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COVID-19 and the bovine livestock sector in Colombia:

Current and potential developments, impacts and mitigation options



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COVID-19 and the bovine livestock sector in Colombia:

Current and potential developments, impacts and mitigation options

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food system resilience
 value chain
Gender intensification
 Beef
 Sustainable
 Biosafety measures
Traceability Substitution effect
 Virtualization & food safety
 Digitalization New business opportunities
 Extension & technical assistance
 Export market diversification
Vulnerability
 Consumers & Communication Value chain dairy
Productivity formalization
 Value chain disruptions food system re-
 Shift in research focus
 silience
Panic buying
 Fake news
 Rural
 Generational transfer
 Multi-actor Platforms
 Input & consumer prices
 Resource bundling
 products education Milk
 poor
 rate dollar
Beef gender
 Shift in research focus
 Sustainable intensification
 Value chain consumers
 Virtualization + digitalization

Abstract

The COVID-19 crisis is affecting the bovine livestock sector in Colombia. First impacts and short-term mitigation measures are already visible in all links of the beef and dairy value chains. The full magnitude of the crisis is not yet visible but most impacts already are or will be negative and will affect the beef and dairy value chain's performance in the near future. However, positive trends are also visible and some will endure the crisis and help building a more resilient food system for the future. Consumer preferences will change towards more food safety, traceability, animal welfare and sustainability and the sector will need to understand this and push value chain formalization and consumer communication. The transformation of the primary sector towards more sustainability and efficiency is becoming urgent, not only to increase resilience during times of crisis (as in the actual COVID-19 situation), but also to face the aggravating effects of climate change and combat inequality. Digitalization and virtualization have become important means during the crisis in all links of the value chains, creating opportunities for sustainably increasing sector efficiency. Research can play a fundamental role in analyzing and understanding the impacts posed by the current crisis, providing technologies and recommendations for recovery, and developing solutions for building resilient food systems. This document serves as a guide to understand current developments, impacts and mitigation measures related to the COVID-19 pandemic. It also provides an outlook on potential future impacts and suggestions for mitigation options that can help policy- and decision-makers in preparing the sector better for future crises.

Keywords: resilience, food system, sustainable intensification, consumer behavior, traceability, food safety, value chain formalization.



Introduction

On March 11 2020, the World Health Organization (WHO) declared COVID-19 a pandemic (WHO, 2020). Due to its rapidly evolving character, global spread, and the many associated uncertainties and missing remedies, the virus is affecting humankind in an unprecedented way. To protect public health, governments have taken a wide range of measures: broad testing schemes, travel bans, obligatory use of biosafety elements (e.g. masks, gloves), the closure of schools, restaurants and bars, mandatory home office (where possible), self- or prescribed quarantine/confinement of individuals, or large parts of the population and even nationwide lockdowns. This has largely affected the global economy, causing significant downturns in many sectors and affecting stock markets. Compared to many other sectors, where negative impacts are becoming visible very quickly, it would seem that the agriculture and livestock sector is not (yet) much affected by the situation (FAO, 2020a; ECLAC, 2020a). This perception, however, might delude since many of the effects are still unquantified, resulting from e.g. monitoring difficulties, slow updates of databases, and

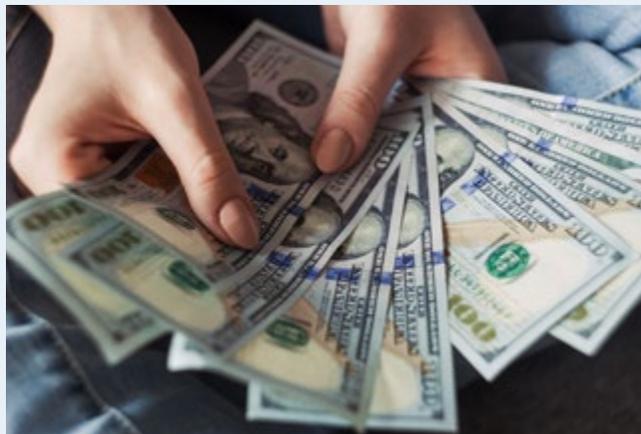
general data scarcity, or have not yet completely come across. Nevertheless, some disruptions in the value chains are already noticeable and likely to grow over time (FAO, 2020b). Since the agriculture and livestock sector is key to food security, nutrition and livelihoods, it is crucial for governments to identify and understand existing and potential negative impacts and implement actions to mitigate them on time.

