, Australia). After duplicate removal, two screening rounds were applied: (1) title/abstract/keyword screening and (2) full-text review. Data extraction was conducted in two phases using standardized forms, capturing study design, CCC management details, outcome measures, and CCC effect directions. A pilot extraction phase ensured consistency across reviewers.

Studies were retained based on clear research questions, methodological transparency, statistical rigor, and ethical compliance. Criteria included sample description, study design, measurement tools, statistical methods, and reporting standards.

Extracted data were tabulated and synthesized by domain. A cost-benefit analysis will be conducted to provide evidence-based recommendations for the different types of CCC systems.

In contrast to the scientific literature, the so-called **'grey' literature** is less widely known and often harder to access. This is because it is usually published in the language of the country of origin and consists of project reports, bachelor's and master's theses. It also sometimes fails to fulfil the scientific criteria required for reliable studies. However, these documents can still offer valuable insights as they frequently contain preliminary indications of novel methods and/or practical challenges that become apparent when these are applied on dairy farms. We therefore asked all project partners to provide us with such texts. Due to their limited reliability, these texts were not analysed scientifically, but rather searched for indications of possible best practice procedures, knowledge gaps, and reasons why CCC may not be more widely adopted in practice.

2.2.2. Screening internet sources

During the first General Assembly, as well as during the introduction of the NNFs into the structure and methodology of the NIPs, we asked all participants to provide information at the project-share point, e.g., links to websites or reports on national research projects dealing with CCC.

While **guidelines** are often very comprehensive and detailed, **fact sheets** provide essential information on specific issues in a condensed form. Most fact sheets originate from **research projects** that involved significant contributions from practical farms or advisory organisations. They are therefore often easy to find on the projects' **websites**. However, information is also provided by advisory organisations, animal welfare organisations, and farmers' associations.

Watching **videos on YouTube** has become a widespread method of quickly finding practical solutions for one's own actions. In addition, institutions and farmers now have their own channels to share their approaches with other professionals and the general public. In addition to the information provided by the project partners, an independent search for suitable videos was also carried out. The keywords “dairy cow and calf” and “cow-calf contact” were used in the languages of the partner countries. Where possible, videos with English or German subtitles were viewed and notes were made on recommended methods or challenges.

Contrary to the scientific literature research, which had to follow strict rules, when internet sources and grey literature were used, it was ensured that they addressed specific, already known CCC challenges, e.g., colostrum supply, weaning or getting used to the foster cow. These were then combined with the results of the NIP consultations. The aim was to show which solutions to the challenges and barriers raised by the NIPs are already available, while simultaneously highlighting the knowledge gaps that still exist.

2.2.3. Data collection within the TDN project

2.2.3.1. Brainstorming within the NIPs using the Innovation Wheel method

It is a major aim of the NIPs to facilitate the uptake of CCC practices in their country by testing solutions and innovations for common country-specific CCC challenges in the form of so-called ‘living labs’. To identify relevant challenges and knowledge or resource gaps which could be developed further as a living lab, the NIPs did a

brainstorming session under the guidance of the NNFs using the Innovation Wheel method (as previously successfully employed in the 'Pathways for sustainable food' project'[b]) with the following steps:

Step 1: Identify idea/ambition – CCC practice or developing CCC practice
Step 2: What are the current practices relating to the idea?
Step 3: What are the current challenges and barriers which limit the uptake of CCC practice?
Step 4: What are the knowledge, innovation and/or resource gaps?
Step 5: What are the potential solutions to the gaps identified?
Step 6: What is the viability of each potential solution?

During each step, all NIP members put their ideas for the question on post-it notes and were given enough time to discuss every idea and ask other members to expand on their practices, challenges and gaps etc. before moving on to the next step. Once finished, the ideas were summarized by the NNFs and transmitted to WP3 in the form of a post meeting online interview. The country-specific number of participants during the meeting when doing the Innovation Wheel exercise is summarized in Table 1.

It should be noted that the information gathered from the CCC farmers within the NIPs is based on their experience of adapting the CCC system to their farms. Additionally, the farmers did not have to meet certain criteria, like for example a minimum duration of CCC contact at their farm, to become part of the NIPs.

Table 1. Country-specific NIP compositions during the meeting when the Innovation Wheel exercise was done

	AUT	DK	GER	NOR/ SWE	UK/ IRL	FRA	GRE	ROU	ITA	ITA (Buf)*	EST**
Number of participants in total	21	9	11	12	9	12	8	12	12	12	15
Number of experienced CCC farmers	14 (from 12 farms)	7	9	11	6	5			1		
Number of interested CCC farmers	3		2	1	2		5	4	1	5	10
Number of advisors		1				3		2	3		1
Number of veterinarians						3		2	1	5	
Number of scientists	4	1					2	4	6		1
Other (farm assurance schemes, breeding organization, dairy industry, teachers, ...)					1	1	1			2	3

* Buffaloes; **The Estonian NIP did not complete the systematic Innovation Wheel exercise as a group.

2.2.3.2. Workshop with the TDN consortium at the General Assembly meeting

A one-hour workshop on the topic "How long should cows and calves stay together in CCC?" was carried out with 28 participants out of the TDN consortium during the second TDN General Assembly meeting, which took place in

[b] https://pathways-project.com/wp-content/uploads/2025/02/PATHWAYS_D1.2_August-2024.pdf (page 50, accessed 26.07.2025)

Thessaloniki, Greece, on Wednesday 21st May 2025 as a non-public event. The workshop was led by WP3 and was carried out using the interactive polling tool Mentimeter (Mentimeter AB, Stockholm, Sweden).

The workshop participants were given three 5-minute impulse talks covering the duration of cow-calf contact from

- the scientific point of view regarding behavioural and social needs
- the scientific point of view regarding nutritional needs
- the perspective of regulations and existing CCC labels

The impulse talks were followed by a 30-minute open discussion with the workshop participants. Afterwards an interactive poll was carried out on the questions:

- What is the **acceptable minimum duration** that **calf and dam** should stay together in CCC?
    a. If the calf stays with dam until weaning
    b. If the calf is switched to a foster cow
- What is the **desirable duration** that **calf and dam** should stay together in CCC?
- What is the **acceptable minimum duration** that **calf and foster cow** should stay together in CCC?

Answer options were pre-determined to '0-2 days', '0.5 week', '1 week', '2 weeks', '3 weeks', all options of 1 month till 12 months in 0.5-month steps and 'I don't know'. There was an option for free comments in the interactive poll to raise additional discussion points that could not be covered during the preceding open discussion.

2.2.3.3. Interviews with experienced TDN farmers

Out of the NIPs from those countries where CCC practices are well established, some experienced farmers were recruited to participate in a one-hour group interview with WP3. The interview was carried out as a semi-structured online interview and planned as group interviews, so that participants could complement each other. However, due to time constraints of the farmers, the engagement in the interviews was partly limited and only the interview with the Norwegian-Swedish NIP was carried out as the planned group interview. In the interviews with the other countries' NIPs only representatives of one farm were present. Topics were chosen according to the expertise of the specific country: UK-Irish NIP: Health monitoring and joint pasture access of calves together with the cows; German NIP: Weaning and separation of calves and marketing of CCC products; Austrian NIP: Foster cow rearing systems; Norwegian-Swedish NIP: integration of milking robots into CCC systems.

3. Results

Since not all used sources can be cited in accordance with scientific standards, we have decided to vary the citation formats accordingly:

- If the source cited is a peer-reviewed scientific article, the authors and year of publication are cited. The sources can then be found in section 6.1.
- If it is a reference to grey literature, a guide, video, or similar, a [number] is given in brackets. These sources are then listed separately in section 6.2.7.
- Footnotes are written in lowercase letters and the explanation is given at the bottom of the page.

Last but not least, we have subdivided the material according to their type (guides, websites, videos, etc.) to make it easier to find specific information. All sources can be found at the end of the main text and can be quickly identified via the table of contents.

3.1.1. Systems in theory

There is a considerable variety between the individual dairy farms across the European countries. The farms differ, for example, regarding the size of the farm, including the type and number of animals kept, the available number of staff, the barn type and layout, options for pasture access, as well as in management decisions, like year-round or block calving. Since each of these factors influences the options to keep cow and calf together, there is no single standardised method for a CCC system, but instead a range of systems has developed over the years. The most important aspects to classify CCC systems are the type of cow used, the daily contact duration between cow and calf and the number of calves reared with CCC. On some farms, the calves have contact to their own dam (= **dam-calf contact rearing system**), while on other farms, one or more foster cows are rearing several foster calves, sometimes including their own calf (= **foster cow rearing system,** all definitions according to Sirovnik et al. 2020). It is also possible that a calf starts to be reared by its dam but is then switched to a foster cow (= **mixed or hybrid rearing system**). In terms of duration of the daily allowed contact time between cow and calf, there are some farms, where cow and calf have contact for almost 24 h daily (with possible temporary separations during milking and feeding, = **whole-day contact system**), while on other farms they only have contact for specific periods of the day (= **part-time contact system**). The latter can be practised as **half-day contact system** with contact either only during the day or only during the night. If the cow-calf contact is only allowed for two (or more) short periods per day, e.g., for 2 x 15 min or 2 x 30 min, this is called a **restricted suckling- or short time contact system**. Regarding the type and number of calves, it can be differentiated if only a certain part of the calves of the farm are reared with CCC, which are often the replacements heifers, or if all calves, including the bulls, are reared with contact to a cow. Figure 1 provides an overview and summary of these different elements of CCC systems, which nowadays exist in all possible combinations, while farmers were successfully adapting CCC systems to their existing on-farm realities. An overview of the distribution and types of CCC systems that are practised across the TDN partner countries is given in the next section.

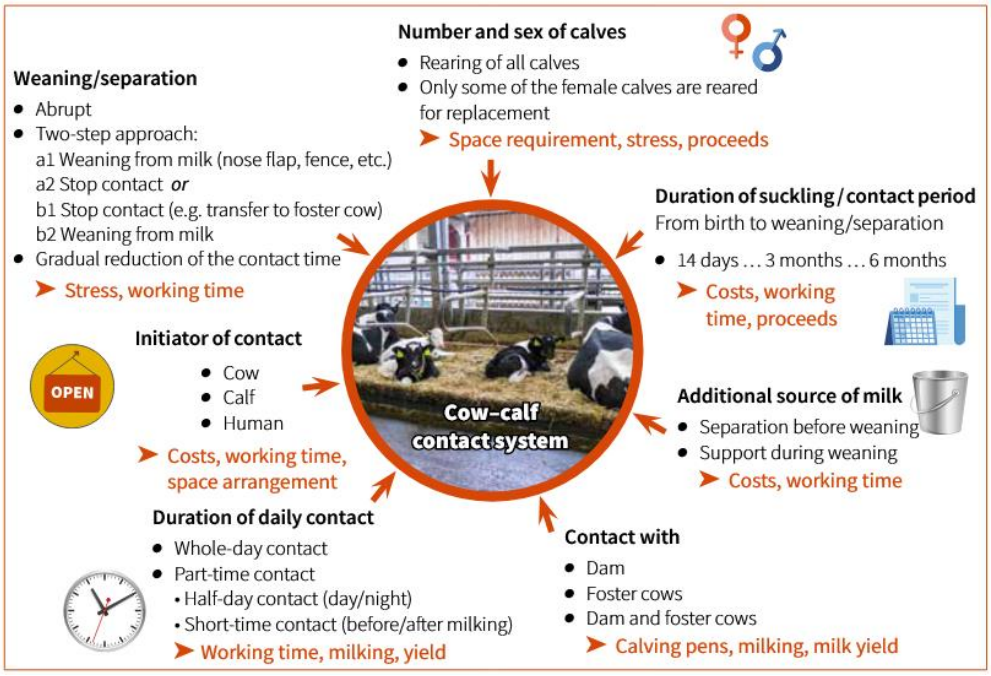

Figure 1. Different elements of cow-calf contact systems – almost all variants can be combined (red: the decision affects, among other factors, …) [14]

3.1.2. Existing CCC systems in the TDN partner countries

3.1.2.1. Germany

There are at least 200 farms in Germany that practise CCC, and these are publicly listed [40]. In a recent scientific survey conducted in 2018/2019, the herd size of the German CCC farms ranged from 20–160 cows with a median of 55 (Eriksson et al., 2022), which is also reflected in the herd size of the German NIP which ranges from 13 to 90 cows. However, there is also a CCC farm with 1,200 dairy cows in Germany [7]. Thus, typical CCC farms in Germany vary from smaller to larger farms.

The German NIP was aware of the following CCC practices:

- Dam rearing system with whole-day contact as part of the main dairy herd
- Dam rearing system with half-day contact during the day or night
- Foster cow rearing system with whole-day contact
- Mixed rearing system (first dam, then foster cows) with short-time contact during the day
- Mixed rearing system (first dam, then foster cows) as a separate group from the herd with a milking robot and pasture access. Contact times change here from whole-day dam-contact, to half-day dam contact and then to whole-day contact to foster cows together with other (foster) calves
- Fattening of CCC calves on pasture with foster cows

3.1.2.2. Austria

In a recent online survey conducted in 2022, there were 37 farms in Austria that currently practised a cow-calf contact system and 34 participants that had tried it in the past (Waiblinger and Hebesberger, 2023). However as likely not all CCC farms of Austria have participated in the survey, the real number is even higher than this (Susanne Waiblinger, pers. communication). The typical CCC farms in Austria vary from smaller farms with 10 to 30 cows and direct marketing up to larger farms with 80 cows (Jakob Gadermaier, pers. communication) which is in line with results of an on-farm study conducted in 2023/2024 where the herd size of CCC ranged between 10–82 cows (Rademann et al., 2025). In the 2022 survey, the 37 farms kept up to 65 cows with a median of 20 cows and all farms were organic and provided pasture access for their animals, mostly already for calves from the first or second week of life (Waiblinger, 2025). In a previous European survey conducted in 2018/2019, the herd size of the 15 participating farms from Austria ranged from 7 to 40 cows with a median of 25 cows (Eriksson et al., 2022).

The Austrian NIP was aware of the following CCC practices:

- Dam rearing system with whole-day contact as part of the main dairy herd
- Dam rearing system with half-day contact during the day or night
- Dam rearing system with short-time contact
- Foster cow rearing system with whole-day contact
- Foster cow rearing system with part-time contact
- Foster cow rearing system with whole-day contact and milking robots

Mixed rearing systems were not mentioned by the NIP, but the Austrian survey by Waiblinger and Hebesberger (2023) found that 15% of the participating farms practised a mixed rearing system, compared to 48% with a pure dam rearing system and 20% with a pure foster cow rearing system. On far most of the farms, CCC was allowed for more than 11 weeks before separation of calves and cows (Waiblinger, 2025).

3.1.2.3. United Kingdom and Ireland

Within the United Kingdom there are at minimum 21 farms that practise a cow-calf contact system, that are listed publicly [8]. Within Ireland, no CCC farm could be identified so far (Rachel Annan, pers. communication). Across the 6 CCC farms which are part of the UK-Irish NIP, the herd size varies from Micro-dairies with 10 cows up to herds with 120–130 cows. Hence, also in the UK the typical CCC farm varies from smaller up to larger farms, but are often combined with pasture access, which is typical for dairy farms in the UK.

The UK-Irish NIP was aware of the following CCC practices:

- Dam-rearing system with whole-day contact on pasture
- Foster cow rearing system with whole-day contact

3.1.2.4. Norway and Sweden

In Sweden, at least 12 farms that practise a CCC system exist, which participated in the recent European survey conducted in 2018/2019 (Eriksson et al., 2022). Across those 12 CCC farms, the farm size varied from 9-500 cows, with a median size of 85 cows (Eriksson et al., 2022). In Norway, there are at least 31 farmers that practise a CCC system with a minimum contact duration of two weeks and a mean herd size of 32.5±17.1 cows, who participated in a recent Norwegian survey from 2022 (Hansen et al., 2023). However, the authors estimated the total number of CCC farms in Norway to be as high as 179 farms at the beginning of 2022, with an additional 158 farms planning to implement CCC in the future (Hansen et al., 2023). Within the CCC farmers in the Norwegian-Swedish NIP, the farm size varies from 16 to 180 cows with the Norwegian CCC farms typically being a bit smaller than the Swedish ones and having all less than 60 cows. In both countries, it is typical that the CCC systems are often combined with milking robots, which is in line with the fact that almost half of the dairy farms in Norway have a milking robot [24]. Within the NIP, the smallest CCC farm with 16 cows has 1 milking robot, while the biggest one with 180 cows has 3 milking robots.

The Norwegian-Swedish NIP was aware of the following CCC practices:

- Dam-rearing system with whole-day contact in a free-stall barn
- Dam-rearing system with whole-day contact in a separate area of the barn
- Dam-rearing system with half-day contact in a free-stall barn
- Dam-rearing system on pasture
- Mixed rearing system (1 month with the dam, 2 months with foster cows)

All listed systems were always practised in combination with one or more milking robots.

Pure foster cow rearing systems were not explicitly mentioned by the Norwegian-Swedish NIP, but within both countries exists a considerable number of farms that use a foster cow rearing system as well (Stine Grønmo Kischel, pers. communication). Within the European survey, there were two out of the 12 participating Swedish CCC farms that practised a foster cow rearing system (Eriksson et al., 2022), which equals about 17% and thus matches the proportion of the Austrian foster cow systems. For Norway, a recent project revealed that 67% (26/39) of the farms allowed the calf to suckle its own mother, while 10% (4/39) practiced a foster cow rearing system, and the remaining 23% (9/39) of farms practiced a mixed system (Julie Føske Johnsen, pers. communication).

3.1.2.5. Denmark

According to our Danish NIP, CCC systems in Denmark are mainly practised in larger farms of 150-400+ cows with foster cow rearing systems, but a couple of smaller CCC farms with 10-35 cows exist as well. A total of 9 farmers which practised a CCC system were identified for a Danish survey conducted in 2020 (Bertelsen and Vaarst, 2023). In this study, the herd size ranged from 50-270 cows, with a median of 150 cows. Participants for this survey were recruited via the dairy companies, which might have biased the sample towards bigger farms. In a stable school project conducted in the period between 2019 – 2022 in Denmark, 16 Danish farmers that currently practised CCC were involved and their herd size ranged from 7–600 cows with a median of 135 cows (Vaarst and Christiansen,

2023). Hence, there is a minimum of 16 farms in Denmark practising a CCC system, but the true number of CCC farms is likely higher. Typically, the Danish CCC farms are both large farms and make use of a foster cow rearing system, as the latter is perceived as more feasible for bigger herds and as more economically sustainable with the current Danish milk price (Iben Alber Christiansen, pers. communication).

