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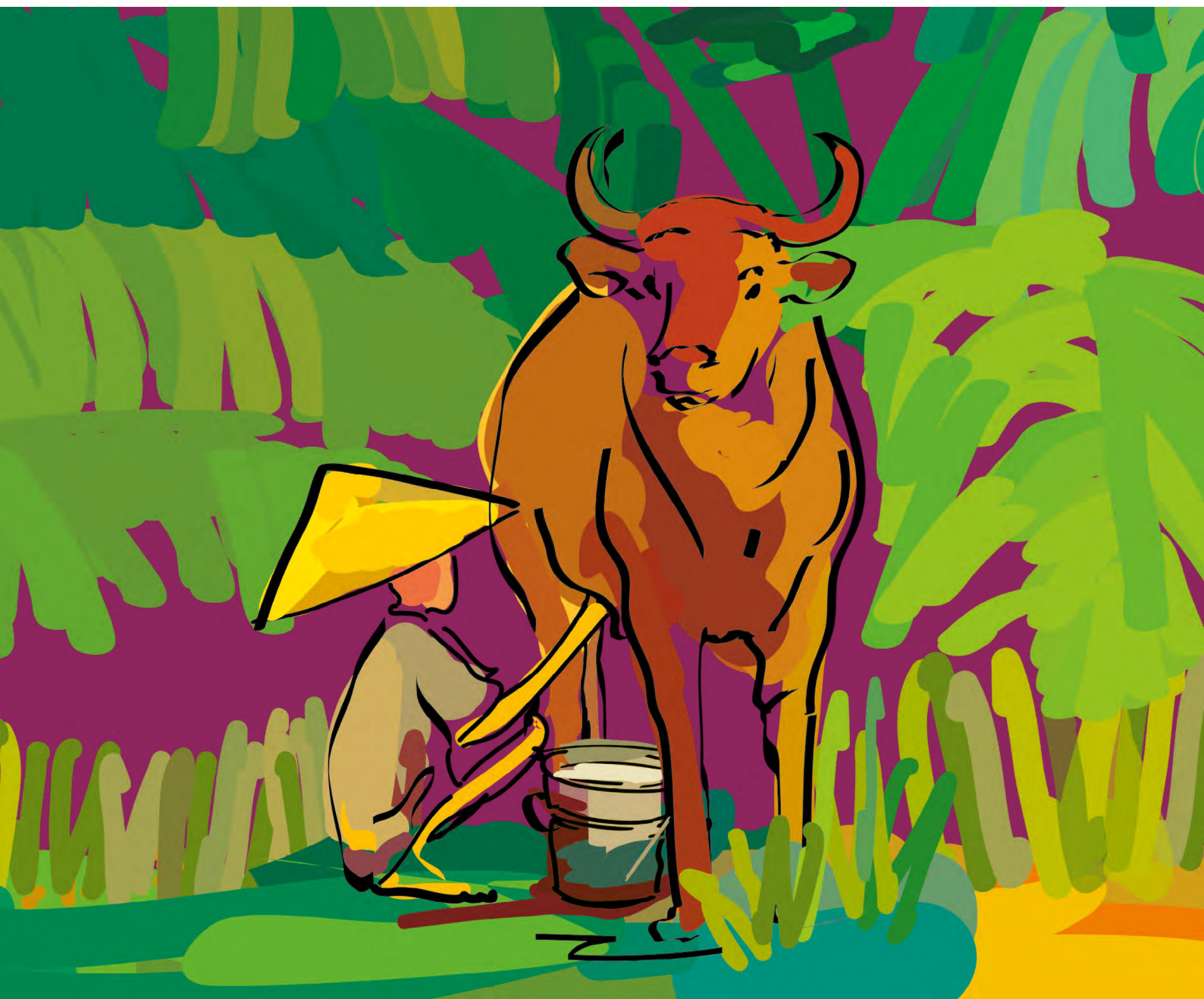
AGRICULTURAL RESEARCH FOR DEVELOPMENT