Colombia is among the countries with the most severe preventive measures concerning COVID-19 with a strict nation-wide lockdown in place since mid-March 2020. This has strongly affected the national economy, but not caused large disruptions in food supply and security yet. This in turn has resulted in a weak pronouncement of the adverse impacts the agriculture and livestock sector is now facing. This situation will likely aggravate within the upcoming months, resulting from changes in global agricultural trade and prices, logistical bottlenecks and disruptions along the value chains, or changing consumer behavior, among others.

Nevertheless, formal assessments and documentation are missing in Colombia, since data are still scarce. In this regard, the present document provides an overview on the current and potential impacts of COVID-19 on the Colombian bovine livestock sector. It accounts for the most recent developments and first mitigation measures, by compiling, organizing and describing first observations and informal assessments made by national and international institutions and experts. It serves as guiding document for policy and decision makers and provides suggestions for short-, medium- and long-term mitigation options against potential threats to the sector.

The development of the U.S. Dollar rate since the arrival of COVID-19 in Colombia

The first confirmed COVID-19 case in Colombia was reported on March 6 2020 and this, together with the global impacts of COVID-19 on the oil price, has led to uncertainties among capital investors, generating risk averse behavior and increasing the demand for U.S. Dollars (USD) from the financial system. This has caused a short-term shock in the price of the USD leading to a process of rapid devaluation of the Colombian Peso (COP). The USD reached a maximum price of 4,153.91 COP on March 20 and stayed above 4,000 COP until the end of that same month, leading to the highest devaluation in the history of the currency. During the first two weeks of April, the COP increased in value and by April 15, the price of one USD was 3,858.21 COP. Since then, the USD price has had a boost again, reaching >4,000 COP at the end of April (Banco de la República, 2020a). According to the April 2020 Financial Opinion Survey carried out by Fedesarrollo (Fedesarrollo, 2020b), the main analysts of Colombia's financial sector project an average dollar rate of 3,879 COP until the end of July 2020. Compared to the average dollar rate of 2019 (3,281.09 COP; Banco de la República, 2020b), the increase in 2020 is remarkably high, and will have decisive consequences for the Colombian bovine livestock sector, both for exports and imports of beef and dairy products and for imports of inputs required for primary production and product transformation.





Expected Impacts

Consumption and access

The COVID-19 crisis is affecting consumers in many different ways. Their perceptions, behavior or preferences have direct and indirect impacts on agricultural value chains and in particular, beef and dairy value chains. To define and consolidate mitigation efforts to overcome the current crisis, it is key to understand these impacts, as well as the role and power consumers have as actors in a food system.

Consumers are subject to the economic downturn and rising unemployment coming along with the crisis. Many of them face financial difficulties, are in part-time work or challenge salary reductions, among others. This impact is particularly strong in countries with little or no social safety net and large shares of informal jobs (FAO, 2020a; ECLAC, 2020b; OIT, 2020), such as Colombia, where many citizens have already lost their jobs, faced salary reductions or are forced into informality, being left with little or no income to buy food (Nielsen, 2020). According to FEDESARROLLO (2020), the country's unemployment rate will change from 10.5% in 2019 to 16.3-20.5% in 2020, as a direct result of the crisis. In April 2020, the national unemployment rate had already increased by 9.5% compared to April 2019, reaching 19.8% in total (DANE, 2020f). This is causing a reduction of purchasing power that will further aggravate in the near future. In May 2020, 79% of Colombian households were already experiencing heavy financial struggles due to the current crisis and the rigid lockdown measures (Kantar, 2020).

Consumers have lost confidence and uncertainty prevails, resulting in avoiding spending money on non-essential items (Sullivan and Amos, 2020). Food demand is generally not very elastic and the effect on the overall food consumption will likely be limited. However, a reduction of purchasing power can cause alterations in the food basket because of substitution effects – both short and long-term. Rabobank (2020) estimates the global demand for milk products to decline by 20–30% during the second quarter of 2020, resulting from the closure of restaurants and schools. Milk powder will be affected by approximately 20% and cheese by 13%, respectively. For Colombia, the National Federation of Cattle Producers (*Federación Colombiana de Ganaderos*; FEDEGAN) is projecting that consumers will partially substitute beef, which is among the most expensive protein sources, with cheaper options such as grains or chicken (CONtextoganadero, 2020b). The internal consumption of beef has already reduced by ~2.5% in the first quarter of 2020 (CONtextoganadero, 2020d; DANE-ESAG, 2020b), and cattle slaughtering for internal consumption has decreased by 30–40% during the first weeks of April (CONtextoganadero, 2020h). This will decisively affect the national beef industry. Concerning milk consumption, no negative projections exist so far, since potential substitutes are generally more expensive (e.g. soy