The Danish NIP was aware of the following CCC practices:

- Dam rearing systems in smaller herds with less than 30 cows
- Dam-rearing and foster cow rearing systems during the summer period on pasture
- Mixed-rearing systems
- Foster cow rearing systems in bigger herds

3.1.2.6. France

A total of 163 French farms that reared their replacement calves with foster cows were identified in several regions of France during a survey conducted in 2018 [23]. However, the applied practices were very diverse and sometimes historical. The herd size of the 102 farms selected for interviewing (half of them had to be organic) ranged from 8-210 cows with a median of 66 cows [23]. The larger European survey from 2018/2019 included 26 out of these 163 French CCC farms. The 26 farms were located in the mountainous regions of the Grand-Est and Massif Central in north-east and south of France (Eriksson et al., 2022). The herd size ranged from 25–210 cows, with a median of 50 cows (Eriksson et al., 2022). The introduction of the foster cow rearing came from England following a study trip in 2010 by around twenty farmers from Brittany. Since then, foster cow rearing systems have been developing mainly in the north western France (Constancis et al., 2022).

In general, the French farms that practise CCC are smaller to medium farms that produce dairy for the premium market, including organic production, AOP/IGP and/or with own cheese/dairy production directly on the farm and direct marketing (Constancis et al., 2022). The most common system is a foster cow rearing system with block calving to raise dairy heifers and/or veal calves on remote pastures with less productive cows (Constancis et al., 2022). Crossbreeding and once-a-day milking are also often associated with both, dam and foster cow rearing systems.

The French NIP was aware of the following CCC practices:

- Dam-rearing or foster cow rearing system with short-time contact, where calves stay in a pen close to the main dairy herd and cows (dams or foster cows) enter the calf area for a short time period to allow nursing
- Dam-rearing system with half-day contact during the day or night
- Foster cow rearing systems on pasture (often producing (organic) veal calves)
- Mixed rearing system with half-day contact

3.1.2.7. Italy (cattle)

In Italy, CCC practices are generally not applied on dairy farms and only a small number of farmers practise CCC. Our Italian NIP consists of one currently practicing CCC farmer and one farmer who practised CCC in the past. In the recent European survey from 2018/2019, there were 19 farms that practised CCC in Italy, which had a herd size from 19-100 cows with a median of 40 cows (Eriksson et al. 2022). All of these 19 farms were located in Sicily and refer to themselves as traditional farms that used CCC for generations (Eriksson et al. 2022).

The Italian NIP was aware of the following CCC practices:

- Dam-rearing system with whole-day full contact for a short time after birth (for more than 24 hours, but generally a shorter time period of 1-2 weeks)
- Dam-rearing system with partial CCC for a short time after birth (calves in a so-called ‘cuddle box’ with the opportunity for social contact, but no suckling)
- Dam-rearing system with short-time contact for a few hours of the day
- Foster cow rearing system with whole-day contact (using cows at the end of their productive career as foster cows)

3.1.2.8. Italy (Buffaloes)

In Italy, there are around 2,238 farms that keep approximately 435,000 Italian Mediterranean buffalos in total, including around 218,000 adult females for production of buffalo mozzarella cheese. The average herd size at the buffalo farms is around 300–350 animals, of which about 100 are lactating animals (Yuri Gombia, pers. communication). Traditionally, the buffalo calves are separated from their dams within the first 24 hours after birth and are then raised in individual pens for the first two months of life, after which they are reared in smaller groups of about 10–40 animals (Yuri Gombia, pers. communication). Across the Italian buffalo NIP, there are 5 farms of which 2 practise a CCC system. The one farmer has 376 buffaloes and practises a foster cow rearing system with short-time contact until weaning. The other farmer has 390 buffaloes and practises a foster cow rearing system with whole-day contact.

3.1.2.9. Romania

In Romania, CCC is typically practised at micro-farms with about 2-5 cows, but the exact number of these CCC farms is unknown. Such small-scale holdings are prevalent in Romania, as >60% of the Romanian cattle population is kept in micro-farms (Dinu Gavojdian, pers. communication). These CCC farms in Romania often keep dual-purpose breeds and typically practise a short-time contact system where cows and the replacement heifer calves have contact to each other twice a day during the milking times. The male calves are typically not raised with contact to a cow on these farms. Also, CCC is commonly not practised by the larger Romanian dairy herds that keep Holstein cows. However, during the recruitment phase for the Romanian NIP, three farms with more than 20 cows which practised a CCC system could be identified (Dinu Gavojdian, pers. communication). Within the Romanian NIP, there are now two practicing CCC farmers in total with a herd size of 28 and 40 dairy cows that practise a short-time contact system.

In addition, there are also some small to medium sized farms in the Romanian highlands that use foster cow rearing systems for fattening of cross-bred calves from the dairy system for beef production.

The Romanian NIP was aware of the following CCC practices:

- Dam-rearing system with short-time contact
- Foster cow rearing system with whole-day contact for fattening of crossbred calves

3.1.2.10. Estonia

In Estonia, the dairy farms are comparably large and intensively managed with an average milk production of 11,647 kg/cow/year (in 2024) and a herd size of more than 200 milking cows where CCC is not practised so far. There are some organic producers that tried a foster cow rearing system with a small group of calves in the past, but have not continued this practice (Airi Vetemaa, pers. communication). A couple of farms with less than 10 cows are currently experimenting with dam-rearing. There is also Järva County Vocational Training Centre with a focus on agricultural education that has experimented with a foster cow rearing system with dairy cows for 1.5 years. For the Estonian NIP 10 dairy farmers who mostly run organic farms (herd size ranges from 7-200 cows) could be recruited, of which 2 small farms already run a CCC system and the others are interested to get more knowledge about CCC systems to consider if it is possible to implement the system at their farm in future. Among the conventional dairy farms in Estonia, there is a lack of interest in CCC systems.

The Estonian NIP was aware of the following CCC practices:

- Dam-rearing system with whole-day contact or part-time contact in smaller farms (<10 cows)
- Foster cow rearing system with whole-day contact

3.1.2.11. Greece

To date, there are no dairy farms in Greece that practise a CCC system (Chrysa Adamakopoulou, pers. communication), but within the Greece NIP, there are five farmers from larger dairy farms with approximately 400 cows per farm who are interested in a potential adoption of a CCC system at their farm in the future. The Greek living lab executed within the TDN project will be the first application of a CCC system in the Greek dairy sector (Chrysa Adamakopoulou, pers. communication).

The Greek NIP was aware of the following CCC practices:

- No dairy CCC practises known so far. However, there are pasture-raised beef cattle in Greece and thus the use of nose flaps is familiar to the Greek farmers.

3.2. Overview of available scientific CCC knowledge and remaining knowledge gaps

3.2.1. Development of scientific literature on CCC in the last 30 years

Just as CCC systems have attracted increasing interest from dairy farms in recent years, there have also been developments in the scientific community. While there were only a few scientific studies and articles in scientific journals ten years ago, there has been a sharp increase in particular over the last five years (Figure 2).

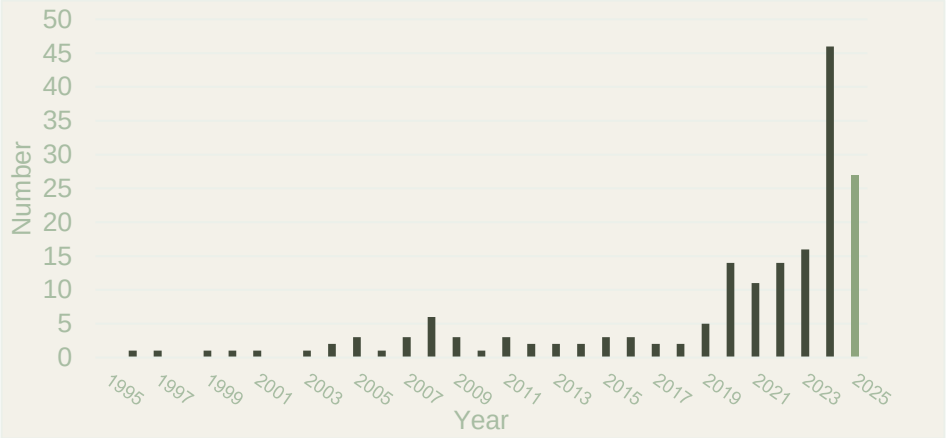

Figure 2. Development of the number of scientific publications on the topic of 'cow-calf contact' in the literature database Web of ScienceTM until July 2025

3.2.2. Initial findings of the systematic literature search

Of the scientific studies identified in a literature search, 108 studies (104 on dairy cattle and 4 on water buffaloes) were found to meet the set criteria for investigating the effects of prolonged CCC on animal welfare, performance, economics, and stakeholder attitude. Below is a description of the search and selection process.

A total of 2073 studies were collected for screening and, after the first screening round, 171 of them continued to the second screening round. Fifty-eight studies were excluded after full-text screening (21 studies because CCC duration <2 weeks, 8 studies because of lack of relevance to the objectives, 8 studies because of no description of calf age at permanent separation, 6 studies because of not involving dairy cattle or water buffaloes, 6 studies because of absence of comparison between two or more CCC interventions, 5 studies because of no or unclear description of CCC interventions, and 4 studies because of consisting of literature-based mathematical models), resulting in 113 studies proceeding to the data extraction phase. Thereafter, 5 studies were excluded after quality assessment: 2 studies on performance because of insufficient sample size and absent formal statistical analysis, 1 study on animal welfare because of insufficient sample size and absence of formal statistical analysis, and 2 studies on stakeholder attitude because of insufficient methodological description limiting interpretation of findings. Finally, 108 studies (104

on dairy cattle and 4 on water buffaloes) are currently available for investigating effects of prolonged CCC on the animal welfare, performance, economics, and stakeholder attitude (Figure 3).

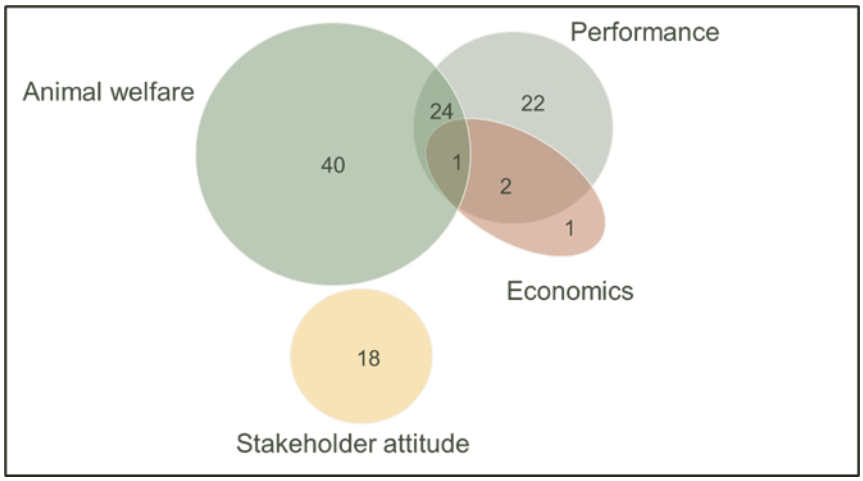

Figure 3. Illustration of the distribution of papers with data extracted across animal welfare, performance, economics, and stakeholder attitude domains. The numbers stated in the overlapping areas between circles represent the number of studies covering two or more domains.

As illustrated, the majority of CCC literature has focused on animal welfare and performance. Within each of these two domains, Table 2 shows how these studies are distributed in relation to type of contact, physical contact, daily contact duration, and CCC period duration. No study compared effects of CCC in terms of resource allocation to calves and initiator of contact. Hence, information on these two interventions will be presented as supplemental tables in the scientific manuscript only. Due to the low number of studies, this breakdown was not performed for the economics domain.

Additionally, we filtered the number of studies within animal welfare and performance domains that included key comparisons among CCC practices (Table 3) that will be used to perform a cost-benefit analysis and provide recommendations on these practices. Due to the low number of studies, this filtering was not performed for the economics domain.

Based on these initial findings, some initial points and related knowledge gaps can be raised:

- There is an unbalanced focus among domains, since studies on animal welfare and performance are overrepresented compared to economics and stakeholder attitude. This imbalance may bias or limit the future cost-benefit analysis;
- Many more studies investigated dam-rearing practices than foster cow rearing practices. Very few studies included both types of contact;
- Few studies investigated effects of CCC duration on animal welfare and/or performance, limiting our capacity to advise stakeholders on the most appropriate CCC duration;
- We identified a high variation in CCC management practices, which is a challenge for assessing their effects on animal welfare and performance. For instance, studies involving the investigation of “restricted suckling”

employed several daily frequencies (1-, 2-, 3-times) and duration of each suckling bout (range: 5 min to 4 h, including unspecified durations).

Table 2. Breakdown of papers within animal welfare and performance domains according to type of contact, physical contact, daily contact duration, and CCC period duration. Numbers in brackets indicate the number of papers containing a particular category of a particular CCC intervention. Within each CCC intervention, the sum of papers may not equal to the number of papers within domain or CCC intervention as some papers contained more than one of the categories for a particular CCC intervention.

	CCC intervention			
Domain	Contact to	Physical contact	Daily contact duration	CCC period duration
Animal welfare (N=60)	Dam (N=51)	Full contact (N=40)	Whole-day (N=44)	Short* (N=45)
		Partial contact (N=14)	Part-time (N=26)	Long** (N=15)
			Restricted suckling (N=12)	
	Foster cow (N=11)			
Performance (N=45)	Dam (N=42)	Full contact (N=43)	Whole-day (N=27)	Short (N=34)
		Partial contact (N=10)	Part-time (N=15)	Long (N=12)
			Restricted suckling (N=18)	
	Foster cow (N=3)			

*Short: 2–12 weeks, **Long : > 12 weeks

Table 3. Number of studies within animal welfare and performance domains per comparison

Comparison	**Animal welfare**	**Performance**
Dam rearing vs. Foster cow rearing	5	4
Within dam rearing: full-contact vs. partial contact (weaning methods)	9	7
Within dam rearing: restricted suckling vs. whole-day or part-time	9	3
Within dam rearing: whole-day vs. part-time	19*	10
Short duration vs. longer duration of CCC (including either dam or foster cow rearing, or both)	6	3

*The majority of studies utilised behavioural outcome measures (N=15), followed by physical outcome measures (health, physiological) (N=5), and cognitive outcome measures (N=2).

The review work is ongoing and the submission of a scientific review article to a peer-reviewed journal is due November 2025.

3.3. Best practices, barriers and knowledge gaps

3.3.1. Overview of the country-specific barriers and knowledge gaps identified by the project's NIPs

As described in detail in section 2.2.3.1, the members of the NIPs in each TDN partner country were asked to do a brainstorming as a group using the Innovation Wheel method to list the current challenges and barriers that limit the uptake of the CCC practice in their country, as well as the current knowledge, innovation and/or resource gaps regarding the adoption of CCC. The three most frequently mentioned challenges were the current barn layout, an impaired profitability and problems during the weaning and separation procedure of cow and calf (Table 4). Next to further management and animal behaviour related challenges, a shortage of personnel and knowledge about CCC, as well as problematic regulations were raised as main barriers for the uptake and successful implementation of CCC systems (Table 4). All challenges and the related knowledge and resource gaps are described in detail below.

Table 4. Overview of the **challenges and barriers for adoption of cow-calf contact (CCC) systems** raised (X) by the different National Practice Hubs (NIPs) in the TransformDairyNet partner countries. Marks in bold (**X**) signify the challenges or barriers that were considered as most important by the country's NIP, if the NIP did a rating.

	AUT	DEN	GER	NOR/ SWE	UK/ IRL	FRA	GRE	ROU	ITA	ITA (Buf)*	EST**
Barn layout, space & infrastructure at farm	**X**	X	X	X	X	X	**X**	X	X	X	X
Reduced saleable milk, profitability & marketing	**X**	**X**	X	X	X	X	**X**	**X**	X	X	
Weaning & separation	**X**	X	X	**X**	X	X	X		X		
Transmittable diseases between cow and calf				X	X	X	X		X	X	X
Udder health	X			X	X	**X**	X		X	X	X
Shortage of (CCC-interested/skilled) personnel	X	X				X	**X**	X	X	X	
Large farm size	X	X				X	X		X	X	
Cow & calf behaviour (labour requirement)	X	X		X		**X**			X	X	
Milk ejection/ failed milkings at robots	X	X	X	**X**							
Official milk recording	**X**		X								
Animal (health and oestrus) monitoring	X			X	X	X					
Limited knowledge about CCC						X	X	X	X	X	
Problematic governmental or other regulations		X				X		X	X		
Calving area & colostrum management									**X**	X	

*Buffaloes
**The Estonian NIP did not complete the systematic Innovation Wheel exercise as a group. Ticked challenges signify only individually mentioned challenges by Estonian NIP farmers and are not a complete list.

3.3.2. Overview of CCC knowledge from ‘grey’ literature and online sources

As the interest of farmers in CCC systems has increased, particularly in northern and central European countries, a greater number of **practical research projects** (6.2.2) on the subject have been undertaken. Many of these projects resulted in practical **guides** (6.2.1) and **fact sheets** (6.2.4) designed to help interested farmers take their first steps in CCC rearing on their own farms. These guides are usually written in the local language. However, some have been translated into English. Others are the result of international collaboration, e.g., the guide published by FiBL, which was translated into the languages of the partner countries. We found a total of nine guides (not counting translations) from different countries. Most of them provide a comprehensive overview of CCC and attempt to categorise the wide spectrum of systems found on dairy farms (Table 5). Because of this diversity, the guides usually present a few example farms and explain how they manage CCC in more detail. This is often supplemented by **webinars** (6.2.3) and/or videos, which are now freely available and often showcase farms that have implemented CCC on their farm. In addition, farmers themselves actively promote this rearing system through **videos** (6.2.5), on the one hand to express their convictions, but also to advertise their own products or those of a dairy that processes milk from CCC farms.