Milk roadmap summary

The road towards sustainable dairy chains [2024-2034]



The road towards sustainable dairy chains [2024-2034]

On every continent, milk and dairy products provide a range of essential nutrients. There is therefore a vital need to boost milk production worldwide if we are to feed 10 billion people by 2050, but not at any price or no matter how. Dairy production must be both socially and environmentally sustainable, and high quality. CIRAD has been supporting dairy chains in the global South for decades, and has now pinpointed four ambitions for achieving a sustainable dairy sector over the next 10 years. ■

Milk and its by-products are consumed worldwide. Whatever the latitude, whatever the climate, on the plains or in the mountains, in rural and in urban zones, people produce, process and consume dairy products. Milk, primarily from cows, generates income for 120 million dairy farms, which each have three cows on average. However, that figure masks the substantial diversity of production systems, with widely varying degrees of intensification and specialization. Milk collection and trading is dominated by a small number of agri-food giants, with the 20 largest dairy firms accounting for 25% of global milk production. Those powerful firms cover the entire globe, by means of their own installations or agreements with local partners. However, while they hold a major share of the milk volumes collected worldwide, these groups are far from the only dairy processors. In every country in the world, vast numbers of more modest structures that process and market a broad range of dairy products are emerging. Some products, such as milk, yoghurt, cream and ice cream, and to a lesser extent butter and cheese, call for strict respect of the cold chain, while others, such as milk sterilized at ultra-high temperatures (UHT), UHT dairy drinks, milk powder, condensed milk and evaporated milk, can be kept at room temperature for several months. Population growth is driving the dynamics seen across different continents, and according to United Nations forecasts, feeding almost 10 billion people worldwide in 2050 will mean increasing dairy production. This particularly applies to zones with strong population growth (sub-Saharan Africa, India, Southeast Asia, etc), which are precisely those in which people, the majority of whom are poor, want to consume more milk or make a better living from livestock farming.

Producing more, and better

Nevertheless, milk and dairy products remain animal products, which makes them controversial, notably as regards their overall environmental balance (greenhouse gas emissions), livestock farming conditions (animal wellbeing) and their impact on human health (cholesterol, diabetes, cardiovascular disease). While such controversies are legitimate in the global North, they are much less so in the countries of the global South, where consumption is modest and milk and its by-products are strongly recommended for their nutritional value, particularly for children. Increasing supply in quantity terms is already a challenge in itself, but that increase also has to satisfy certain conditions if it is to be both sustainable and acceptable: we need to be able to market quality products, reduce the carbon footprint of livestock farming, and foster social and environmental benefits. In short, the challenge for the dairy sector over the next decade will be to produce, collect, process and distribute "more" and "better". In some cases, these macro-challenges may be contradictory or the subject of controversy. Observations and options are not always shared or even agreed on across the world, and there are often notable discrepancies between North and South in particular. ■

© J-D. Cesaro, CIRAD

| Supplementary feeding of dairy cows in northern Senegal

© G. Duteurtre, CIRAD

| Milking in northern Benin

Promoting a more sustainable dairy sector: four ambitions to frame operations

CIRAD's research on dairy value chains follows on from that of the Institut d'élevage et de médecine vétérinaire des pays tropicaux, which became CIRAD's livestock and veterinary medicine department in 1984, focusing on the earlier stages of the value chain and on zootechnical aspects. That research has changed over the years, with a significant increase in the number of partnerships and of disciplines, often covered by several research units, notably **SELMET**, which facilitates the planning and design of projects aimed at developing dairy value chains and the territories involved. CIRAD's three departments, Biological Systems (BIOS), Tropical Production and Processing Systems (PERSYST), and Environment and Societies (ES), are providing resources with a view to achieving four main ambitions…

Ambition 1

Promote agroecological intensification of dairy production systems

The objective is to produce knowledge and innovative proposals aimed at optimizing milk production and collection systems with a view to agroecological transition. Work will centre on a plot and animal level, to characterize the technical and environmental impact of any proposed innovations. There will also be research on a farm level to support changes in practice, by means of participatory modelling or innovation platforms. Tools may also be used to build future scenarios or train grassroots players.