milk, almond milk). Other dairy products (i.e. cheese and yogurt), however, are less demanded since the beginning of the COVID-19 emergency, resulting from school and restaurant shutdowns (Bravo, 2020; Durán, 2020; González Bell, 2020). Regarding short-term changes in food consumption, the uncertainty caused by the pandemic and the extended lockdown has caused panic buying – in Colombia visible above all for milk (CONtextoganadero, 2020a), and led to sudden increases of consumer prices. According to FAO (2020a), there is also a possibility of a disproportional decrease in the consumption of animal protein because consumers might fear animals to be hosts of the virus. There is no scientific evidence for this but increasing amounts of fake news and rumors in social networks contribute to creating insecurity among consumers and aggravating the substitution effect.

Before COVID-19, the offer of sustainable food products in Colombia, including beef and dairy products, was rapidly developing as a response to an increasing demand (i.e. by wealthier consumers) and willingness to pay (Charry et al., 2019), creating opportunities along the value chains (e.g. Charry et al., 2018). The crisis might cause two opposing effects regarding product differentiation efforts (based on Trujillo, 2020; Sullivan and Amos, 2020): First, the abovementioned substitution effect could lead to even less demand for differentiated beef and dairy products, since they are generally more expensive than conventional ones, negatively affecting the development of sustainable value chains. Second, the crisis might lead to a change in consumer perceptions and cause a shift towards more sustainability and animal welfare once the financial means are available, leading to a boost in the development of sustainable value chains. Since the lockdown was put in place, Colombian consumers are also putting more emphasis on healthier diets (Kantar, 2020). The crisis has shown that consumers have lost confidence in the food system and that uncertainty prevails, nurtured also by false information. It is expected that this will influence the demand for more food safety, hygiene and traceability, especially in livestock value chains, leading to higher investments on the part of the industry (Sullivan and Amos, 2020; CONtextoganadero, 2020h).

The options for food purchase and out-house food consumption have also completely changed since the crisis has evolved. Retail is reorienting to supermarkets (i.e. for consumers with higher purchasing power) and traditional, cheaper shops or public markets (i.e. for consumers with lower purchasing power) (FAO, 2020a; Nielsen, 2020). Consumers in Colombia now buy 23% more on public markets compared pre-COVID-19

levels, indicating a loss of purchasing power since the beginning of the pandemic (Nielsen, 2020). Traditional shops, often the cheapest and nearest source of food for poorer people, are experiencing major challenges during the crisis, since they cannot adjust quickly to the changing demand (e.g. limited financial resources, vision and possibilities to change the portfolio). For Colombia, this has resulted in the permanent closure of 15% of these shops, 85% of that attributed to the crisis (Nielsen, 2020). New online platforms for food purchase are popping up (FAO, 2020a), and food sales through the internet, social networks and (mobile) phone are increasing. This is creating opportunities for people to start new businesses in the food sector, reinventing themselves or becoming more efficient. In Colombia, 25% of the consumers already use those channels (reporting increase of 32% in March alone), and 75% of them think about continuing this after the crisis has ended (Kantar, 2020), making a permanent change possible (Sullivan and Amos, 2020). The out-house food consumption has collapsed altogether, since restaurants and bars are now closed to the public and it is not yet clear when they will be allowed to reopen. In order to survive, many restaurants have changed their business models, i.e. added delivery options (or now offer on specialized delivery applications), reduced their menus and prices or offer precooked options for home consumption, while others have shut down completely. This transformation also caused new requirements for bio- and food safety measures, i.e. for food preparation and delivery. Both domestic and international tourism are on hold during the lockdown adding to a reduced food demand, i.e. considering the out-house food consumption and the consumption of high-priced quality food (e.g. special meat cuts). The full magnitude of the crisis on food purchase and out-house food consumption is not yet clear. It is however expected that restaurants and bars (in which food is served) will require more time for recovery than retailers and that workplace catering will become more salient, since more people will remain working from home than before the crisis (Sullivan and Amos, 2020).