CCC as a 'new' approach to rear calves has only been introduced to dairy farming in recent years, so it is not surprising that these systems have not yet been incorporated into farmer apprenticeship training. We are therefore very pleased to have found two different **teaching materials** (6.2.6) that specifically address this topic.

Since including scientifically standard citations for all the guides, fact sheets, videos and webinars in the text would make it very difficult to read, we have limited ourselves to providing a few examples. However, we have listed all the sources at the end of this report.

Table 5. Published guides addressing cow-calf contact systems, Marks (x) signify the aspects addressed (Foster cow rearing = is addressed besides dam rearing)

Title (in brackets: original title in original language)	Cow, Calf Health	Colostrum	Weaning, Separation	Milking	Foster cow rearing	Human-Animal-Relationsh.	Barn, Equipment	Grazing	Economy, Marketing
Barth et al. (2022) Cow-bonded calf rearing in dairy farming: A practical guide (*Kuhgebundene Kälberaufzucht – Leitfaden für die Praxis*)	x	x	x	x	x	x	x	x	x
Christiansen & Bertelsen (2024) Space requirements and experiences with barn design for cows with calves *(Pladsbehov og erfaringer med staldindretning til ko med kalv)*					x		x		
Lehmann et al. (2021) Dam-rearing of dairy calves: Lessons from practice for future research & development	x	x	x	x	x	x	x	x	x
Lidfors & Berg (2004) Cows and calves together - practical possibilities of letting calves suckle in modern dairy farming (*Kor och kalvar tillsammans- - praktiska möjligheter att låta kalvarna dia inom modern mjölkproduktion*)	x	x	x	x	x	x	x	x	x
Scheidegger, Augsburger, Buchli (2025) Marketing of products of mother-calf husbandry (*Vermarktung von Produkten aus Mutter-Kalb-Haltung*)									x
Spengler Neff et al. (2023) Cow-reared Calf Husbandry in Dairy Farming (*Mutter- und ammengebundene Kälberaufzucht in der Milchviehhaltung*), also available in Italian, French, Polish	x	x	x	x	x	x	x	x	x
Vaarst & Christiansen (2020) Cows with calves *(KØER MED KALVE)*	x	x	x	x	x		x	x	x
Wagenaar & Langhout (2006) Rearing calves with cows - nature works!	x	x	x		x				
Waiblinger & Kirchweger (2025) Cow-bonded calf rearing with grazing (*Kuhgebundene Kälberaufzucht mit Weidehaltung*)	x	x	x	x	x	x	x	x	x

3.3.3. NIP-identified challenges and knowledge gaps complemented with possible solutions from the 'grey' literature and online sources

3.3.3.1. Barn design, space and infrastructure at the farm

In order to keep calves together with their dams with whole-day or half-day contact, there is a need to integrate the calves into the milking herd for at least part of the day. This means that there needs to be an additional lying space (or reduced number of milking cows), feed and water provision in calf-adjusted height and removal or adjustment of any barn equipment that can be dangerous for the calves. It is also advisable to have a separate calf creep within or connected to the cow area, which offers the calves a quiet zone with a suitable micro-climate, and which can also be used for temporary separations, e.g., during milking or during the night. Many NIPs therefore mentioned that, depending on the existing barn layout, it is challenging to make the necessary adaptions to the current cow barn to fit it to the needs of the calves. Especially for dairy farms with block calving, where all calves are born within a short time frame, integration of the calves into the milking herd requires a substantial amount of extra space or a considerable reduction of the number of cows, which brings economic challenges. Therefore, existing CCC farms that use a block calving system often run the calves with dams only during the summer period at pasture or work with a foster cow rearing system, where the cow-calf group is kept separately from the milking herd. In the latter case, it can be a challenge that there is no suitable extra shed for the foster groups and/or too little farmland available to build such an extra shed for the foster groups. The Italian NIP for buffaloes highlighted this as a particular issue, because buffalo farmers use the technique of de-seasonalization to concentrate all calvings between March and July and there is no use of pasture at any season of the year. From the Romanian NIP it was additionally mentioned that the farms located near the cities often kept the cows in a tie-stall at night and on a jogging paddock during the day, so that a whole-day contact system is particularly challenging. Taken together, the time and costs to build or modify the existing barn to run a CCC system is perceived as a significant barrier for the implementation of a CCC system across all countries.

Resulting knowledge and resource gaps mentioned by the NIPs:

- Guides with successful barn design options for different farm sizes and types
- More technical solutions for CCC barns (e.g., sensors; smart gates that make cow-calf separation for milking a 'one man job' or even automatic)
- Consultants trained for CCC barn constructions
- In the countries, where no CCC systems exist so far: pilot farms to help interested farmers to visualize and conceptualize the idea of CCC

Available and possible solutions:

Many of the available guides contain plans for barns (Table 5), either showing existing systems or suggesting designs for new buildings. It is often worthwhile taking a closer look at the available online videos (6.2.5, e.g., [5]) for inspiration on how to modify existing barns. There is also a webinar on barn construction available in German [31]. Nevertheless, it would be desirable that suppliers of barn equipment also consider CCC systems in their product development with specific solutions that meet the special requirements in terms of space, climate, etc.

Furthermore, there is still a lack of technology specially adapted for CCC systems. However, technology already used in suckler cow husbandry for beef cattle could provide solutions. For example, gates can be used to create calf creeps that are accessible to humans and calves, but not cows [35].

TDN aims to translate the existing guides on barn design listed in Table 5 into the partner countries' languages to enhance accessibility. In a recent Norwegian survey with 31 farmers who practised CCC, the majority of farmers reported that they had done none or only small adjustments of their cowshed when they introduced CCC at their farm (Hansen et al., 2023). Therefore, the knowledge transfer about options for barn adjustments that are easy to implement in the cowshed should be a focus for the further progress of the TDN project. Also, creation of pilot CCC systems has been proposed as part of the TDN Living Labs in Greece and Italy.

3.3.3.2. Reduced saleable milk yield, profitability and marketing

Cows in CCC systems have a reduced milk yield of about 12–15 litres per day in the milking parlour (Barth, 2020) or robot (Churakov et al., 2023) compared to non-CCC cows, since the rest of the milk is suckled by the calf. The real extent of the reduction in tank milk varies from farm to farm, with the general trend that the reduction in tank milk is higher in whole-day or short time contact systems (if the latter allows a full suckling bout to occur) compared to half-day contact systems, as well as in systems where a higher percentage of the milking cows is allowed to nurse a calf (e.g., block calving systems). In addition to this, some cows that nurse a calf react with an impaired alveolar milk ejection in response to machine milking (Lupoli et al., 2001; de Passillé et al., 2008) so that the milk with the highest fat content that is usually obtained towards the end of milking, remains in the udder. This results in not only less milk but also reduced milk fat in the machine harvested milk of nursing cows compared to controls. Since the price that the farms obtain for their milk from the dairy companies is based on fat content of the delivered milk, the combination of a reduced fat content and the reduced amount of milk leads to a significantly reduced income from the milk sale and hence a severe economic challenge for the farms. In Denmark, a foster cow rearing system with about 200 cows is an economically viable option given the current Danish milk price (54 ct/Litre), but rearing calves with their dams instead of foster cows is economically challenging for Danish farms as well (Iben Alber Christiansen, pers. communication).

In order to compensate for the reduced income from the milk sale, the CCC farms need to be paid a higher price for their milk and meat products, or alternatively need to obtain subsidies or premiums from public support schemes for the high welfare benefits they provide to the animals. Finding suitable marketing opportunities for CCC dairy and beef products, especially aside from direct marketing, is often difficult for the farmers and represents a considerable barrier for the adoption of CCC systems. In Romania, there is the additional challenge that maximum subsidies are only paid for purebred beef cattle, but not for cross-bred beef or beef-on-dairy, which makes fattening of calves from dairy systems less attractive (Dinu Gavojdian, pers. communication). For Greece, where no CCC farms exist so far, there is also no information available on whether there is a segment of consumers in the Greek market who would generally be willing and able to purchase products from CCC systems, which was considered an important information gap by the Greek NIP.

To our knowledge, there is currently also a lack of financial support schemes for CCC farms in all TDN partner countries and many NIPs raised this as a particular barrier for the adoption of CCC systems in their country. Taken

together, the lack of successful economic perspectives with CCC systems is a challenge in all countries and, as highlighted by the Romanian NIP, this fact directly causes a lack of farmer motivation.

That there is no clear definition and no common EU-standard for CCC systems is a directly associated problem that creates a barrier to the adoption of CCC systems. Particularly, it is not clear how many days cows and calves have to stay together in order to be called a CCC system and if foster cow rearing systems are equally acceptable as dam-rearing systems. The lack of such a common standard in the partner countries, but also EU-wide, is a barrier as this would be a necessary first step for public support scheme payments and/or creation of an audited label to sell CCC products at a higher price to dairy companies. In seven TDN partner countries, smaller labels for CCC already exist[c], but these are often limited to specific regions. However, since 2021 there is a German national standard offering the possibility of an additional certification of CCC for certified organic farms [18]. In addition, the Norwegian-Swedish NIP raised the barrier that there are currently not enough CCC farmers in their countries to create a high enough deliverable milk volume in order to establish own CCC streams in the dairy plants, which is equally true for all of the other TDN partner countries.

Resulting knowledge and resource gaps mentioned by the NIPs:

- Tools for consumer education to create a societal mindset change and higher demand for CCC products
- Information on the existence of a consumer demand for CCC products in the individual countries
- Fair prices/premiums/subsidies for milk and meat from CCC (certified) farms
- Marketing structures for fattening of CCC calves
- Calculator tools to estimate a priori what the transformation to a CCC system will cost
- More knowledge exchange on (direct) marketing options
- A clear definition and potentially a common EU-standard or label for CCC farms, which needs however to be flexible and to have specific solutions for different farming realities and should be implemented with a minimum of bureaucracy

Available or possible solutions:

A calculator tool for the simulation of cost and benefits of different types of CCC systems already exists and should be developed further, translated into several languages and made known to a wider audience: https://cowcalfeconomictool.github.io/

Providing calves with more milk than is typical in many artificial rearing systems presents an economic challenge to many farmers, as dairies usually do not offer extra payment for this special rearing method [19]. Nevertheless, alongside direct marketing and specialised dairies and marketers [12],[6], approaches such as private sponsorships for individual cows that can then raise their calves on this base, are also emerging. A guide, published by the Specialist Advisory Centre for dam contact in calf rearing, outlines possible solutions [27]. Although it is primarily based on conditions in Switzerland, many of the suggestions can certainly be adapted for use in other countries.

[c] https://transformdairynet.eu/wp-content/uploads/2025/04/20250526_Summery-Report_final_Labelling-meeting.pdf (accessed 10.07.2025)

One issue that affects many dairy farms is the treatment of male calves or female calves not intended for breeding in the dairy herd. Often, farmers are unable to keep these animals due to constraints in terms of space and labour. In such cases, cooperating with another farm for foster cow rearing can be a solution [26]. This issue has also been addressed in a project [13] and by a farmer initiative [6].

The work on the development of practical options for assurance standards for CCC systems is an ongoing focus area of the TDN project. Please see the summary of the TDN workshop on CCC labels with established cow-calf contact schemes[d] and from the TDN workshop on the necessary minimum duration of cow-calf contact with the TDN consortium (3.3.4). Recommendations on assurance standards for CCC systems will be summarised in the Deliverable 3.4 “Report on CCC assurance standards”, which is due to be published at the end of the project in May 2027.

3.3.3.3. Milk ejection, failed robot milkings and standards for official milk recording

There are also several challenges with CCC systems related to milking that were raised by the NIPs. One key aspect are alveolar milk ejection problems which can occur during machine milking in a part of the cows that nurse a calf, and can have negative economic consequences for the farms as already described in the previous section (3.3.3.2). In case a milking robot is used in CCC systems, there can be the challenge that (certain) milking robots create errors in the case that the calf has emptied one of the four quarters before the cow enters the robot. Sometimes these can just be error messages that the milking of the quarter was not complete, but some types of robots also terminate the whole milking process completely if one quarter is empty and have to be manually programmed to skip the specific quarter. Future software updates or adaptions for milking robots to make them compatible with CCC systems are an important resource gap in this regard.

A further key problem that was raised by experienced CCC farmers from the German and Austrian NIP is that there are no handling standards for the official milk recordings from CCC cows, or if they exist, they are not consistent between the different testing bodies. This problem is relevant for all farms which keep cow and calf together for more than 3 months, as according to ICAR guidelines the first milk recording has to be carried out latest 95 days after calving [16]. Since calves that are raised organically need to be fed whole milk for a minimum of 90 days according to the EU Regulation 2018/848, this applies to most organic CCC farms. It is important that CCC cows enter the official milk control differently than non-CCC cows due to the reduced milk quantity and altered milk fat content of the machine harvested milk from cows that suckle a calf. Often, these factors are not taken into account, which leads to falsified results for the breeding value estimations and fat-to-protein ratios of CCC cows. For a foster cow, days on which she is not machine-milked are not counted as lactation days. Thus, a full milk control is impossible, as the cow needs at least 270 lactation days to qualify for a standard lactation according to the ICAR guidelines.

In Romania, there is the additional challenge that farms have to be registered for the official milk recordings to get subsidies and that the amount of money is directly linked to the salable yield of the farm (Ordinance No. 61/2023 on the establishment of a state aid scheme in the livestock sector[e]). Hence, the partly omission of milk recordings of

[d] https://transformdairynet.eu/wp-content/uploads/2025/04/20250526_Summery-Report_final_Labelling-meeting.pdf (accessed 10.07.2025)
[e] https://apia.org.ro/wp-content/uploads/2025/02/ordonanta-de-urgenta-nr-61-2023-privind-instituirea-unei-scheme-de-ajutor-de-stat-in-sectorul-cresterii-animalelor.pdf (accessed 24.07.2025)

cows that suckle their calf, or even complete omission in case of foster cow rearing systems, will have direct economic consequences for the farmers and is an important economic barrier.

Resulting knowledge and resource gaps mentioned by the NIPs:

- Software adaptions for milking robots to make them compatible with CCC systems
- Development of a standard procedure for the official milk recording of CCC cows which produces realistic figures and is consistently used by testing bodies

Available or possible solutions:

The practice videos do not cover milk recording to determine yield and composition, but this issue is raised in some of the guides (Table 5). FiBL has, however, published information sheets with a first approach to deal with this topic in French [29] and German [30]. These already existing guidelines should be developed further, translated into more languages and made known to the relevant stakeholders to achieve a wider application. A recently completed research project was initiated to develop a similar testing system for Bavarian dairy farms, but it is not yet known whether a practical solution has been found [20].

There are currently very few recommendations on how to deal with impaired milk ejection during milking of cows that are also nursing calves. To avoid this, some farmers bring the calf into the milking parlour, as shown in some videos [12]. However, hygiene must be maintained during milking [14]. Bringing the calf into the milking parlour or even allowing it to suckle before or during machine milking is therefore not a solution for many farms. A farmer explicitly recommends simply staying calm when problems arise with milk ejection [9].

3.3.3.4. Weaning and separation

Calves and their dams which are kept in CCC systems form strong bonds, irrespective if they have whole-day or part-time contact with each other (Hvidtfeldt Jensen et al., 2024). And even in short-time contact systems (Fröberg et al., 2008) and sometimes also in foster cow rearing systems (Kent, 2020), affiliative behaviours indicative of bonding are present between cow and calf. As cows and calves in CCC systems are usually separated between 2–6 months (depending on the country, Eriksson et al. 2022), which is earlier than the natural weaning age of 9–11 months (Reinhardt and Reinhardt, 1981), they often react with high stress levels during the weaning and separation process. This is often expressed by high frequent vocalizations, unrest and pacing behaviour, weight loss and other negative reactions. All of our NIPs which have experienced CCC farmers, mentioned that the weaning and separation process is a challenge and that there needs to be more knowledge on the topic how weaning and separation in CCC systems should best be carried out in order to make it less stressful for the animals and also for the personnel. The CCC farmers from the Norwegian-Swedish NIP, who used an approach to transition the calves onto an additional milk feeding source (automatic milk feeder or bucket) to alleviate the separation stress reported that this can often be difficult and time consuming. Farmers from the Danish NIP who separate cows and calves into different paddocks for weaning reported that sometimes the animals try to break out of their enclosures, which can also be time consuming. Hence, the weaning and separation process is a key challenge from the perspective of animal welfare as well as labor requirement.

Resulting knowledge and resource gaps mentioned by the NIPs:

- A guide on optimal separation age and successful separation methods for different CCC systems with tips from producers
- How high is the stress for the animals with different separation methods?
- What drives the individual differences between animals/groups within a year?
- Further helpful weaning tools, e.g., nose flaps in different sizes

Available or possible solutions:

Weaning and separation are often considered to be particular challenges of the system. All guides agree that abrupt weaning should be avoided, a point also emphasised by farmers. It is also recommended that weaning and complete separation should not occur at the same time [34] and that the process is gradual. One option is to reduce contact time by transferring the calves to another cow [33],[25] or gradually reducing suckling times. Nose flaps are mentioned repeatedly, although it is also noted that injuries can occur to the calves' noses and that the calves may lose or pull off the nose flap. It is also noted that some calves can still reach the teats despite the nose flap being in place. One farmer has therefore made a small adjustment to the nose flap to prevent this [10].

Within TDN, the topic of weaning and separation will be addressed in the form of a living lab from the Norwegian-Swedish NIP which will compare the effects of different management practices and methods on the separation stress of calves. Additionally, a webinar that aims to summarize the scientific knowledge as well as the currently known best practices on weaning and separation is planned in the course of the TDN project.