Ambition 2

Promote sustainable, inclusive value chains that leave more room for local dairy production

As well as promoting agroecological innovations, research will be done on value chains, to integrate those innovations into responsible business models (cooperatives, mini-dairies, contracts between agribusinesses), into strategies aimed at establishing local dairy firms, and into sectoral policy. This work will be based on socioeconomic analyses of value chains and on dairy technology and agri-food processing research aimed at marketing local milk more efficiently. Multi-stakeholder consultation instruments involving producers, collectors, dairies and support services will serve to support those transitions.

Ambition 3

Boost the contribution of local dairy chains to sustainable food systems

A "food systems" approach will serve to promote the links between the introduction of innovations upstream and their impact downstream, by means of "sustainable" or "fair" quality marks. Analysing food distribution and consumption patterns will help pinpoint long-term innovation pathways that support the emergence of a new urban dairy culture based on local identities and sustainable food consumption practices. Multi-criteria assessments will quantify the impact of proposed innovations on consumer health, biodiversity preservation, improved livestock farm carbon balances and job creation, with a view to identifying appropriate sustainability and fairness indicators. Territorial ecology research will help identify technical and organizational innovations likely to encourage recycling and promote the circular economy.

Ambition 4

Help policymakers and grassroots players build a new generation of marketing and supply management policies

The aim is to build an integrated vision of the agroecological transition pathways available to stakeholders in collection basins, and identify regulatory levers and bottlenecks. CIRAD will be involved in promoting agroecological production models and territory-based economies. By means of multi-scale approaches (territorial foresight, diachronic studies, etc), it will work to link levers for fostering local territory-based dynamics in collection basins with national, community and international policy issues. ■

© G. Duteurtre, CIRAD

| Sharing milk after milking in northern Benin

Details

Agroecological intensification of production systems, promotion of local milk production, food system-based approaches, appropriate marketing policies, supply management, and so on... A look at the key points in the roadmap with Guillaume Duteurtre (economist) and Christian Corniaux (zootechnician), researchers from the SELMET research unit and dairy value chain research coordinators at CIRAD.

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How can we tackle the main technical and environmental challenges facing current dairy production systems?

Christian Corniaux: The systems we are looking at need to produce more to meet demand, but as things stand, they are relatively unproductive and have limited water and fodder resources. We need to intensify operations while controlling greenhouse gas (GHG) emissions. One of the main levers for doing this is to feed livestock balanced rations. Current basic rations contain dry fodder, which produces high levels of GHGs. We suggest rebalancing them by means of energy- and nitrogen-rich feed concentrates that guarantee optimum milk production and limit GHG emissions. Research is also required on genetic improvement and disease control.

What sort of collection and distribution model would help build sustainable, inclusive value chains in West Africa?

C.C.: In this part of the world, most dairies use imported milk powder, even though milk is produced locally. The difficulty lies in making that milk accessible, but it can be done, by means of collection points. CIRAD is working to set up dairy innovation platforms aimed on the one hand at improving collection and on the other at supplying dairy farmers with feed and other inputs. These platforms bring together a community of farmers, dairy representatives and collectors, who meet to discuss technical and organizational innovations well as milk prices. Locally collected milk has a higher cost price than imported powdered milk, but can be used to produce goods for niche markets (cheese, typical products, butter) or products particularly popular with consumers (mixed with cereals, etc).

How can quality marks recognize innovations introduced upstream and encourage sustainable consumption habits?