Meat and milk prices

In many countries, COVID-19-related increases in food demand and disruptions in value chains (e.g. restrictions for transport or processors) have led to food price increases at local level during the second half of March. Since then and as result of an abruptly declining demand, food prices have tended to fall, being now a major concern for farmers and the agricultural sector (FAO, 2020b). ECLAC (2020a) expects that food price declines will continue over time and affect even goods spared from any downtrend so far.

According to FAO (2020c; see Table 1), average consumer prices for beef and liquid milk have increased between February 14 and May 4, both at global level and in Colombia. Since May 4, beef prices have declined but are still above pre-COVID-19 levels, whereas milk prices continue to increment, both at global level and in Colombia. Nonetheless, strong price fluctuations can be observed for both beef and milk prices during the COVID-19 crisis. In Colombia, a price increase occurred for beef during the last two weeks of March and the first week of April (peak: 15,144 COP/kg average price for all cuts; DANE, 2020a). Since the second week of April, prices have been declining. This has been associated with variations in demand, resulting from lower levels of panic buying and an increasing substitution effect (i.e. with grains) (CONtextoganadero, 2020b). Apart from the abovementioned data from FAO, specific information on

the price development for liquid milk does not yet exist for the period March-April 2020. Yet, DANE (2020b,c) reports that milk was the fourth most bought product in Colombia during the week of April 19–25, especially long-life milk, resulting in a price increase of 1.26% during that time, which reveals panic buying behavior amongst consumers (CONtextoganadero, 2020a). Between April 29 and May 5, the milk price increased again, by 0.57% (DANE, 2020e). The global demand for milk powder has dropped and led to a significant decline in international prices (i.e. in the U.S., Europe and Oceania). While milk processors are currently accumulating their produce to stabilize prices, a flooding of markets is likely to occur once the storage capacities reach their limits. Discarding dairy cows in order to amend milk production and stabilize price levels more permanently, is not a viable option, since abattoirs challenge severe restrictions (e.g. preventive measures, sick personnel) and slaughter volumes have collapsed. Dairy farmers might even start dumping their milk in order to secure price levels, which is already happening in the U.S (Yaffe-Bellany and Corkery, 2020). While prices for milk powder in Colombia had been increasing until the first week of April (peak: 24,284 COP/kg; DANE, 2020a), they are now falling at a steady pace. This price decrease can partly be associated to an oversupply, resulting from tax exemption-related milk powder import increases during the first months of 2020 (prior to the COVID-19 crisis; CONtextoganadero, 2020i,j).

Table 1. Changes in beef and liquid milk prices during the COVID-19 crisis

Commodity	Geography	Unit	Average price change (%, Feb 14-May 4 2020)	Average price change (%, Feb 14-May 13 2020)
Beef, fresh or chilled	Global	1 kg	+5.2	+5.0 (-)
	Colombia		+9	+7.8 (-)
Milk, processed liquid	Global	1 liter	+1.9	+2.2 (+)
	Colombia		+2.9	+3.3 (+)

Source: Own elaboration, data from FAO (2020c)

Beef, dairy and input imports/exports

According to ECLAC (2020a), the collapse of the world economic activity, in particular in the United States, China and Europe, has a negative impact on Latin America and the Caribbean, as trade volumes reduce and prices change in an unpredictable manner, affecting above all trade with raw materials. The World Trade Organization (WTO, 2020) estimates that the world trade volume will drop by 13-32% in 2020 as a direct result of changes in global demand related to the COVID-19 crisis (ECLAC, 2020a). In Latin America and the Caribbean, the strongest impacts will be observable in those South American countries specialized on the export of primary goods and vulnerable to price fluctuations, and a decline in the total export value of agricultural goods of 5% is expected for the region for 2020 (ECLAC, 2020a). Both reduced export volumes and declining global food prices will have important repercussions on the incomes of export-dependent countries (ECLAC, 2020b). Import restrictions will have greater impacts on those sectors depending on imports for maintaining their production and in general for countries depending on beef and dairy imports for satisfying their internal consumption (e.g. large parts of Africa).