3.3.3.5. Transmittable diseases, udder health and health monitoring

The potential transmission of diseases between cow and calves is frequently mentioned as a barrier to adoption of CCC systems. A major concern that was shared by many of our NIPs is the transmission of mastitis pathogens between cows through suckling calves. This is especially, but not exclusively, relevant for foster cow rearing systems, where calves are not assigned to one particular cow. When foster cows are not additionally milked, there was also a concern about an increased risk of a late detection of such (early stage) mastitis cases. But also in dam rearing systems, there can be problems with so called ‘milk thieves’, which are typically older calves from lower yielding dams, which suckle other calves’ dams in addition to their own mother. Furthermore, it was considered as a challenge that there are also less options for the prevention and treatment of udder infections in CCC systems, since calves should not ingest post-milking dipping products, nor intramammary antibiotics.

Next to the concerns about impaired udder health due to infections, several NIPs also raised the issue of teat damage to foster cows’ udders when a high number of calves are suckling them.

With regard to the calves, the most frequently mentioned barrier for introduction of a CCC system was the risk of transmission of paratuberculosis, also known as Johne's disease, from the cow to the calf. This usually occurs when the calf ingests the bacteria orally through contact with the infected cow’s excretions at an early age when calves are more vulnerable. In CCC systems, it is not possible to prevent contact of the calves to the cow’s faeces, so that it was listed as a barrier for implementation for CCC systems if the cow herd is not paratuberculosis free. Next to

paratuberculosis, some NIP farmers also reported infections with pneumonia and cryptosporidium in calves that were kept with cows, which was partly thought to be caused by a high pathogen load in the cow shed. Maintaining a high level of hygiene is a significantly greater challenge in the cow shed than in the smaller calf area(s). However, as already discussed in much detail in the section about Animal Health of the recent TDN report on regulations[f] , the relevance of CCC as a risk factor for Paratuberculosis is still unclear (Martins et al., 2025) and there is only mixed scientific evidence regarding positive or negative effects of suckling systems on prevalence of cryptosporidiosis, pneumonia, immunity and mortality in calves (Beaver et al., 2019).

Lastly, several of our NIPs mentioned that good monitoring and oversight of cows and calves can be a challenge in CCC systems. This was particularly emphasised for foster cows' conditions and calves' growth and health in whole-day foster cow rearing systems, where the foster groups are kept away from the main dairy herd in a separate barn and the personnel is less frequently around. Additionally, oestrus observation and problems with anoestrus of cows that suckle a calf were named as a challenge in CCC systems by several NIPs as well.

Resulting knowledge and resource gaps mentioned by the NIPs:

- Veterinarians who are familiar with CCC systems and can advise on specific CCC related health issues

Available or possible solutions:

In CCC systems, health checks in calves focus entirely on the appearance of the animals. This is because information on milk intake, which is available in artificial rearing, is not provided, and that calves in these systems typically have access to larger parts of the barn or even pastures, so that farmers often need to move actively among the animals [21] rather than standing beside the pen. However, sensor systems promise help in the future, and the Austrian NIP applied for a living lab that aims to develop an automatic scale for monitoring the weight of the calves continuously. Most of the existing guides (Table 5) address the health of the animals and provide assessment schemes as well as recommendations to keep the animals healthy. A good supply of colostrum is the first step – this is something that many farmers emphasise, and there is an additional video that goes into more detail on this topic [11].

Selection of suitable foster cows is a recurring topic. Some guides (Table 5) recommend using only healthy cows as foster cows. However, it is often reported that cows with high milk cell counts are used but one farmer explicitly advises against using cows infected with mastitis pathogens, highlighting the associated risks [28]. One way to achieve this is to ensure that existing infections are completely cured before the cow becomes a foster cow [22].

In order to minimise competition between calves for the foster cow's milk, it is important to ensure that they are not too far apart in age when they are grouped together. Seasonal calving is ideal for foster cow rearing systems [37]. To ensure the calves are healthy and fit when they go to the foster cow, a farmer recommends feeding them colostrum from a teat bucket and to monitor them for the first three to six days [36]. Another farmer believed that the alien calf must first drink milk from the foster cow for some time before it will smell like her and she will recognise it as her own [15]. To date, we have not found any scientific evidence that supports this claim.

[f] https://transformdairynet.eu/wp-content/uploads/2025/06/D3.3_Report_Regulations_final.pdf (accessed 09.07.2025, pg. 29)

To avoid teat injuries caused by excess strain, a foster cow should not be responsible for too many calves. For a calculation matrix of the number of calves that can be nursed by one cow see [14], page 18.

3.3.3.6. Farm personnel and large farm size

The available human resources at the farm can also be a barrier to the implementation of CCC systems. In general, the caretakers need to have specific training and/or more experience to look after calves in a CCC system compared to the common single housing with bucket feeding. In the latter, it can be easily seen how much milk the calf has drunk from the bucket or if there is diarrhoea on the floor of its pen, whereas in a CCC system the caretakers need to do a thorough animal observation and health checks. Also, calves in CCC systems can get different types of scours (infectious or nutritional) because they drink larger quantities of milk than calves that are fed in a more restricted way. Furthermore, milk intake can fluctuate depending on the cows' availability. Hence, caretakers need more experience and generally require a ‘good eye’ for the animals when working in a CCC system. In Romania and Greece, the shortage of trained caretakers is already a substantial problem for dairy farms with the artificial calf rearing system and on Romanian farms the staff is often employed for mixed work (e.g., animal care and harvesting crops). Hence, the workers are sometimes not particularly interested in engaging in animal work and would dislike the switch to a CCC system, since moving and separating cow and calves is hand work, which some employees do not particularly enjoy. From the German NIP, which has collectively many years of experience with CCC, it was mentioned that the farm personnel need to have a good amount of flexibility and creativity in their daily work in CCC systems to find individual solutions adapted to the different cow-calf pairs. Hence, the availability of farm personnel with an interest in running a CCC system and the knowledge to run it can be a substantial barrier for the successful adoption of CCC systems. As stated by the Greek NIP, this concern was particularly relevant for the larger farms. There, the farmers agreed that CCC systems may be more suitable for smaller herd sizes due to the time investment required, the number of personnel needed, and the availability of appropriate barn facilities. Looking at the literature, the perception that CCC systems are labour intensive seems, however, only to be partly correct. In the previously mentioned Norwegian survey, a higher workload was only mentioned in 4% of cases as a main reason to discontinue CCC, while the farmers who currently practised CCC report a decreased workload as a positive economic outcome of running a CCC system (Hansen et al., 2023).

Resulting knowledge and resource gaps mentioned by the NIPs:

- Availability of well-trained farm personnel
- Technical solutions for CCC barns that save labour and can be operated by one person or work automatically

Available or possible solutions:

Numerous videos feature farmers reporting how satisfied they are with their work after implementing CCC on their farms, e. g., [17, 32]. This should be investigated further and highlighted in recruitment advertising. In TDN, a living lab will address farmer satisfaction as a specific topic. However, another important issue is the training of future farmers. They are typically taught to raise calves artificially after early separation of cow and calf, using automatic feeders or feeding buckets, which means they cannot observe normal dam-calf behaviour on their training farms. Teaching materials on CCC systems should thus be developed specifically for each country, or existing materials [39] could be translated into the relevant languages as a first step.

3.3.3.7. Cow and calf behaviour (labour requirement)

Due to the close work with the animals in a CCC system, there are also some behaviours of cows and calves that were named as actual or potential challenges for the adoption of a CCC system. Regarding the foster cow rearing system, the main challenge named by those NIPs which are already practicing these systems (DEN, AUT, FRA) was the adoption phase. This period, which lasts on average 3–5 days, is often work intensive and sometimes there are foster cows that do not accept the calves at all. Finding methods to make the adoption phase easier for the animals are welcomed.

A further challenge in foster cow rearing systems named by the French NIP can be the age difference of the calves. If the gap between the younger and older foster calves becomes too wide the older calves can dominate the teats, with younger calves not getting an adequate share of the milk from the foster cow. To ensure a low age difference between the foster calves, it is often necessary to practise block calving, which can have its own challenges regarding the available space in the barn or a more uneven milk supply over the year. If the foster cows are not milked, there can be the additional challenge that the available milk yield of the foster cow and the number of the foster calves needs to fit together, which can also sometimes be a challenge for the farmers.

Regarding dam-rearing systems, there were mainly concerns about the maternal instinct of, in particular primiparous, cows and staff safety when interacting with cows and calves. This challenge was however mainly raised as a potential barrier by NIPs with little CCC experience, and less so by the experienced NIPs as an actual barrier. However, there is little experience with this in water buffalo systems and thus particularly in the CCC systems with water buffaloes, aggression of cows towards humans could become a relevant barrier, as mentioned by our Italian buffalo NIP.

Related to this, there were some concerns that keeping the calves together with the cow herd could pose a security risk for the calves. This entailed that calves could get injured by adult cows which show erratic behaviour when in oestrus or, for the buffalo farms, that calves could get run over in an event where the buffalo herd gets scared and starts running in a panic mode.

For dam-rearing and foster cow rearing systems, a frequently reported challenge by experienced NIPs regarding animal behaviour is also that the calves in CCC systems get shy or sometimes even scared by the presence of humans compared to artificially raised calves that are daily milk-fed by humans. This was especially highlighted for foster cow rearing systems with whole-day contact by the Austrian NIP, as this can become a problem for the health monitoring and necessary medical treatments of the calves. The higher necessary time investment by the staff to create a bond with the calves compared to the current artificial rearing system was also considered a barrier for the adoption of CCC systems by the Italian NIP.

With regard to calf behaviour, the Italian NIP for buffaloes raised the additional concern that, once weaned from the cows, the buffalo calves may start cross-sucking.

Lastly, there were some remarks that individual CCC cows sometimes do not want to enter the milking parlour or milking robot. The Norwegian-Swedish NIP raised the issue that primiparous CCC cows in particular enter the milking robot too rarely. Besides a lack of training, it was assumed that udder pressure is released through sucking, which might decrease the motivation of CCC cows to enter the robot compared to non-CCC cows.

Resulting knowledge and resource gaps mentioned by the NIPs:

- Guides about successful adoption practices in foster cow rearing systems
- There were no further knowledge and resource gaps mentioned by the NIPs but guidelines and best practices for CCC with milking robots or maintenance of a good human-animal relationship could be helpful

Available or possible solutions:

Foster cow rearing systems are still under discussion due to the continued separation of dam and calf, despite the calf being raised by a foster cow rather than through bucket feeding. However, foster cow rearing systems are often the first step towards a dam-calf contact system and guides (Table 5) as well as many videos (6.2.5) and fact sheets (e.g., [4]) that present and describe these systems are available online. However, many topics relate to both rearing by the dam and rearing by a foster cow, e.g., barn construction, milk yield, weaning. Therefore, these keywords have not been categorised specifically as relating to dam or foster cow rearing.

A frequently discussed topic is how to train the foster cow to accept the unfamiliar calves. This process often takes several days, and it is recommended that the cows and calves are kept separately during this time until the cows accept the calves. It is often suggested that cows are fixed in the feeding rack [1],[37] and offered concentrate feed when calves are guided to suckle. Nevertheless, many videos show that the familiarisation of foster cows and calves is often accompanied by agonistic behaviour of the cows, and it is repeatedly pointed out that a good foster cow is characterised by calm behaviour. Opinions differ greatly on whether first-lactating cows should be used as foster cows. Many farms rely on cows that have calved multiple times [2]. However, it would be useful to clearly summarise the various methods of familiarising calves with foster cows under different practical conditions, and also evaluate them from an animal welfare perspective.

Contact between humans and calves and cows need particular attention in foster cow rearing systems, as foster cows are often not milked. Intensive pasture management, as required by rotational grazing, ensures that the farmer has repeated contact with the animals during the day, which also ensures safe handling of the animals later on [37]. Recommendations for achieving a high-quality human-animal relationship are included in some guides for CCC (Table 5) and these will be used as a base to spread the information.

3.3.3.8. Governmental or other regulations potentially impeding CCC

A full report on regulatory requirements on the European and national level in the areas of animal welfare and housing, animal health, breeding, and food hygiene and safety that potentially affect the implementation and up-scaling of CCC systems in dairy production is available on the TDN website[g].

During the Innovation Wheel exercise, the French NIP listed the regulations for specially protected cheese types like Comté or Gruyère as partly challenging, since the requirements that the animals cannot be milked by a robot or once a day, make CCC systems with robots or once-a-day milking impossible for these producers.

[g] https://transformdairynet.eu/wp-content/uploads/2025/06/D3.3_Report_Regulations_final.pdf (accessed 09.07.2025)

According to the Danish regulations, only 70 litres of unpasteurized milk can be directly marketed per week. This was listed as a barrier by the Danish NIP, as direct marketing is often a good option for value creation of CCC products.

3.3.3.9. Calving area and colostrum management

In Italy, many dairy farms have no dedicated calving area, which was considered a general problem in Italian dairy farms. However, the Italian NIP raised the concern that this could become an additional challenge for successful implementation of CCC systems, since the lack of calving boxes limits the options to properly monitor cow and calf and to ensure that they form a bond.

The colostrum management after birth was also named as a potential challenge in CCC systems by the Italian and Norwegian-Swedish NIP, since it is harder to control the quality, quantity and right timing of the colostrum feeding of a calf when it suckles its dam than when the colostrum supply is done by bottle feeding after separation.

Available or possible solutions:

Best practices for adequate colostrum supply in CCC systems with supplementary bottle feeding have already been described, e.g. [3, 14, 38] and will be made available to a wider audience through TDN fact sheets.

3.3.3.10. Limited knowledge about CCC

Lastly, the limited knowledge about CCC systems was mentioned as a barrier across almost all NIPs. Within the countries that have limited to no experience with CCC systems, there were many general questions about CCC systems including:

- Where and how do to start? What is the right system for a given farm context?
- How is the milking done in CCC? For example, time and frequency, do cows accept machine milking?
- How is separation done in half-day systems with no danger to the staff?
- Do CCC cows and calves develop undesirable behaviour in the medium or long-term?
- What barn layout do you need? For example, should CCC cows be kept near the milking parlour? How can CCC be organized on farm?
- Is there a segment of consumers who are willing and able to purchase CCC products?

Questions that were shared by experienced and unexperienced NIPs and can be considered as general knowledge gaps entailed:

- How long should cow and calf be together before separation so that it has the best overall effect (for the animals and the farm)?
- Is this system really beneficial for the animals? What is the net welfare impact of CCC when positive welfare indicators and separation stress are weighed against each other?
- Is it problematic to always use the same cows as foster cows?
- How can the marketing be done for CCC systems to make it economically sustainable?

- What are the pros and cons of CCC regarding (bottom-line) economics?
- What are the sustainability impacts of CCC?
- Are there any nutritional or other health benefits of CCC products for humans?

Some of these questions will be addressed in the course of the TDN project, while others can be passed on to scientists, consultants and farmers through the TDN network to find the needed answers.

3.3.3.11. Summary

In summary, there is a broad range of barriers and challenges for the introduction of CCC systems on farms. The most frequently mentioned issues include potentially high costs of adapting existing barn infrastructure, impaired farm profitability due to the missing marketing options and/or public support schemes for CCC products, and limited knowledge on optimal weaning and separation procedures to make the system really animal-friendly. Aside from this, the general lack of knowledge and shortage of trained and motivated personnel present major challenges, especially in countries with limited CCC experience. Relevant resource gaps listed by the countries with more experience were a common European definition for CCC systems, standardized procedures for the official milk recording in CCC cows as well as software adaptations for milking robots used in CCC systems.

Despite the number of challenges, it must be emphasised positively that guidelines and recommendations already exist for many of the identified knowledge gaps. However, these are often unavailable in national languages, or are based on experiences under very specific regional conditions or farming situations. This means that they cannot always be directly applied in other contexts, but might nevertheless be used as a first orientation. It is crucial to translate and disseminate this existing knowledge to all stakeholders across the production chain, including consumers and the wider society. Some fundamental knowledge gaps have also emerged that need to be addressed by the scientific community.

3.3.4. Workshop on the minimum necessary CCC duration

As outlined above, there is a particular resource and information gap, namely that there is no clear definition and no common EU-standard for CCC systems. At the second TDN General Assembly meeting, which took place in Thessaloniki, Greece at Wednesday 21st May 2025 a one-hour workshop on the topic “How long should cows and calves stay together in CCC?” was carried out with the TDN consortium. The aim of this workshop was to discuss and summarise the arguments for and against different CCC durations. However, the TDN consortium did not intend to set any standards. The key results of this workshop are summarized here.

3.3.4.1. Discussed topic: What is the desirable duration that calf and dam should stay together in CCC?

Considering the question “What is **the desirable duration** that calf and dam should stay together in CCC systems?“, 11 out of 28 participants voted in favour of a desirable duration of 6-7 months (Figure 4). The arguments included a sufficient rumen development and reduced nutritional dependence of calves at that age, that separation it is less stressful also for the cows and that “animals are more ready at that time”. A participant mentioned that if there had

been the option for “no separation”, that would have been even more desirable. The potential risk of teat damage if calves are too large, considering the amount of milk that cows can produce nowadays that make calves grow faster than in previous times, was mentioned as a concern for a too late separation.

Seven out of the 28 participants voted for a desirable duration of contact of 3 months. Arguments in favour include, again, the risk of cows’ teats being hurt by fast-growing calves and that the high milk yield of cows nowadays would delay the transition of milk-feeding calves to ruminants. However, it was noted by another participant that there are farmers that wean the calves later than 3 months and do not report problems with teat damage and that cow-calf contact without suckling for more than 3 months should still be considered, which would also reduce separation stress. It was also mentioned that, although 3 months of contact was perceived as sufficient for most calves, there is individual variation. A participant raised the concern that if weaning started before 3 months, which can be the case if a slow weaning approach is used, it would be too early. Another argument against a 3-month duration of contact included experiences from farmers that reported that it is easier to separate dam and calf when they are older.