Guillaume Duteurtre: When people buy dairy products, they look at quality as well as price. To judge that quality objectively, they rely on various quality marks (brands, labels, or geographical origins). Using such quality marks on packaging allows farmers' organizations, firms and local authorities to promote certain livestock farming practices based on particular "specifications". CIRAD helps local communities introduce quality marks that promote the local origin of milk and sustainable farming practices. For instance, we are currently working to obtain official recognition for a cheese produced by Fulani people in northern Benin.

How can public policy foster local territory-based dynamics within collection basins?

G.D.: Public policy can help steer the dairy sector along sustainable development pathways. First of all, to promote the development of dairy basins that generate value in rural areas, the authorities must introduce trade policies. The aim is to make cheap imports less competitive. Based on current trade agreements, States are working to pinpoint weak spots in local dairy chains in relation to international competition. Governments must also promote supply management policies that encourage investment in developing collection basins. For instance, CIRAD is working to support the ECOWAS regional "local milk" campaign, which includes strengthening support and incentives for local milk collection, and the introduction of appropriate product regulations. ■

Find out more: **milk@cirad.fr**

Africa-Milk: Improving milk collection operations in Africa

Demand for dairy products in Africa is growing. However, dairies find it hard to obtain sufficiently plentiful, consistent, quality milk supplies locally. Between 2018 and 2022, Africa-Milk supported the co-design and rollout of technical and organizational innovations intended to boost and secure local milk supplies in four African countries: Burkina Faso, Kenya, Madagascar and Senegal. Its operations notably hinged on dairy innovation platforms, in view of the potential for agroecological intensification of dairy production and for developing inclusive dairy basins. Africa-Milk relied on close collaboration between research organizations and the private sector. The consortium comprised research organizations in Africa (ISRA, INERA, UoN, FIFAMANOR) and Europe (WUR and CIRAD), all with solid experience of African milk production and sustainable development, and nine dairies in four countries (Burkina Faso, Kenya, Madagascar and Senegal), covering a variety of agro-climatic and production contexts.

Find out more:

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| Dairy products made by Socolait, Madagascar

Inventing the dairy chains of the future
CIRAD is addressing the challenges facing the sector

Many different production systems, growing demand

A wide range of production systems

120M dairy farms worldwide, with an average of 3 cows per farm

But huge differences between countries in the global North and global South…

USA (50% of farms)
> 1000 cows

France (average)
65 cows

The 20 largest dairy firms collect 25% of the world's milk

Cow's milk dominates the sector

80%
dairy cows

10-15%
buffaloes

4%
small ruminants (sheep and goats)

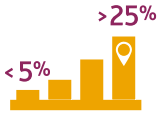
<1%
camels (rising rapidly)

Growing demand: spotlight on West Africa

Despite a 45% jump in dairy production in 20 years, the share of demand covered by local milk has fallen from 60% to 40%.

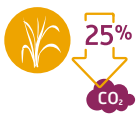
Our research aimed at boosting production without increasing carbon impact

Supporting local production



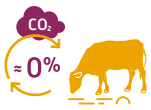
The dairy offensive in West Africa, headed by ECOWAS, aims to increase the share of local milk in West African dairy processing operations from less than 5% to more than 25%.

Innovating in terms of dairy cow rations



Using locally produced fodder reduces the carbon impact of rations in Sahelian environments by 25%.

Assessing the carbon footprint of production systems



If the carbon stored in soils and vegetation in rangelands is taken into account, the carbon footprint of pastoral systems in the Sahel is close to zero.

Our ambitions…

Promote **agroecological intensification** of dairy production systems

Promote **sustainable, inclusive value chains** that leave more room for **local dairy production**

Boost the **contribution** of local dairy chains to **sustainable food systems**

Help policymakers and grassroots players build a **new generation of marketing** and **supply management policies**

…in partnership

Several platforms in partnership for research and training (dPs) are working on the dairy sector:

PPZS
ASAP
SPAD
SIRMA
MALICA

CIRAD works with numerous local and international NGOs, producer organizations, dairies, etc. In France, it works with the **Centre national interprofessionnel de l'économie laitière (CNIEL)**.