Colombia is exporting beef, living cattle and dairy products but the share of the national production destined for export is relatively low. In 2019, Colombia exported 4.2% of its national beef production both as meat (20,773 tons) and living cattle (75,370 cattle heads, equivalent to 19,094 tons of meat), mainly to low-value markets such as Lebanon and Iraq (living cattle) and e.g. Russia, Lebanon, Vietnam or Egypt (beef), generating an export value of 132 million USD (DANE-ESAGa, 2020; FEDEGAN, 2020a; FEDEGAN-FNG, 2020). FEDEGAN reports that the national beef industry was able to mitigate the reduced internal demand by boosting their exporting volumes by 80% during the first quarter of 2020 (CONtextoganadero, 2020d; DANE-ESAG, 2020a). It has yet to be observed if this increased export volume can be maintained or if the decreasing international demand for beef will also affect and reduce Colombian exports. Concerning dairy products, Colombia exported 2,361 tons of in 2019 (of a total milk production of 7.3 billion liters), mainly as cheese, butter and yogurt to the U.S., Chile and Russia, generating an export value of 9.7 million USD (FEDEGAN, 2020b; Legiscomex, 2020a). Compared to 2018, there was a decrease in milk product exports of 54% in 2019, mainly attributed to climate-related production shortages. The current high dollar rate increments the income generated from these exports. FEDEGAN expects the income from beef/living cattle exports to make up 6.46% of the total national

production value for 2020, leading to an increased competitiveness of the national cattle sector against imports (CONtextoganadero, 2020b).

Colombia, a net importer of milk powder, could benefit from price declines but much of that will depend on whether they will be of such magnitude to mitigate the negative effects of the current high dollar rate. FEDEGAN is expecting a decrease in milk powder imports and a resulting boost of the national dairy sector's competitiveness (CONtextoganadero, 2020b).

Although to different extents, both the cattle and the dairy sector depend on imported agricultural inputs. At farm level, these include e.g. forage seeds, feed concentrates and other fodder, vaccines, salt and minerals, or machinery and other equipment. As mentioned before, global market prices have declined for many of these products. FEDEGAN expects the high dollar rate to neutralize the positive effects of declining prices and thus production costs for the Colombian livestock sector to remain high (CONtextoganadero, 2020b). Forage seed exports from Brazil, the largest forage seed producer in the world, have already dropped by 26.9% between March and April 2020, and by 10.9% when compared to April 2019 (Legiscomex, 2020b). Data regarding forage seed imports for Colombia are not yet available but both a reduced demand from the livestock producer side (due to e.g. less available resources) and a reduced offer from the forage seed producer side (due to e.g. disruptions in the value chains, exporting/importing restrictions) are to be expected.