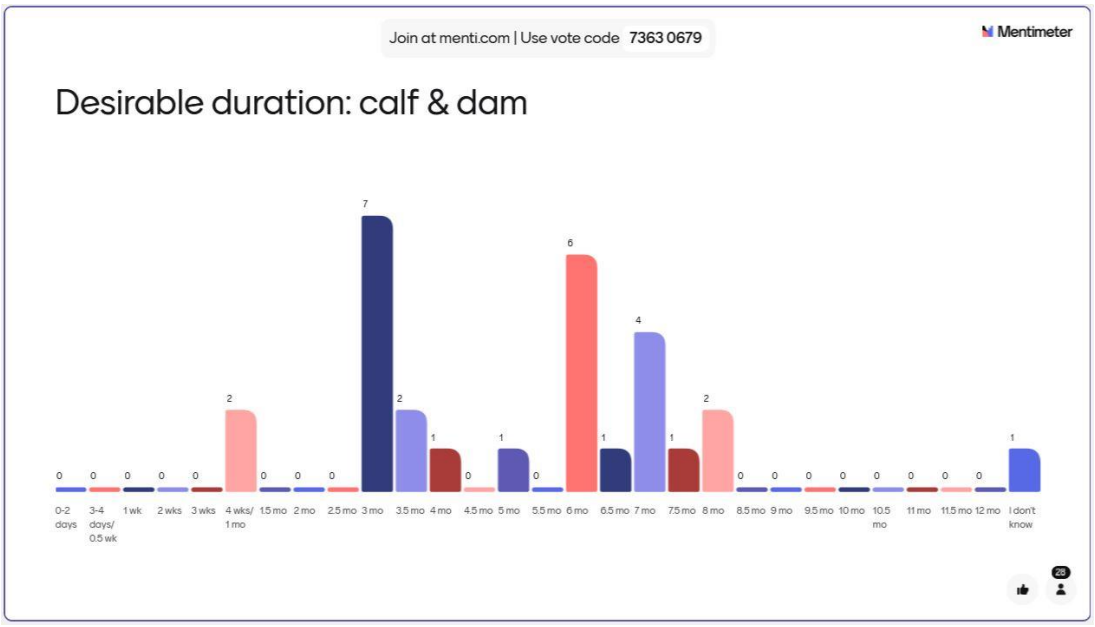

Figure 4. Distribution of votes for the question “What is **the desirable duration** that calf and dam should stay together in CCC systems?” posed to the participants of the TDN General Assembly in Thessaloniki, 2025

3.3.4.2. Discussed topic: What is the acceptable minimum duration that calf and dam should stay together in CCC?

Regarding the question “What is the **acceptable minimum duration** that calf and dam should stay together in CCC systems?”, 3 out of 28 participants voted in favour of 2 weeks (Figure 5). An argument was that this period at least takes into account the benefit for the calf of getting all milk ingredients from colostrum and post-colostrum milk,

compared to separation right after birth. Moreover, a participant mentioned that from experience in commercial systems, it “works” to separate cow and calf after 4 weeks, and then transfer calves to bucket-feeding; however, allowing for separation after 2 weeks would give room for farmers to consider special situations such as disease outbreaks, weaning in groups of different ages and allowing for individual weaning strategies for individual calves. Concerns regarding a minimum duration of 2 weeks included the consumer's perspective, who might consider it too short and unacceptable. Out of the 28 participants, 11 voted for an acceptable minimum duration of 3 months that calf and dam should stay together, considering similar arguments as stated above.

Some general points of discussion included that knowledge gaps must be filled. Moreover, a participant mentioned the importance of considering farmers’ needs, from economics and farm management to perceptions and attitudes, which may vary between countries. It was also highlighted that science alone might not be able to give all answers but that also the society’s and farmers’ views need to be considered as much as the animals needs to ensure implementation and acceptance. Moreover, it was perceived as challenging to only focus on the acceptable duration of contact, as also other important factors must be considered in the evaluation of a CCC system, for example the duration of daily contact and whether the contact occurs before or after milking. Likewise, it was noted that the minimum suitable CCC duration might be hard to standardize, as the individual development differs between calves and CCC farmers’ available resources.

The participants concluded that it is very important in the discussion about the minimum and desirable duration of CCC to clearly distinguish whether this refers to the time point when weaning starts, ends and whether contact without suckling shall be included evenly. It was also highlighted, that for most arguments raised, we do not have solid and persuasive data.

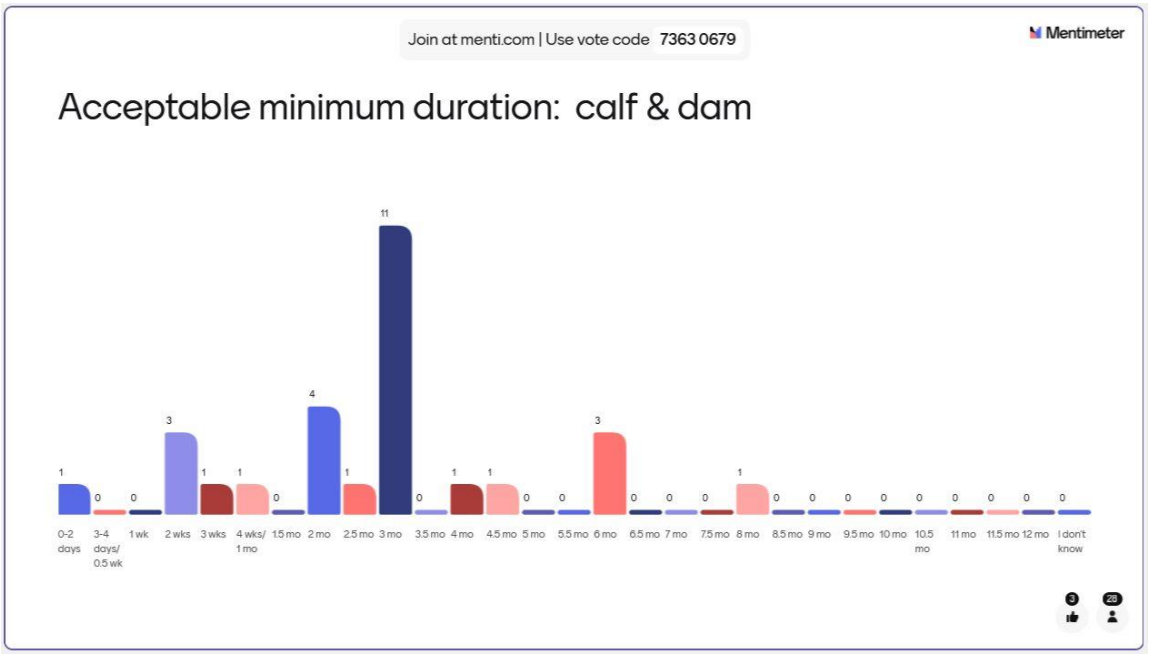

Figure 5. Distribution of votes for the question “What is **the acceptable minimum duration** that calf and dam should stay together in CCC systems?” posed to the participants of the TDN General Assembly in Thessaloniki, 2025

Unfortunately, due to time restrictions, it was not possible to discuss the same questions for a foster cow rearing system.

3.3.5. Best practices for CCC recommended by experienced TDN farmers

From the NIPs of those countries with longer CCC experience, farmers were asked to take part in a one- hour semi-structured group interview on best practices for a specific CCC-related topic. These recommendations are summarised below and will later be synthesised with results from the TDN survey as well as from the 'grey' literature and online sources to provide short fact sheets for farmers that attempt to fill some of the knowledge gaps outlined in the previous sections.

3.3.5.1. Recommendations for good health monitoring and pasture access (UK-Irish NIP)

Interview participant(s): 1 farmer, 6 years experience with a CCC system on pasture during the vegetation period with a herd of 120 cows

Recommendations for good monitoring of calves' health and milk ingestion, as well as prevention of calves becoming scared of humans:

- The human should be a part of the first meal of the calf. Help the calf to start suckling from the cow and then bottle feed it.
- Keep a routine to walk through the herd a couple of times every day. This way you will get the calves used to you, so that the calves know you are also part of the herd. Also, the more you look, the more you see, and it is easier to pick up on subtle changes.
- Good contact to the dams is important, since calves will copy the behaviour of the cows.
- A really good help for health monitoring of the calves is knowing the rough daily milk yield of each dam in the parlour. If the cow gives more milk than usually (i.e., the calf drank less), definitely go and check on the calf.

Recommendations on the prevention of disease transmission between cow and calf:

- Ensure that you have a really good colostrum management. Bottle feed or tube feed the calf 4 litres of colostrum within the first 24 hours **in addition** to the colostrum that the calf has suckled from the cow. Comply with best practices for colostrum feeding (e.g., defrosting colostrum below 40°C to ensure the antibodies are not destroyed).
- Ensure good cleanliness and hygiene of the barn! Have made very good experiences with steam cleaning the whole cow barn when cows are out on pasture (treat it as you would a conventional calf house, then you have very few problems).
- Have made good experiences with vaccination of cows against salmonella in the late gestation stage (plus additionally trying to keep the bird burden at the cow barn low).
- Take cows with a very high cell count that you cannot get under control out of the herd. Separate such cows with their calf from the rest of the herd until weaning and then cull her at the end of the year. This should also be done even if it seems hard because the cow is producing a lot of milk. Keeping such cows is very dangerous since you can never fully control calves that cross-suckle.

Recommendations for pasture access of calves together with the cows:

- Calves can go outside on pasture after 2–3 days spent with the dam in the calving box.
- The youngest calves can walk about ½ mile or 15–20 minutes. Thus, keep them close to the dairy shed to begin with.
- Shelter is recommended for (at least the youngest) calves out on pasture, especially when it is very hot or very wet. If calves are wet all the time, they do not grow so well.
- Recommendation to not use electric fencing for the pastures with calves. Better use a wooden fence or stone wall.
- There should be well spaced-out water troughs across the pasture at a height that the calves can reach.
- It can happen that a calf gets 'lost' outside of the fence of the pasture and then it can sometimes get tricky to find it. However, they experience that often when the cows hear the motorbike/quad coming, they go and pick up their calves (also the <1-week young calves), as they seem to know the routine when they are moving to another paddock (usually they graze one paddock for 5-7 days). If the herd goes back to same paddock, then the dam will point out the right direction where the calf is lying.
- In order to control the parasite load, the cow herd is sent to different parts of the farm each year in alternation. Additionally, grazing of the cows' pastures with sheep during the winter time helps to reduce the parasite load. A good colostrum management after the birth of the calves is also a key element in the prevention of parasitic diseases.
- Cows with calves on pasture can be harder to move. This can be for example due to the reduced udder pressure through the suckling or if you have to move cows and calves simply for unattractive purposes like nightly separation. For the latter, they have good experiences with using a feed trailer with alfalfa pellets to offer the cows a snack outside of the pasture to motivate them to move.

General recommendations:

- Aim to minimise stress at all times.
- Relax and let things happen. Give the system time to work and don't change more than one thing at a time.
- Make all changes slow and avoid making changes at critical times, e.g., at the start of service period.
- Offering a 'free snack' to the cows has proven to be helpful at the times when you want to make considerable changes.
- Make the weaning process slow.
- They have good experiences with the following weaning protocol:
    - They do a 2-months part-time contact phase followed by 1 week with nose flaps (Quiet wean®) at the end. They start part-time contact with nightly separation when the calf is 6-8 weeks old and do it until up to 3.5 months of age.
    - They keep the weaner calf groups together throughout the whole time, which helps calves to get used to the stability of the peer group and to eat enough forage on their own.
    - Ensure that cows and calves always have visual contact to each other during the 2 months part-time contact phase.
    - Afterwards the weaned calves always have an experienced 'trainer cow' with them that supports the calves in getting to know their new environment and routines.
- They have good experiences with a tandem milking parlour with their CCC system, since calves that accidentally enter the milking parlour have a side corridor where they can simply follow the next cow out.

3.3.5.2. Recommendations for weaning/separation and marketing options (German NIP)

Interview participant(s): Farmer A who practised a CCC system for 8 years with a herd of 25 cows, Farmer B later added comments who has 3 years CCC experience with 70 cows.

Recommendations for weaning and separation:

- The separation should not be done abruptly.
- Recommended separation methods were the weaning with nose flaps or a combination of using foster cows with a gradual weaning approach:
- Farmer A has good experiences with nose flaps (Quiet wean®)
    - Insert the nose flap when calves are 3–4 months old (depending on their growth).
    - The calf should keep the nose flap for 10–14 days[h], after which cow and calf are completely separated.
    - Control the calves 2x daily to ensure that they have not lost the nose flap and are fit and healthy.
- Farmer B has good experiences with the use of foster cows and a gradual weaning over 10 days
    - First, calves have 4 weeks whole-day contact with their dams, then they are switched to a group with foster cows and other foster calves with whole-day contact for another 3 months.
    - Weaner calves are separated from the foster cows when they are 4 months old over a period of 10 days. During this period, the younger calves stay with the foster cows with continued whole-day contact.
    - During the 10 days weaning phase, the weaner calves are first separated from the foster cows overnight. Each day, the time of separation is gradually increased until the weaner calves have only one hour of contact to their foster cows at the last day (day 10) of the weaning process.
    - It helps that the younger calves have often already emptied a part of the milk from the udder of the foster cows when the weaner calves re-join the group, so that the weaner calves have only access to low amounts of milk.
- Before and during the weaning process, calves should have an attractive calf creep with very good hay and something like crushed grain to stimulate the roughage intake and prevent weight loss of the calves. The creep should at best be shared by the younger calves and the weaner calves, allowing the younger calves copy the roughage feeding behaviour from the older calves.
- Introduction of new weaning methods should always be tested with only a few cow-calf pairs first to get a feeling for it. Do not change too much too quickly.

Recommendations for marketing of CCC calves:

- Own fattening of CCC calves on pasture and subsequent direct marketing at a higher price can often be successful if the farm has good direct marketing.
- Selling the approximately 3-month-old weaner CCC calves to a beef fattening farm that has direct marketing and also does landscape maintenance has become well established at Farm A.
- Marketing a part of the old and young animals as beef salami works well for Farmer A. The advantage is that the salami is a permanent product that does not need to be refrigerated. However, only small quantities can be sold in this way.

[h] Please be aware that scientific research only recommends using a nose flap for up to 4–5 days (Vogt et al., 2024)

- Farmer B has good experience with online marketing and postal shipping of his veal. The farm invests a lot into transparency and a good education of the consumer and experiences a good consumer demand in return.
- Farmer A tried marketing his CCC calves as veal together with other farms of his region, but the challenge was that the calves' carcasses, if they come from many farms with different breeds, have different characteristics. Due to the processors demand for uniform carcasses, as they are used to from beef cattle farms, this marketing option was unsuccessful and can only be established if non-uniform carcasses are accepted by the processors in the future.
- Farmer B finds his CCC system profitable as the calves only drink for 4 weeks at the dam and are then switched to a group with foster cows where they receive less milk. After the farm switched to the CCC system, they significantly reduced their time investment to look after sick calves and reduced costs for the veterinarian, as well as reduced working times due to no longer required mucking out and washing of calf igloos, feeding of calves and cleaning of buckets.
- In general, it is very problematic that there are currently no premiums for CCC milk from the dairy companies, as well as also no premiums for CCC meat products from the respective retailers. Also, there should be more funding from the EU for high welfare systems.

General recommendations:

- All changes should be made slowly and in small steps.
- The human is a key factor. You need to have good staff with an eye for the calves and the herd to do a CCC system.

3.3.5.3. Recommendations for integration of a milking robot (Norwegian-Swedish NIP)

Interview participant(s): 3 farmers, Farmer A with 12 years of CCC experience, the last 3 years CCC with one DeLaval robot with 30 cows. Farmer B with 7 years of CCC experience and 34 cows on a DeLaval robot. Farmer C with 35 years of CCC experience, for the last 4 years with 45 cows on a DeLaval robot.

Recommendations for the type of milking robot:

- A DeLaval milking robot is recommended for CCC systems. All 3 farmers are very satisfied with it and say it works well with CCC in the standard form and no special update for CCC is needed. Other farmers who practise CCC with a Lely robot seem to have more problems with it.
- In case the calf suckled a quarter before the cow is milked, the DeLaval robot gives a note that the 'milking is incomplete' in the particular quarter, but otherwise milks normally. The suckled quarters vary each time, so there seem to be no particular quarters that the calves prefer.
- There is no option to programme the robot to only take part of the milk during a milking and leave the rest for the calf which could be a helpful update for CCC. However, you can programme the robot to only milk, e.g., three of the four quarters.
- The CCC cows have a higher milk yield than the robot registers. Hence, you have to manually adjust the concentrate amount that is fed to the CCC cows for the additional milk that is drunk by the calf.

Recommendations for the milking management:

- It is advised to start milking the cow straight away from the first day of calving so that she gets used to the additional machine milking. In the first two days you should milk the cow using a bucket milking machine in the

calving pen, since the cows are vulnerable after calving and additionally give more milk when they can stay with the calf as they are more relaxed. It is general best practice to do the first two milkings into a bucket and not in the robot, since a good proportion of the valuable colostrum will disappear into the lengths of the pipework of the robot. After the two days the cow should go through the milking robot.

- In order to get first calvers used to the robot, it is advised to habituate the cows to the robot about 3 weeks before calving and feed them concentrate there.
- It can be a good option to separate the CCC cows from the rest of the milking herd into a separate area (=VIP). This makes access of the younger cows to the robot easier, as there can be problems that the first calvers, which are usually low ranked, avoid the robot if the higher ranked animals obstruct the passage to it.
- Milk ejection problems in the robot are an issue with CCC, often with the younger cows. In order to prevent this, it is important to move the younger cows often through the robot before calving so they get used to it. It is advised to create a routine, be calm and make cows feel safe and relaxed in the robot. When milk ejection problems happen, stay calm and send the cow through the robot again. If nothing helps, there is an option to give an oxytocin injection to provoke the milk let down[i].
- A good option to deal with milk ejection problems is the use of a half-day contact system. With this practice, the cows usually let down all their milk in the robot at least during the one milking after the long separation.
- Calves accidentally entering the robot is reported not to be an issue and only happen very rarely.
- Once the calves are separated from the cows it usually takes 2-3 days until the cows have adapted to the new situation and give the full milk yield in the robot. Also, here the caretakers should stay calm and give the animals their time.