Our means and resources

34 scientists from **7 research units**

10 disciplines involved, **from livestock sciences to sociology** by way of geography

100 **PhD and other students** trained **since the 2000s**

2013 and 2019 CIRAD helps to draft **regional** dairy **strategies** for West Africa

690 **references** (publications and grey literature) in the CIRAD **Agritrop** database

4 **international meetings** on milk as a development driver co-organized by CIRAD

Partnerships, the core of CIRAD's research

CIRAD's dairy research is facilitated by solid partnerships with other research organizations in France, elsewhere in Europe, and in the countries of the global South in which it works. IRD, INRAE, Institut Agro and the Universities of Wageningen (WUR, Netherlands) and Bari (Italy) are just a few of its longstanding partners. In the global South, its closest partnerships are those with other members of the platforms in partnerships for research and training (dPs), such as **ASAP**, **MALICA**, **PPZS**, **SIRMA** and **SPAD**. Over the past decade or so, CIRAD has forged partnerships with international NGOs such as Oxfam, AVSF or CARE, with which it has advocacy activities relating to EU dairy policy. It is also building research and communication operations with France's Institut de l'élevage (IDELE) and Centre national interprofessionnel de l'économie laitière (CNIEL). Among other things, implementing the 10-year roadmap will mean consolidating and broadening those partnerships. ■

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| Milking a dromedary in Mauritania

A word from our partners

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Interview with Hindatou Amadou,

in charge of advocacy operations at the Association pour la promotion de l'élevage au Sahel et en Savanes (**APESS**), based in Ouagadougou (Burkina Faso)

Hindatou Amadou is coordinating the multi-stakeholder platform to promote local milk in West Africa and the Sahel, which associates a number of producer organizations, NGOs and dairies. She will be the main interlocutor for the ambitious project to support the dairy offensive in West Africa (PAOLAO), headed by the Economic Community of West African States (ECOWAS).

Can you tell us about the partnership between your organization and CIRAD?

The first meeting between APESS and CIRAD was during the "mon lait est local" (my milk is local) campaign in 2018. This was a regional campaign to defend and promote local milk, set up by a coalition of more than 55 organizations (producer organizations, consumers, researchers, NGOs, mini-dairies and local businesses) working in six countries: Burkina Faso, Chad, Mali, Mauritania, Niger and Senegal. ECOWAS dairy policy had highlighted local milk with its "dairy offensive", but in practice, nothing was changing. The campaign, set up with the help of Oxfam, served to draft a true mobilization strategy, in which CIRAD played a crucial role, since various types of evidence were needed. In particular, CIRAD produced studies showing the importance of imported milk powder in the sub-region. It was this campaign that allowed us to bring various players together and encourage them to speak the same language, with a common aim: to promote local milk. With CIRAD's support, we have also been able to conduct advocacy operations in Europe, including going to the European Commission in Brussels to back the "n'exportons pas nos problèmes" (let's not export our problems) campaign.

How do you feel about the ambitions set out in the CIRAD dairy roadmap?

All the ambitions speak to us, albeit some more than others. The multi-stakeholder platform to promote local milk in West Africa and the Sahel, which I am coordinating, is split into thematic commissions that all fit with those ambitions. As regards ambition 2, it is clear that this is what we have been doing for a long time with the dairy innovation platform. However, thanks to CIRAD, we will no doubt have access to more current data, with clearer evidence, to allow us to make greater progress. Ambition 4, which concerns marketing policy, relates to one of the platform's key operations at present: we are working hard to promote a revision of the ECOWAS common external tariff, to put a stop to milk powder imports into the region. With CIRAD, we have helped draft the project to support the ECOWAS dairy offensive in West Africa. The regional platform heads component 2, with concrete proposals approved by the coalition as a whole, including CIRAD. This is a good project; it concerns no fewer than 18 countries over a long period (2023-2027). It was a long time coming, and we are now expecting results. ■

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Interview with Gaukhar Konuspayeva,

food biotechnology tutor at **Al-Farabi University, Almaty**, Kazakhstan

Gaukhar Konuspayeva is working on camel's milk composition and processing, and has been an essential partner for CIRAD over the past 15 years or so.