Recommendations to motivate the cows to enter the robot if kept with calves:

- When cows and calves are kept together at pasture and the cows do not return to the milking robot (as the calf has released the udder pressure), it helps to only offer the cows water in the shed so that they return for the water. They usually go through the milking robot then as well.
- Additionally, or alternatively, the cows can be fed silage in the barn so that the cows return to the shed for the silage and go through the milking robot. In case of a half-day contact system, farmer A reported that it works well to motivate the herd with the silage to return to the shed and then the nightly separation can be done easily.
- If the cows receive their concentrate feed only in the robot, this also makes the return attractive.
- Nonetheless, it can often be a problem that the first calvers enter the milking robot too rarely or not at all and that it is work intensive to manually push them through it. A possible option could be to practise CCC only up from the second calving, but this has not yet been tested.

3.3.5.4. Recommendations for foster cow rearing systems (Austrian NIP)

Interview participant(s): One farmer couple, herd size 90 cows with a milking robot, practises a foster cow rearing system for 2 years with all calves, beforehand the foster cow rearing system was only used periodically.

Recommendations for the selection of foster cows:

[i] Please be aware that oxytocin should not be used regularly, as the cows may become accustomed to it (Bruckmaier, 2003).

- Use older animals with a calm temperament. First calvers are usually not good foster cows. Especially for the foster group with the youngest calves, the cow should be calm and well-behaved.
- Cows that have been fosters in the past are also a good option as due to their experience they are usually calmer.
- The udder of the foster cow should not be too low and the teats should not point inwards (towards each other), since both will make suckling more difficult for the (young) calves.
- The interviewed farmer normally uses cows up from 150 DIM as foster cows, which have lower milk yields and not so high udder pressure anymore. Only 30% of their foster cows become fosters straight up from calving, the other 70% join the milking herd first and then become fosters after 150 DIM. They report that this does not make a big difference for acceptance of the foster calves, but that the acceptance depends much more on individual differences than on the time point when they become fosters.
- If you have such a mixed system with early and late lactating foster cows avoid putting them together into one foster group to make the feeding of the cows easier.
- The number of calves that can be partnered with a foster cow depends on the individual milk yield. Cows with higher milk yield that become fosters straight after calving can take 3–4 calves, whereas the cows that become fosters in the late lactation have usually only 1–2 foster calves. They usually calculate about 10 liters of milk per calf.
- The age difference between the younger calves should not be more than 10–14 days so that the younger calves do not have to compete for the milk. If the age difference is > 4 weeks between the calves, the younger calves usually have substantial problems to receive enough milk.

Recommendations for the transfer of the calves to the foster cows:

- The farm has good experiences with the following protocol:
    - The calves stay with their dams for about 2–3 days. At the last day together (day 2 or 3), the dam and calf do not have whole-day contact, but only contact in the morning and evening. At the same time (day 2 or 3) the foster cow is put into the foster calves' pen, so that they can already get to know each other. From day 3–4 the calves stay completely with the foster cow and the dam is moved to the milking herd.
    - The dam should still be able to have some tactile and visual contact to her calf after the calf is fully transferred to the foster cow. This can be done by having the foster group pen (with the youngest calves) next to the milking robot, so that the dams can have nose to nose contact with their calves through the gate at the milking robot. It is reported that this has the positive side effect of encouraging the dams to come to the milking robot (since there is the only opportunity to still have contact to the calf) and at the same time making the separation less stressful for the dams.
    - After 2–3 weeks the calves are then moved to another foster group in a separated building (away from the milking herd). In this regard, they have made the experience that if the foster cow stays in the same place and the foster calves change the pens there are usually little problems, while there is a stronger behavioural reaction if the foster cow has to change buildings. It is also observed that once the foster cow has nursed several other calves in addition to her own one, the cow does not seem to have a stronger bond to her own calf or treat it differently than the others, so that the calves can be easily swapped between groups.
- Ensure a good monitoring of the foster group for the first 2–3 days together. Check that the calf is suckling well from the foster cow (check that the udder is empty and the calves' bellies are full). If a calf does not suckle well from the foster cow, push it back onto the foster cow and support it with the suckling.
- If the calves do not want to suckle the foster cow (happens rarely), it is recommended to put the dam into the foster group pen and let the calf start suckling its dam and then transfer it quickly onto the foster cow, once the suckling reflex is established.
- If the foster cow does not want to let the calf suckle, hold the back legs together with a hobble to prevent that the cow is kicking the calves and the calves become frightened of the cow.

- From experience, hobbles can be needed up to 1 week but then the foster cows usually accept the calves. However, when the foster calves get afraid of the cow and do not want to suckle her anymore, the foster cow should be replaced (e.g., switch the foster cow from the group with the youngest foster calves with a foster cow of a group with older foster calves, as the older calves can usually deal with more problematic cows).
- First time calvers should be separated from their calves immediately after birth and calves put immediately with the foster cow (without 2–3 days of contact) to reduce problems with the milking robot. This has also the advantage that all foster cows know the robot and can be put through the robot in case that the foster calves drink too little in the beginning and the foster cows need to be put additionally into the robot for a short time.

Recommendations for monitoring the foster calves' milk intake:

- In order to monitor the milk intake of the calves, one should control the udders of the cows daily. If they are always empty than the cow likely has too little milk for the calves, if the udder is always full and you see milk dripping from the udder, she likely has too much milk for the number of calves.
- Control the paralumbar fossa behind the last rib of the calves, if they had enough milk.
- You can additionally check if the calves show the suckling reflex at your finger to check if they are hungry and did not receive enough milk.
- Regular weighting of the calves to monitor their weight gains is advised.
- A high monitoring frequency is advised within the first 2–3 weeks of the calves' lives, after that the calves are usually fit enough to take what they need, so then a less frequent monitoring frequency is sufficient.

Recommendations for the weaning process of the calves from the foster cow:

- Wean the calf at the age of ~4 months over a period of 2–4 weeks.
- They have made good experiences with the following protocols:
    - Establish a separate group of 2–3 weaner calves of about the same age with one foster cow, which has only a low milk yield of maximum 15 liters.
    - Do not feed the cow any energy dense food, so that her milk yield will decrease additionally.
    - Then after 3–4 weeks wean the calves abruptly at the selected day according to the lunar calendar[j].
    - Alternatively, the calves can remain in the larger foster cow group and be weaned with a nose flap over a period of one week, before the calves are taken out of the foster group.

General recommendations:

- Foster cow rearing systems require a high amount of space. If there is not enough space, it is hard to implement the system successfully. This should be taken into account and planned for from the beginning. For this, consultants for foster cow rearing systems would be helpful, but they often do not exist.
- Be patient if the system does not work straight from the beginning.
- It is recommendable to feed the calf in the first 2–3 days after calving additionally with a bucket and have a bucket with electrolyte solution in all of the foster calves' pens. This way they know the bucket as well and it is easier to treat the calves if they get sick and easier to sell the calves to non-CCC farms with bucket rearing.

[j] Please note that there are currently no scientific studies on the effect of weaning according to specific moon phases.

4. Discussion

One of TDN's objectives is to present the current state of knowledge and existing knowledge gaps on CCC in research and dairy farming practice. This report focuses on practical knowledge. A more comprehensive analysis of the available scientific literature will be published at a later date, but some initial findings are included here. Practical knowledge was gathered from ‘grey’ literature, project reports, websites and YouTube videos. Guides which introduce farmers and other interested parties to the topic of CCC, and present and explain a variety of farms with different implementations of CCC, have been found.

In recent years, there has been an increase in sources of practical knowledge related to CCC, similar to the growth seen in scientific literature. Unfortunately, it is not always possible to determine whether these are based on own surveys or have simply been compiled from other sources. However, it is certain that public funding of practical research projects at the EU and state levels has contributed significantly to this increase, as well as to ensuring the quality of the knowledge disseminated. Projects in the form of European Innovation Partnerships (EIPs) stand out in particular. This is undoubtedly due to the development of CCC based on practical dairy farming. In addition to existing scientific interest, it was – and still is – innovative farmers who pioneered CCC systems on their farms, developed them further and presented them to the public. This certainly explains why all the existing guides were developed in collaboration with working farms and have clear practical relevance.

Including NNFs and NIPs in this knowledge-gathering process has highlighted areas where existing knowledge still needs to be shared, but it has also revealed gaps that need to be addressed. These gaps exist in research, the practical implementation of knowledge on farms and throughout the value chain, and even in the definition of terms. However, the following four main topics could generally be identified: (1) Infrastructure, (2) Personnel, (3) Economy and (4) Animal Welfare.

In terms of **infrastructure**, there are a few examples to follow, most of which are based on existing farms. Very few barns have been built specifically for CCC. What is still lacking is a comprehensive assessment of these adjustments or new barns in terms of work efficiency, human welfare and animal welfare. The same applies to the equipment used in the barn. Looking to the future, it is crucial that the design of barns and the development of technologies, such as milking robots, take CCC into account. Although monitoring technologies such as sensors and video systems, are advancing rapidly, current systems are often designed for artificial calf rearing. These methods are not fully effective in CCC systems, so new monitoring approaches will be needed.

Many farmers have rediscovered their enjoyment of work by raising calves alongside their dams. However, it is mostly pioneers who dare to do what their predecessors would have rejected, and what often neither new nor experienced farm **personnel** would willingly do. This may be due to a lack of experience and not feeling well equipped to run a CCC system or because the new approach, whereby animals are allowed to act more independently, is unfamiliar to many farmers and employees. As demonstrated in some projects, the 'stable schools' tool is useful here, as it enables knowledge to be transferred directly between farmers. However, this alone will not suffice, as the entire environment – trainers, advisors, veterinarians, etc.– usually has no experience with CCC. Most guides and project reports are

aimed directly at farmers, with very little material designed specifically for other stakeholders. These are genuine gaps that may need to be filled to raise awareness of, and encourage acceptance of CCC as a calf rearing method.

A significant proportion of the reviewed material demonstrates that **economics** constitutes the core element for a broader dissemination of CCC systems. Despite the fact that a significant number of farmers have adopted CCC in response to a desire to enhance animal welfare, which includes improving animal health, the economic challenge is always mentioned. This consists of investing significantly more milk in calf rearing than is the case with artificial rearing, and thus having considerably less milk available for marketing, either directly or to a dairy. It is essential to emphasise that in artificial rearing systems, calves are frequently underfed due to economic constraints. This results in a consistent failure to meet their physiological and nutritional requirements, often leading to compromised animal welfare. The higher milk intake observed under CCC should therefore not be misinterpreted as overfeeding. There is some assistance available in form of guides and an app to help farmers assess their own economic situation on their farms a little better, but a review of the scientific literature reveals that there are hardly any publications on the economic implications of CCC systems. In particular, any potential long-term positive economic effects of CCC on dairy farms have not yet been thoroughly investigated or demonstrated in practice.

In addition, there are hardly any studies that examine the potential demand for products from dairy farms that allow CCC. This may also be the reason why, apart from Norway (see SUCCEED project), there are no clear indications that larger milk processors are interested in more farms with CCC. In this context, it is also noteworthy that there are still no clear definitions of what should be classified as CCC, nor if rearing calves with a foster cow should be considered an equivalent approach. And thus, an apparent conflict of objectives also emerges: Farmers should be given as much freedom as possible to design their own CCC systems, while certain standards must be met to ensure long-term acceptance by consumers and society.

And since CCC is promoted by farmers as an animal welfare-oriented method of rearing calves, any standards developed for CCC system must also be based on actual animal **welfare** outcomes. Most scientific articles on CCC focus precisely on this aspect, but so far, they have not provided sufficient answers to the key questions that are so relevant for the further development of this rearing method:

- How long should the calf have contact with its own dam or a foster cow?
- When and how is weaning and separation best achieved?
- And what about the animal welfare in foster cow rearing systems?

The challenges posed by such specifications were made abundantly clear at the workshop held during the TDN's General Assembly in Thessaloniki.

5. Conclusions

A review of the available information on CCC, combined with insights from discussions among TDN participants, has revealed that a substantial body of practical and scientific knowledge exists. However, this knowledge needs to be disseminated more widely and adapted to the specific conditions in different countries, regions and farm types. At the same time, significant knowledge gaps remain, particularly in areas such as system design, implementation practices and standards. Addressing these gaps is essential to support a broader and sustainable transition of the sector towards this form of calf rearing.

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Lidfors, L. and C. Berg (2004): **Kor och kalvar tillsammans. - praktiska möjligheter att låta kalvarna dia inom modern mjölkproduktion** (Cows and calves together – practical possibilities for allowing calves to suckle in modern milk production). Uppsala: Sveriges lantbruksuniv (Rapport / MAT 21, 2004:5).

Scheidegger, E., Augsburger, C. and C. Buchli. 2025. **Vermarktung von Produkten aus Mutter-Kalb-Haltung.** (Marketing of products from dam-calf contact rearing). Leitpapier. Eds. Verein Cowpassion, KAGfreiland, Fachstelle MuKa, Förderverein Mutter-Kalb-Haltung. https://www.mu-ka.ch/wp-content/uploads/2025/04/Leitpapier_Vermarktung-von-MuKa-Produkten-def.pdf

Spengler Neff, A., Schneider, C., Ivemeyer, S. 2023. **Mutter- und ammengebundene Kälberaufzucht in der Milchviehhaltung - Haltungssysteme für eine artgerechte Aufzucht.** Ed. FiBL, Demeter Schweiz, Bio Suisse, Demeter e.V., Bioland e.V., Naturland e.V., IBLA Luxemburg, Merkblatt Nr. 1575, DOI: 10.5281/zenodo.8139050, https://www.fibl.org/de/shop/1575-muttergebundene-kaelberaufzucht

*English (**Mother-bonded and Fostered Calf Rearing in Dairy Farming**), French (**Élevage des veaux sous la mère ou avec une nourrice en production laitière**), Italian (**Allattamento naturale dei vitelli con la madre o una balia negli allevamenti di bovini da latte**), Polish version (**Odchów cieląt przy matkach i krowach mamkach w ekologicznym stadzie bydła mlecznego**), all versions: https://www.fibl.org/de/shop*

Spengler-Neff, A., Lerch, M. and C. Schneider. 2021. **Artgerechte Kälbermast und Aufzucht von Mastremonten.** (Species-appropriate veal production). Ed. FiBL, Merkblatt Nr. 1019, https://www.fibl.org/de/shop/1019-kaelbermast

Vaarst, M. and I. A. Christiansen. 2020. **KØER MED KALVE**. (Cows with calves) Ed. Innovationscenter for Økologisk Landbrug (ICOEL). https://icoel.dk/media/4ncnrmtj/ko_kalv_katalog_2020_reduceret-stoerrelse.pdf

Wagenaar, J. P. and J. Langhout. 2006. **Rearing calves with cows - nature works!** Ed. Louis Bolk Instituut. The Netherlands

Waiblinger, S. and S. Kirchweger. 2025. **Kuhgebundene Kälberaufzucht mit Weidehaltung**. (Cow-bonded calf rearing with grazing) Ed. BIO AUSTRIA Bundesverband.https://www.vetmeduni.ac.at/fileadmin/v/tierhaltung/eip-agri-bio-austria-kuhgebundene-kalberaufzucht-2025.pdf

6.2.2. Project websites

A wide variety of information, videos, fact sheets and other materials are often available on the project websites. To keep this report concise, we limited the selection to listing the projects. Please visit their websites for more material.

Last access: 30.07.2025

Title (in original language)	Link	Cow, Calf Health	Colostrum	Weaning, Separation	Milking	Foster System	Human-Animal-Relationsh.	Barn, Equipment	Grazing	Economy, Marketing
Better decision support in ccc-systems (Bedre beslutningsstøtte i ko-kalv-systemer)	https://icoel.dk/om-os/projekter/nextgenerationeu/2024/bedre-beslutningsstoette-i-ko-kalv-systemer/					x		x		
Calf rearing with cow contact : natural, healthy and feasible (Kälberaufzucht an der Kuh: natürlich, gesund und praktikabel)	https://www.thuenen.de/de/fachinstitute/oekologischer-landbau/arbeitsgruppen/arbeitsgruppe-rind/kaelberaufzucht-an-der-kuh-natuerlich-gesund-und-praktikabel	x		x		x	x	x	x	
Can dairy cows have the best of both worlds – positive emotional states rearing their calf and subsequent stress-less separation?	https://anivet.au.dk/en/research/projects/can-dairy-cows-have-the-best-of-both-worlds-positive-emotional-states-rearing-their-calf-and-subsequent-stress-less-separation			x						
Cow and Calf in Contact (Kuh und Kalb im Kontakt)	https://www.thuenen.de/de/fachinstitute/oekologischer-landbau/arbeitsgruppen/arbeitsgruppe-rind/kuh-und-kalb-in-kontakt	x		x	x					
Cow'n'calf: Mother-bonded calf rearing in organic dairy herds	https://pure.au.dk/portal/en/projects/cowncalf-mother-	x		x				x		

Title (in original language)	Link	Cow, Calf Health	Colostrum	Weaning, Separation	Milking	Foster System	Human-Animal-Relationsh.	Barn, Equipment	Grazing	Economy, Marketing
	bonded-calf-rearing-in-organic-dairy-herds/									
Cow-bonded calf rearing on dairy farms in southern Germany – development of indicators for assessing animal welfare and milk yields (Kuhgebundene Kälberaufzucht auf Milchviehbetrieben in Süddeutschland - Entwicklungen von Indikatoren zur Bewertung von Tierwohl und Milchmengen, KuKIndiTM)	https://www.hswt.de/forschung/projekt/2177-kukinditm	x			x					
Cow-calf contact in dairy systems: Impacts on production, animal health, farm economics & the environment	https://www.wur.nl/en/project/cow-calf-contact-in-dairy-systems-impacts-on-production-animal-health-farm-economics-the-environment.html			x	x			x		x
Cow-calf contact systems in Irish dairying	https://teagasc.ie/news--events/daily/cow-calf-contact-systems-in-irish-dairying/	x							x	x
COwLEARNING for sustainable beef and milk supply (COwLEARNING - für nachhaltige Rindfleisch- und Milchversorgung)	https://cowlearning.boku.ac.at/	x				x	x		x	x
Ecological responsibility for cows with calves (Økologisk ansvar for ko med kalv)	https://icoel.dk/om-os/projekter/maelkeafgiftsfonden/2021/oekologisk-ansvar-for-ko-med-kalv/	x		x	x				x	
GrazyDaiSy - Dairy cattle meet their natural needs through grazing, dam-rearing and health support	https://projects.au.dk/coreorganiccofund/core-organic-cofund-projects/grazydaisy/					x			x	
Improving the value of organic dairy calves. (VALOV'BIO Améliorer la valorisation des veaux laitiers en bio)	https://www.fibl.org/fr/sujets/project-base-donnees/projet-item/project/2989									x
InnoRind - Cattle Innovation Network – sustainable cattle farming in Germany (Innovationsnetzwerk Rind – Teilprojekte zur muttergebundenen Kälberaufzucht,	https://www.thuenen.de/de/fachinstitute/oekologischer-landbau/projekte/rinderhaltung-1/innovationsnetzwerk-	x	x	x	x			x		

Title (in original language)	Link	Cow, Calf Health	Colostrum	Weaning, Separation	Milking	Foster System	Human-Animal-Relationsh.	Barn, Equipment	Grazing	Economy, Marketing
Weidemast von Ochsen und Tierwohlplanung)	rind-teilprojekte-zur-muttergebundenen-kaelberaufzucht-weidemast-von-ochsen-und-tierwohlplanung									
Milk & Calf – Marketing of products from dairy farms practicing cow-calf-contact (Milk & Calf - Vermarktung von Produktion aus kuhgebundener Haltung)	https://www.thuenen.de/de/fachinstitute/oekologischer-landbau/projekte/rinderhaltung-1/milk-calf-vermarktung-von-produktion-aus-kuhgebundener-haltung									x
More time with the mother - better for the calf? (Mehr Zeit bei der Mutter, besser für das Kalb?)	https://www.thuenen.de/de/fachinstitute/oekologischer-landbau/projekte/rinderhaltung-1/mehr-zeit-bei-der-mutter-besser-fuer-das-kalb	x			x		x	x		
Pasture-Innovations (WEIDE-INNOVATIONEN – Neue Wege in der Weidehaltung unter schwierigen Bedingungen)	https://www.bio-austria.at/projekt-eip-weide-innovationen/	x	x	x		x	x	x	x	x
ProYoungStock - ProYoungStock	https://proyoungstock.net	x	x	x		x			x	x
SmartCalfCare - For cows, calves, you, and me (SmartCalfCare - For ku, kalv, deg og meg)	https://www.vetinst.no/forskning-innovasjon/tidligere-forskningsprosjekter/smartcalfcare-for-ku-kalv-deg-og-meg	x		x				x		
Study and promotion of practices for rearing young dairy cattle, sheep and goats with adults (Étude et promotion des pratiques d'élevage des jeunes bovins, ovins et caprins laitiers avec des adultes)	https://www.fibl.org/fr/sujets/project-base-donnees/projet-item/project/2337	x				x				x
SUCCEED Sustainable systems with cow-calf-contact for higher welfare in dairy production	https://www.vetinst.no/en/research-and-innovation/past-research-projects/sustainable-systems-with-cow-calf-	x		x	x			x		x

Title (in original language)	Link	Cow, Calf Health	Colostrum	Weaning, Separation	Milking	Foster System	Human-Animal-Relationsh.	Barn, Equipment	Grazing	Economy, Marketing
	contact-for-higher-welfare-in-dairy-production									
TWO IS BETTER - Pre-weaning calves with their mother and in groups (TWO IS BETTER – Vitelli pre-svezzamento con la madre e in gruppo)	https://www.fondazionecrpa.it/prodotto/two-is-better/	x								x
ValueCalf (WertKalb)	https://oekolandbauforschung-bw.uni-hohenheim.de/wertkalb								x	x

6.2.3. Webinars, Podcasts

Please note : Webinars and podcasts often cover the entire range of topics related to CCC. The fact that not every area has been ticked off here does not mean that these topics are not addressed.

Last access : 30.07.2025

Title (in original language)	Link	Cow, Calf Health	Colostrum	Weaning, Separation	Milking	Foster System	Human-Animal-Relationsh.	Barn, Equipment	Grazing	Economy, Marketing
Raising calves on an organic farm—which method is right for me? (Kälberaufzucht auf dem Biobetrieb - welche Methode passt zu mir?)	https://www.youtube.com/watch?v=tmoM64EL-V0	x	x	x		x				
Economic aspects of cow-based calf rearing and fattening (5 Ökonomische Aspekte der kuhgebundenen Kälberaufzucht und Mast)	https://youtu.be/XJ1i5b5aZaY?si=e8kM02l6a7k-X2_g									x
The natural behavior of cows and calves and systems of cow-bonded rearing (Das natürliche Verhalten von Kuh und Kalb und Systeme der kuhgebundenen Aufzucht)	https://www.youtube.com/watch?v=tpE0C7SnI2w&list=PLx-WRvZ7tnwxeXY3LsM0S8LkmFSQEqi2L&index=4	x	x							

Title (in original language)	Link	Cow, Calf Health	Colostrum	Weaning, Separation	Milking	Foster System	Human-Animal-Relationsh.	Barn, Equipment	Grazing	Economy, Marketing
Stable construction for cow-bonded rearing (Stallbauliche Umsetzung der kuhgebundenen Aufzucht)	https://www.youtube.com/watch?v=ScQ2IxXnByU&list=PLx-WRvZ7tnwxeXY3LsM0S8LkmFSQEqi2L							x		
Rethinking the rearing of dairy calves to re-establish the mother-calf bond: A cross-sectional study of the rearing of calves under the mother's care and that of foster cows (Repenser l'élevage des veaux laitiers pour rétablir le lien mère-jeune: Étude croisée de l'élevage de veaux sous la mère et de celui sous vaches nourrices)	https://www.youtube.com/watch?v=ErFTEYQd2LE&list=PLJGHaoiN0RENIdTNypZcnTz-Pqfw9DVLD	x		x		x			x	
17th Symposium – Udder or bucket? Is cow-based calf rearing sustainable? (17. Fachtagung - Euter oder Eimer? Ist die kuhgebundene Kälberaufzucht zukunftsfähig?)	https://www.youtube.com/watch?v=8mtYY2Vt3qw	x	x	x	x	x		x	x	x
The science around cow and calf mothering	https://www.youtube.com/watch?v=IKpxcZ23GjM&t=807s	x		x						x
Examining Dairy Cow-Calf Contact	https://www.youtube.com/watch?v=NSyjBqfFxc8	x		x	x			x		x
Cow and calf (Genopodden ep. 28 – Ku og kalv)	https://www.youtube.com/watch?v=ixT8EeuymKU									
Rethinking dairy calf rearing to restore the mother-calf bond (Repenser l'élevage des veaux laitiers pour rétablir le lien mère-jeune)	https://www.youtube.com/watch?v=ErFTEYQd2LE&list=PLJGHaoiN0RENIdTNypZcnTz-Pqfw9DVLD&index=7	x		x	x	x		x	x	x
RefWel webinar calf rearing - Cow-calf contact - Cow-calf separation (RefWel webinar kalveropfok - Koe-kalfcontact - Koe-kalf scheiding)	https://www.youtube.com/watch?v=1nMx92icfiE	x		x						
Cows, calves & quality time - Ecotrip - on a journey through organic farming (Ko, kalv & kvalitetstid - Økotrip - på tur i økologien)	https://www.buzzsprout.com/2112552/episodes/12170014	x		x						x

6.2.4. Fact sheets

Many fact sheets are also available on websites of projects. Therefore, please see also section 6.2.2.
Last access: 30.07.2025

Bareille, N. Brunet, L., Constancis, C. and F. Hellec. 2021. **Nurse cow dairy system to promote calf health and welfare**. Eds. UMR BIOEPAR & UR ASTER, INRAE, France, https://orgprints.org/id/eprint/42832/1/CORE_Organic_practice_abstract_GrazyDaiSy_Nurse%20cows.pdf

Barth, K., Placzek, M. and I. B. Christoph-Schulz. 2021. **More than a niche: Products from cow-calf contact systems**. Ed. Thünen Institute, Germany https://doi.org/10.3220/PB1615976246000

Buchli, C. 2025. **MuKa-Fact-Sheet-2025. Die häufigsten Aussagen und Annahmen rund um die Mutter-Kalb-Haltung/Muttergebundenen Kälberaufzucht (MuKa) beleuchtet und erläutert** (in English: The most common statements and assumptions about mother-calf husbandry/mother-bonded calf rearing (MuKa) are examined and explained). https://www.mu-ka.ch/wp-content/uploads/2025/02/MuKa-Fact-Sheet-2025.pdf

Buchli, C., Augsburger, C., Rombach, M. and M. Heuel. 2023. **Muttergebundene Haltung von Kälbern auf Milchviehbetrieben**. (in English : Mother-bonded rearing of calves on dairy farms.) Ed. Agridea (4400), Switzerland https://www.mu-ka.ch/wp-content/uploads/2024/07/4400_4_D.pdf

Christiansen, I. A. and K. F. Jørgensen. 2024.**Gode-raade-om-bonding-af-kalve-til-ammetanter**. (in English: Good advice on bonding calves to foster mothers.) Ed. GrOBEat Grass-fed Organic Beef for Sustainable Eating. https://orgprints.org/45728/1/gode-raade-om-bonding-af-kalve-til-ammetanter.pdf

International Dairy Federation (IDF): Factsheet of the IDF N° 38. 2024. Management of calves from birth to weaning: Rearing of calves by dam-calf contact. https://shop.fil-idf.org/products/factsheet-of-the-idf-n-38-2024-management-of-calves-from-birth-to-weaning-rearing-of-calves-by-dam-calf-contact.

Ivemeyer, S. 2025. **Kälberaufzucht im Biomilchviehbetrieb – kuhgebunden oder per Eimertränke**. (in English : Calf rearing on organic dairy farms – suckler system or bucket feeding.) https://www.oekolandbau.de/forschung/boel-forschungsergebnisse/forschungsbereich-tierhaltung/kaelberaufzucht-im-biomilchviehbetrieb-kuhgebunden-oder-per-eimertraenke/

Mulle, C. and V. Gerritsen. 2024.**Begriffsdefinition der mutter- und ammengebundenen Kälberaufzucht** (MAGKA). Kurzgutachten, 03.05.2024. (in English: Definition of the term 'mother- and foster-reared calves': Short expert opinion) https://www.tierimrecht.org/documents/8359/2024-05-06_Begriffsdefinition_MAGKA_Kurzgutachten.pdf

Schneider, C., Bieber, A., Spengler Neff, A. and S. Ivemeyer. 2021. **Separation and weaning of calves reared in cow-calf contact systems**. Ed. FiBL Research Institute of Organic Agriculture (CH), University of Kassel https://orgprints.org/42443/

Sørheim, K. M. and J. R. E. Johansen. 2021. **Foster cows and calves in co-grazing systems in Norway**. Ed. Norwegian centre of organic agriculture. www.norsok.no

Spengler Neff, A., Schneider, C. and A. Bieber. 2022. **Milchleistungskontrolle in Herden mit kuhgebundener Kälberaufzucht.** (in English: Milk recording in herds with cow-calf contact) Ed. FiBL Research Institute of Organic Agriculture https://www.fibl.org/de/shop/1409-milchwaegen

Spengler Neff, A., Schneider, C. and A. Bieber. 2022. **Épreuves de productivité laitière dans les exploitations élevant les veaux sous la mère ou sous une nourrice,** https://www.fibl.org/de/shop/1647-epreuves-productivite-laitiere

6.2.5. Videos

Please note: There are many videos showing cows and calves together. Not all of them actually present CCC systems; sometimes they refer to beef suckler cows, sometimes they just explain what CCC actually is, or advertise farms that use CCC. Therefore, sometimes no specific topics are indicated. This list is a snapshot and only refers to YouTube – other social media channels will certainly offer further examples. Furthermore, project websites (6.2.2) often include links to videos that explain the management of CCC systems.

Last access: 27. – 30.07.2025

Title (in original language)	Link	Cow, Calf Health	Colostrum	Weaning, Separation	Milking	Foster System	Human-Animal-Relationsh.	Barn, Equipment	Economy, Marketing
Animal welfare: Calves and cows together in the pasture (Tierwohl: Kalb und Kuh zusammen auf der Weide)	https://www.youtube.com/watch?v=t10WFr9Lp5k								
Animal welfare: cattle suckler and nurse calf rearing (Tierwohl Rind: Mutter- und Ammengebundene Kälberaufzucht)	https://www.youtube.com/watch?v=3F54D2VA6yk					x			
Animal welfare: When calves and cows are allowed to stay together (Tierwohl: Wenn Kalb und Kuh zusammenbleiben dürfen | Abendschau | BR24)	https://www.youtube.com/watch?v=olZpM0wWG90				x			x	
Bonding between foster cow and calves - Examples from two farms	https://www.youtube.com/watch?v=mUbmWHvaAOQ&list=PLHEF56_IRZwAOMPYjEp8dGMFJsCLcer4k&index=3					x			
Calf sharing with dairy cows (where everybody is happy)	https://www.youtube.com/watch?v=UTd6mTyIL0A				x		x		
Calf to cow (Kalf bij koe)	https://www.youtube.com/watch?v=28F6UuAirRQ								x
Calf to cow milk (Kalf bij koe melk)	https://www.youtube.com/watch?v=5UcljRyg0M								x

Title (in original language)	Link	Cow, Calf Health	Colostrum	Weaning, Separation	Milking	Foster System	Human-Animal-Relationsh.	Barn, Equipment	Economy, Marketing
Calves & cows: barriers designed for safety (Veaux & vaches : des barrières pensées pour la sécurité)	https://www.youtube.com/watch?v=QbgwD8gvoI4							x	
Changing to cow-calf system in dairy farms	https://www.youtube.com/watch?v=y3A3F8sHd3o					x			
Company outing to Felix | Episode 17 | In the country with Hendrikje (Betriebsausflug zu Felix | Folge 17 | Auf'm Land mit Hendrikje)	https://www.youtube.com/watch?v=g8nqaWySgQI	x		x				x	x
Cow & calf belong together: PROVIEH explains cow-linked calf rearing (Kuh & Kalb gehören zusammen: PROVIEH erklärt kuhgebundene Kälberaufzucht)	https://www.youtube.com/watch?v=0uAwysbb3uI								
Cow and calf in cow-calf contact systems (Ko og kalv i ko-kalv-systemer)	https://www.youtube.com/watch?v=Dz-G2M6_9qQ							x	
Cow and calf together - how does it work? (Ko och kalv tillsammans - hur går det?)	https://www.youtube.com/watch?v=DrMKW-owCaY							x	
Cow and calf together? (Ko och kalv tillsammans?)	https://www.youtube.com/watch?v=yYVNe0VoVF8								
Cow- calf contact - effects on the farm Effekte auf den Betrieb)	https://www.youtube.com/watch?v=RIsVt81D74Q								x
Cow calf contact: dairy's ethical future?	https://www.youtube.com/watch?v=n2ZXKyvt6nc								x
Cow'n'Calf/Cow and Calf – Extended cow and calf contact on the dairy farm Oesterlykke	https://www.youtube.com/watch?v=lKIcLD9REWQ			x				x	
Cow-calf contact - rearing by foster cows in a large dairy farm (Kuhgebundene Aufzucht - Ammengebundene Kälberaufzucht in einem großen Bestand)	https://www.youtube.com/watch?v=Kv9YhDjkoEw	x		x		x		x	
Cow-calf contact (Kuhgebundene Kälberaufzucht, LWK Kärnten)	https://www.youtube.com/watch?v=lb894Eghgc8						x		
Cow-calf contact systems on pasture - Examples from two farms	https://www.youtube.com/watch?v=y7-zD6uJkvs&list=PLHEF56_IRZwAOMPYjEp8dGMFJsCLcer4k&index=4					x			
Dam and calf in cow-calf contact systems - Examples from two farms	https://www.youtube.com/watch?v=D_fAbp63V_g&list=PLHEF56_IRZwAOMPYjEp8dGMFJsCLcer4k&index=2					x			

Title (in original language)	Link	Cow, Calf Health	Colostrum	Weaning, Separation	Milking	Foster System	Human-Animal-Relationsh.	Barn, Equipment	Economy, Marketing
Effects on cow and calves (Effekte auf Kuh und Kalb)	https://www.youtube.com/watch?v=YqsoLxW4Hio&list=PLx-WRvZ7tnwxeXY3LsM0S8LkmFSQEgi2L&index=8	x			x				
Extended calf rearing with foster cows, seasonal (Verlängerte Kälberaufzucht an der Amme, saisonal)	https://www.youtube.com/watch?v=kZU0i91aPBE			x		x	x		
Family van Zee keeps calves with the cow (Familie van Zee houdt kalfjes bij de koe)	https://www.youtube.com/watch?v=B3ATH8AoiMA								x
Featured | Cow calves contact in practice (Uitgelicht | Kalfjes bij de koe in de praktijk)	https://www.youtube.com/watch?v=bYW8R0qQ0WQ			x					
Featured | Kalverliefde: calves stay longer with the cow (Uitgelicht | Kalverliefde-melk: kalfjes langer bij de koe)	https://www.youtube.com/watch?v=6hARZMW0-1E			x				x	x
Feeding calves: Neonatal diarrhea [5/6] (Conduite des veaux sous nourrices : Les diarrhées néonatales [5/6])	https://www.youtube.com/watch?v=0uBv30_HrZg&list=PLJGHaoiN0RENIdTNypZcnTz-Pqfw9DVLD&index=5	x				x			
Feeding with colostrum from colostrum bank in cow-calf systems - Examples from two farms	https://www.youtube.com/watch?v=IOxUVsZp_08&list=PLHEF56_IRZwAOMPYjEp8dGMFJsCLcer4k	x	x						
For more animal welfare: Cow-calf contact (Für mehr Tierwohl: Kuhgebundene Kälberhaltung | Milchkuh Doku | Unser Land | BR Fernsehen)	https://www.youtube.com/watch?v=8TeUdJJeYa0			x	x			x	
Foster cow system (Ammengebundene Kälberaufzucht)	https://www.youtube.com/watch?v=40g5FW6Z9-g		x	x		x			
GrazyDaiSy Project	https://www.youtube.com/playlist?list=PLJGHaoiN0RENIdTNypZcnTz-Pqfw9DVLD	x				x			
Green Week | A wind of change in Europe (La semaine verte | Un vent de changement en Europe)	https://www.youtube.com/watch?v=fnvf3al15ug			x					
Green Week | Calves and cows... together! (La semaine verte | Veaux et vaches... ensemble!)	https://www.youtube.com/watch?v=RipTm5kdNk8								