How long have you been working with CIRAD, and in what way?

I wrote my thesis on the physicochemical and biochemical variability of milk in Kazakhstan at CIRAD in 2007, before returning to Al-Farabi University in Almaty as a teacher-researcher. As long ago as 2008, we began responding to calls for proposals with CIRAD, which was then working on camel's milk quality, and had several projects accepted. I suggested working on pollutants (pesticides, heavy metals, etc) in camel's milk, and on its probiotic properties and microbial diversity. Unlike now, we did not at the time have analysis laboratories: I took field samples in Kazakhstan and analysed them in France. Camel's milk is a local product that was not traditionally processed to any extent, but it has really taken off in recent years. Various types of cheese, jam, ice cream, infant formula, etc, are now being made, with new camel's milk products appearing on an almost daily basis. It is important to remember that camel's milk has many advantages: it is very rich in vitamins C and D, contains probiotics, is easy to digest, and does not taste too strong, provided it is produced under the right conditions. The fact that production is local also has benefits: producing cow's milk in arid zones or importing fat-filled cow's milk powder is an aberration in every respect. However, many questions remain for research. In 2022, a thesis was defended on modelling camel's milk fermentation, paving the way for a whole new field to be explored and developed. Growing numbers of businesses are now aware of the merits of camel's milk on a global level, and are keen to invest in development studies.

How do CIRAD's ambitions fit with the development of the camel's milk value chain?

Camel's milk fits in with all four ambitions: agroecological intensification, local production, sustainability and territory-based dynamics. To date, we have tended to "cut and paste" methods used for cow's milk to camel's milk, and we should not have. Not only is camel's milk very different from cow's milk, camels are pseudo-ruminants, with a very specific intestinal microflora. Above all, we should take care not to make the same mistakes as with dairy farming. We have reached the limits in terms of intensive cow's milk production, and now face a range of major ecological issues (carbon footprint of dairy farming). I worked in Saudi Arabia in the 2010s, where I saw a farm with 35 000 dairy cows in an air-conditioned hangar slap bang in the middle of the desert! In both the Sahel and the Sahara, there are different methods available, and it is up to research to study them individually. In any event, it is cheaper and better to drink local camel's milk than imported powdered cow's milk. The roadmap's fourth ambition, focusing on policy, touches on this sensitive issue: we need to promote camel's milk, particularly in the light of climate change. There are a few camel farms in France, and during the 2023 drought, unlike cows, the camels did not stop producing milk! ■

© V. Alary, CIRAD

| Reka milk collection centre south of Giza (Egypt)

© R. Poccard-Chapuis, CIRAD

| Making mozzarella in Brazil

CIRAD is the French agricultural research and international cooperation organization working for the sustainable development of tropical and Mediterranean regions.

CIRAD works with its partners to build knowledge and solutions and invent resilient farming systems for a more sustainable, inclusive world. It mobilizes science, innovation and training in order to achieve the sustainable development goals. Its expertise supports the entire range of stakeholders, from producers to public policymakers, to foster biodiversity protection, agroecological transitions, food system sustainability, plant, animal and ecosystem health, and sustainable development of rural territories and their resilience to climate change.

CIRAD is a public establishment (EPIC) under the joint authority of the Ministry of Higher Education and Research and the Ministry for Europe and Foreign Affairs.

CIRAD hopes that multi-stakeholder partnerships and alliances will discuss, share and support its four ambitions for a sustainable dairy sector.

Contact us to find out more: **milk@cirad.fr**

Working together for tomorrow's agriculture

Find out more about the dairy value chain at CIRAD

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