Title (in original language)	Link	Cow, Calf Health	Colostrum	Weaning, Separation	Milking	Foster System	Human-Animal-Relationsh.	Barn, Equipment	Economy, Marketing
How can cows and calves be together in modern dairy barns? (Hvordan kan ku og kalv være sammen i moderne melkefjøs?)	https://www.youtube.com/watch?v=ltl1wBiWNhY								
How can you tell if a calf is happy? (Hvordan ser man om kalven er glad?)	https://www.youtube.com/watch?v=VA6vG1ssuCY							x	
How does mother-bonded calf rearing work (Wie geht muttergebundene Kälberaufzucht)	https://www.youtube.com/watch?v=DTuahb74Jmo			x				x	
How to Graft an Orphan Calf to a Cow	https://www.youtube.com/watch?v=EA0MFxGxbCs					x			
KALVvedKO - Svanholm Estate (KALVvedKO - Svanholm Gods)	https://www.youtube.com/watch?v=GjalsD8LAdU							x	
Keeping cow families together: BBC report on cow-calf dairy at Babbinswood Farm	https://www.youtube.com/watch?v=EDLIHaohXIw								x
KU-KALV-REG	https://www.youtube.com/watch?v=rZdlfExPM3k	x			x				
Milk without animal cruelty (Milch ohne Tierquälerei | maintower)	https://www.youtube.com/watch?v=u705xw9sRqQ								
Mother-bonded calf rearing & cow sponsorships at the Breuner Hof – solutions to animal suffering (Muttergebundene Kälberaufzucht & Kuhpatenschaften auf dem Breuner Hof - Lösungen gegen Tierleid)	https://www.youtube.com/watch?v=rnhtW_Zi2tI								x
Mother-bonded calf rearing (Muttergebundene Kälberaufzucht)	https://www.youtube.com/watch?v=KLvpm3a-9qI			x					
Mother-bonded calf rearing and fattening (Muttergebundene Kälberaufzucht und -Mast (Betrieb Huber, Renan/BE))	https://www.youtube.com/watch?v=xMDsgBJsQRc	x							
Mother-bonded calf rearing in combination with bucket feeding (Muttergebundene Kälberaufzucht in Kombination mit Eimertränke)	https://www.youtube.com/watch?v=zNyxuyIR7kE			x					
Mother-bonded calf rearing in combination with rearing by foster cows (Muttergebundene Kälberaufzucht in Kombination mit Ammenkuhhaltung)	https://www.youtube.com/watch?v=aG_-P_YutzA			x				x	
Mother-calf rearing in Swiss dairy production (Mutter-Kalb-Haltung (MUKA) in der Schweizer Milchproduktion)	https://www.youtube.com/watch?v=6aP6Dv0lguQ								

Title (in original language)	Link	Cow, Calf Health	Colostrum	Weaning, Separation	Milking	Foster System	Human-Animal-Relationsh.	Barn, Equipment	Economy, Marketing
Natural calf rearing Part 1 (Natürliche Kälberaufzucht Teil 1)	https://www.youtube.com/watch?v=cAzsfboY8Qw								
Natural calf rearing Part 2 (Natürliche Kälberaufzucht Teil 2)	https://www.youtube.com/watch?v=_-zr-wQ-tnQ								
Prolonged rearing by foster cows, asaisonal (Verlängerte Kälberaufzucht an der Amme, asaisonal)	https://www.youtube.com/watch?v=Z0Sebjj8pd4	x	x			x			
Pure foster cow system for weaner production (Reine Ammenkuhhaltung zur Fresserproduktion)	https://www.youtube.com/watch?v=TrYjfk1GFn4			x		x			
R4D best practice - 68. Cow-calf contact system	https://www.youtube.com/watch?v=vS5hiqPXWA4			x	x				
Rearing by foster cows in combination with bucket feeding (Ammengebundene Kälberaufzucht in Kombination mit Eimertränke)	https://www.youtube.com/watch?v=WUlbKeA5NxE					x			
Rearing calves with cows - mother bonded rearing (Kälber kuhgebunden aufziehen – muttergebundene Aufzucht)	https://www.youtube.com/watch?v=7t1sViq3t9E			x				x	
Rearing calves with foster cows: Strongyles and growth [6/6] (Conduite des veaux sous nourrices : Strongles et croissance [6/6])	https://www.youtube.com/watch?v=QGqLqF0FUao&list=PLJGHaoiN0RENIdTNypZcnTz-Pgfw9DVLD&index=6	x				x			
Report: Cow Calf Contact: Dairy's Ethical Future?	https://www.youtube.com/watch?v=PGtnrzcGjqc								
Research into solutions for cow-calf contact: SUCCEED (Forskning på løsninger for samvær mellom ku og kalv: SUCCEED)	https://www.youtube.com/watch?v=rZKmUoPSa8U							x	
Research on cows and calves together – status report (Forskning om ko och kalv tillsammans – lägesrapport)	https://www.youtube.com/watch?v=znxZoUtAlFs								
SideHill Farm's Nurse Cow Operation: Quality & Efficiency	https://www.youtube.com/watch?v=T3vQlAU0b6A	x				x			x
So calf and mama cow can stay together longer (Zo kunnen kalfje en mama-koe langer samen blijven)	https://www.youtube.com/watch?v=ggvoC_vAmlQ								x
Soil Health and a Cow with Calf Management System	https://www.youtube.com/watch?v=X78dcgrCV9o	x							

Title (in original language)	Link	Cow, Calf Health	Colostrum	Weaning, Separation	Milking	Foster System	Human-Animal-Relationsh.	Barn, Equipment	Economy, Marketing
The bond between cow and calf means more than just the milk (Båndet mellom ku og kalv betyr mer enn bare melken)	https://www.youtube.com/watch?v=jvXPkzu7afc								
The Bruderkalb Initiative Hohenlohe: Winner of the 2021 Federal Competition for Organic Farming (Die Bruderkalb Initiative Hohenlohe: Preisträger des Bundeswettbewerbs Ökologischer Landbau 2021)	https://www.youtube.com/watch?v=uYhVw6YHFBM								x
Weaning and separation in foster cow systems - Examples from two farms	https://www.youtube.com/watch?v=nBLUxaTCuek&list=PLHEF56_IRZwAOMPYjEp8dGMFJsCLcer4k&index=5			x					
Where calves and cows are separated twice a day. (Wo Kalb und Kuh zweimal am Tag getrennt werden. LandWild)	https://www.youtube.com/watch?v=RqPn4jssG0A					x			

6.2.6. Teaching material

Waiblinger, Susanne: Neue Wege in der Weidehaltung unter schwierigen Bedingungen (Weide-Innovationen): Weidehaltung kälberführender Milchkühe (New approaches to grazing under difficult conditions (grazing innovations): Grazing lactating dairy cows with their calves). Ed. BIO AUSTRIA Bundesverband. https://cdn.bio-austria.at/app/uploads/2025/05/ap-4-weidehaltung-von-kalberfuhrenden-milchkuhen.pdf, last access: 23.07.2025.

Weber, Elisabeth (2025): Kuhgebundene Kälberaufzucht in der ökologischen Milchviehhaltung (Cow-bonded calf rearing in organic dairy farming) ed. Bundesanstalt für Landwirtschaft und Ernährung (BLE). Online verfügbar unter https://www.ble-medienservice.de/muttergebundene-kaelberaufzucht-in-der-oeko-milchviehhaltung.html, last access: 23.07.2025.

6.2.7. References corresponding to the numbers given in brackets throughout the text (excl. scientific literature)

Please note: Since it is hardly possible to provide comprehensive source references for videos, only the corresponding titles in the original language as well as their English translations, and links are listed here.

1. **Ammengebundene Kälberaufzucht** (Foster cow rearing) https://www.youtube.com/watch?v=40q5FW6Z9-g
2. **Ammengebundene Kälberaufzucht in Kombination mit Eimertränke** (Foster cow rearing in combination with bucket feeding) https://www.youtube.com/watch?v=WUlbKeA5NxE
3. (Guide) Spengler Neff, A., Schneider, C., Ivemeyer, S. 2023. **Mutter- und ammengebundene Kälberaufzucht in der Milchviehhaltung - Haltungssysteme für eine artgerechte Aufzucht.** Ed. FiBL, Demeter Schweiz, Bio Suisse, Demeter e.V., Bioland e.V., Naturland e.V., IBLA Luxemburg, Merkblatt Nr. 1575, DOI: 10.5281/zenodo.8139050, https://www.fibl.org/de/shop/1575-muttergebundene-kaelberaufzucht
4. (Guide) Christiansen, I. A. and K. F. Jørgensen. 2024.**Gode-raade-om-bonding-af-kalve-til-ammetanter.** Ed. GrOBEat Grass-fed Organic Beef for Sustainable Eating. https://orgprints.org/45728/1/gode-raade-om-bonding-af-kalve-til-ammetanter.pdf
5. **Cow'n'Calf/Cow and Calf – Extended cow and calf contact on the dairy farm Oesterlykke** https://www.youtube.com/watch?v=lKIcLD9REWQ
6. **Die Bruderkalb Initiative Hohenlohe: Preisträger des Bundeswettbewerbs Ökologischer Landbau 2021** (The Bruderkalb Initiative Hohenlohe: Winner of the 2021 Federal Competition for Organic Farming) https://www.youtube.com/watch?v=uYhVw6YHFBM
7. **Die Kuh an erster Stelle** (The cow comes first) https://www.hofgut-eichigt.de/unser-hofgut-1/unsere-tiere/ .
8. (Website) **Directory of cow-calf dairies** https://www.cowcalfdairies.co.uk/
9. **Effekte auf Kuh und Kalb** (Effects on cow and calf) https://www.youtube.com/watch?v=YqsoLxW4Hio&list=PLx-WRvZ7tnwxeXY3LsM0S8LkmFSQEqi2L&index=8
10. **Examining Dairy Cow-Calf Contact** https://www.youtube.com/watch?v=NSyjBqfFxc8

11. **Feeding with colostrum from colostrum bank in cow-calf systems - Examples from two farms** https://www.youtube.com/watch?v=IOxUVsZp_08&list=PLHEF56_IRZwAOMPYjEp8dGMFJsCLcer4k
12. **Für mehr Tierwohl: Kuhgebundene Kälberhaltung | Milchkuh Doku | Unser Land | BR Fernsehen** (For more animal welfare: Cow-bonded calf rearing | Dairy cow documentary | Unser Land | BR Television) https://www.youtube.com/watch?v=8TeUdJJeYa0
13. **GrazyDaiSy Project** https://www.youtube.com/playlist?list=PLJGHaoiN0RENIdTNypZcnTz-Pqfw9DVLD
14. (Guide) Barth, K., Bock, A., Breden, A. N., Dwinger, H., Dwinger, S., Gleissner, F., Häußermann, A., Jensen, M., Kubera, J., Kubera, E., Kuckelkorn, J., Lotterhos, A., Miesorski, M., Möller, H., Otterbach, J., Peschel, U., Petersen, J., Tams-Detlefsen, U., Teschemacher, M., Teschemacher, F., Volling, O., 2022. **Kuhgebundene Kälberaufzucht in der Milchviehhaltung: Leitfaden für die Praxis.** (Cow-bonded calf rearing – A practical guide) Rendsburg, Westerau, Kiel: Bioland-Verl; Thünen-Institut für Ökologischen Landbau; Christian-Albrechts-Universität, 115 p https://www.kuhgebundene-kaelberaufzucht.de/handlungsleitfaden/ .
15. **How to Graft an Orphan Calf to a Cow** https://www.youtube.com/watch?v=EA0MFxGxbCs .
16. ICAR: Section 2 - Guidelines for Dairy Cattle Milk Recording: Version June, 2023. https://www.icar.org/Guidelines/02-Overview-Cattle-Milk-Recording.pdf
17. **Ist die Milch nicht für die Kälber da?** (Isn't the milk supposed to be for the calves?) https://www.youtube.com/watch?v=2xERKXrpGQs
18. (Website) **Kalb und Kuh** (Calf and cow) https://ig-kalbundkuh.de/ .
19. **Keeping cow families together: BBC report on cow-calf dairy at Babbinswood Farm** https://www.youtube.com/watch?v=EDLlHaohXIw
20. (Website) **Kuhgebundene Kälberaufzucht auf Milchviehbetrieben in Süddeutschland - Entwicklungen von Indikatoren zur Bewertung von Tierwohl und Milchmengen (KuKIndiTM)** (CCC rearing on dairy farms in southern Germany – development of indicators for assessing animal welfare and milk yields) https://www.hswt.de/forschung/projekt/2177-kukinditm
21. **Kuhgebundene Kälberaufzucht, LWK Kärnten** (Cow-bonded calf rearing, LWK Kärnten) https://www.youtube.com/watch?v=lb894Eghgc8
22. (Guide) Lidfors L, Berg C: **Kor och kalvar tillsammans: - praktiska möjligheter att låta kalvarna dia inom modern mjölkproduktion** (Cows and calves together: practical possibilities for allowing calves to suckle in modern milk production)**;** 2004. Uppsala: Sveriges lantbruksuniv (Rapport / MAT 21, 2004:5).
23. Michaud, A. A., Cliozier, A., Bec. H., Chassaing, C., Disenhaus C., Drulhe T., Martin B., Pomiès D., Le Cozler Y: **Déléguer l'allaitement des veaux laitiers aux vaches ? Résultats d'enquêtes auprès des éleveurs.** (Should milk feeding for dairy calves be delegated to cows? Results of a survey of farmers.) Paris; 2018. https://hal.inrae.fr/hal-02738451v1/document
24. MIKVIG: *Statistikksamling fra Ku- og Geitekontrollen 2020 Årsrapport fra Helsekortordningen 2020*; 2021 (Statistics from the 2020 cow and goat inspection, Annual report from the Health Card Scheme).
25. **Muttergebundene Kälberaufzucht** (Dam-calf contact rearing) https://www.youtube.com/watch?v=KLvpm3a-9qI
26. **Reine Ammenkuhhaltung zur Fresserproduktion** (Pure foster cow rearing for weaner production) https://www.youtube.com/watch?v=TrYjfk1GFn4

27. (Guide) Scheidegger, E., Augsburger, C. and C. Buchli. 2025. **Vermarktung von Produkten aus Mutter-Kalb-Haltung.** Leitpapier. (Marketing of products from dam-calf contact rearing) Eds. Verein Cowpassion, KAGfreiland, Fachstelle MuKa, Förderverein Mutter-Kalb-Haltung. https://www.mu-ka.ch/wp-content/uploads/2025/04/Leitpapier_Vermarktung-von-MuKa-Produkten-def.pdf

28. **SideHill Farm's Nurse Cow Operation: Quality & Efficiency** https://www.youtube.com/watch?v=T3vQlAU0b6A

29. (Fact sheet) Spengler Neff, A., Schneider, C. and A. Bieber. 2022. **Épreuves de productivité laitière dans les exploitations élevant les veaux sous la mère ou sous une nourrice.** (Milk recording in herds with dam or foster cow calf rearing systems) https://www.fibl.org/de/shop/1647-epreuves-productivite-laitiere

30. (Fact sheet) Spengler Neff, A., Schneider, C. and A. Bieber. 2022. **Milchleistungskontrolle in Herden mit kuhgebundener Kälberaufzucht.** (Milk recording in herds with CCC) Ed. FiBL Research Institute of Organic Agriculture https://www.fibl.org/de/shop/1409-milchwaegen

31. **Stallbauliche Umsetzung der kuhgebundenen Aufzucht, Uwe Eilers** (Stable construction for CCC systems, Uwe Eilers) https://www.youtube.com/watch?v=ScQ2IxXnByU&list=PLx-WRvZ7tnwxeXY3LsM0S8LkmFSQEqi2L

32. **The Ethical Dairy** https://www.youtube.com/channel/UCHptUGecLa54vWN3qUnOMiQ/featured

33. **Tierwohl Rind Mutter- und Ammengebundene Kälberaufzucht** (Animal welfare Cattle Dam- and foster-cow-rearing of calves) https://www.youtube.com/watch?v=3F54D2VA6yk

34. **Uitgelicht | Kalfjes bij de koe in de praktijk** (Featured | Calves with their dams in practice) https://www.youtube.com/watch?v=bYW8R0qQ0WQ

35. **Veaux & vaches: des barrières pensées pour la sécurité** (Calves & cows: barriers designed for safety) https://www.youtube.com/watch?v=QbgwD8gvoI4

36. **Verlängerte Kälberaufzucht an der Amme, asaisonal** (Extended calf rearing by foster cows, asaisonal) https://www.youtube.com/watch?v=Z0Sebjj8pd4

37. **Verlängerte Kälberaufzucht an der Amme, saisonal** (Extended calf rearing by foster cows, saisonal) https://www.youtube.com/watch?v=kZU0i91aPBE

38. (Guide) Waiblinger, S. and S. Kirchweger. 2025. Kuhgebundene Kälberaufzucht mit Weidehaltung. (Cow-bonded calf rearing with grazing) Ed. BIO AUSTRIA Bundesverband. https://www.vetmeduni.ac.at/fileadmin/v/tierhaltung/eip-agri-bio-austria-kuhgebundene-kalberaufzucht-2025.pdf

39. (Teaching material) Weber, Elisabeth (2025): **Kuhgebundene Kälberaufzucht in der ökologischen Milchviehhaltung** (Cow-bonded calf rearing in organic dairy farming) ed. Bundesanstalt für Landwirtschaft und Ernährung (BLE). Online verfügbar unter https://www.ble-medienservice.de/muttergebundene-kaelberaufzucht-in-der-oeko-milchviehhaltung.html

40. (Website) **Wo gibt es Produkte aus kuhgebundener Kälberaufzucht zu kaufen? | PROVIEH** (Where can I buy products from cow-based calf rearing? |PROVIEH) https://www.provieh.de/kampagnen/kuh-und-kalb/einkaufen/kuh-und-kalb-hoefe/ .