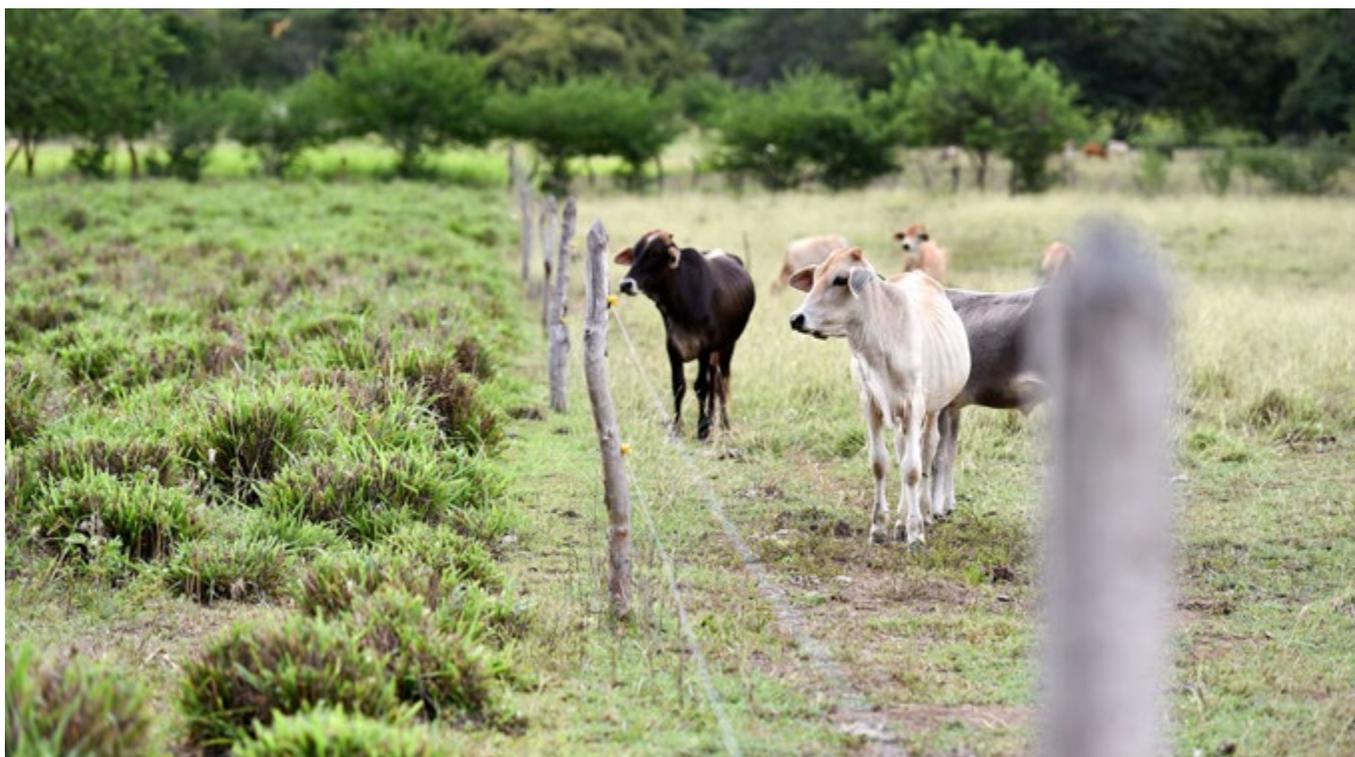
Impacts at farm and value chain level

Input supply, distribution and prices: Agro inputs are required particularly for specialized milk production in the higher tropics and (sustainably) intensified beef production. Some of these inputs are imports (i.e. forage seeds) and as described before, the COVID-19 pandemic might lead to impacts on import prices and product availability. In addition, it might also cause difficulties in the accessibility of both imported and domestically produced inputs in the Colombian rural areas. Lockdowns interrupt or reduce production, quality assurance might be affected and disruptions in logistics result in delivery issues, leading to shortages and eventually (short-term) price increases at farm level (FAO, 2020a). Urea fertilizer prices have on average increased by 9.1% between March and April 2020 (DANE, 2020d). In order to counteract such developments, Resolution 71 of 2020 (MADR, 2020d) obliges distributors of agricultural inputs to report their prices in the Reporting System for Agricultural Input Information (*Sistema de Reporte de Información de Insumos Agropecuarios*, SIRIAGRO) from March 28 2020 onwards or otherwise apply sanctions. Regarding input purchase, difficulties can occur for producers without proper means of transportation or depending on public transport, which in many Colombian regions is either suspended or operating with reduced frequencies. A decreased demand for their products, increased input and consumer prices (considering livestock producers as consumers) are affecting the purchasing power of livestock producers. This can

result in reduced input purchase and negatively affect productivity. Agricultural input shops had to change their operational models in response to the lockdown measures (e.g. providing delivery services). Whether this will cause long-term difficulties for their operations (e.g. bankruptcy) and how this might affect input availability and prices, is not yet clear.

Labor: The lockdown measures have caused short-term effects on the mobility of people, resulting in difficulties for many of them to reach their workplaces. In the rather labor-extensive Colombian bovine livestock sector (which is also strongly dependent on family labor), the impacts will most likely be low. However, labor shortages are occurring at other stages of the value chain, above all for abattoirs and dairy processing plants. In addition, plants are obliged to follow strict biosafety measures (i.e. social distancing), limiting the number of people allowed to work simultaneously and affecting productivity.

Credit: Many Colombian cattle and dairy producers are indebted and a declining productivity could lead to reduced capacities for repaying loans. As a response, the Colombian government, through the National Fund for the Financing of the Agricultural Sector (*Fondo para el financiamiento para el sector agropecuario*; FINAGRO), opened a new credit line called “*Colombia agro produce*” (FINAGRO, 2020). It has a volume of 50 billion COP (~12.7 million USD) to cover a fraction of the interests associated with credits, so that producers would have to bear lower interest rates (below the actual inflation



rate for small- and medium-scale producers; below the current commercial rate for large-scale producers). 40% of the resources were allocated to each small- and medium-scale and the remaining 20% to large-scale producers. Still, just three days after enabling the credit line, the resources for large-scale producers were already exhausted, setting off the alarms of the comptroller's office. Although FINAGRO has clarified that the remaining resources are still available upon request from small- and medium-scale producers, the COVID-19 crisis has already unveiled structural deficiencies within the financial institutions in charge of supporting the agriculture and livestock sector. It has become evident that the institutional capacity to reach small-scale producers is very limited. Consequently, large producers (usually with more access to knowledge and credit offices) can make better use of the incentives offered by the government to encourage production (Suárez, 2020; El Espectador, 2020). In addition to "*Colombia agro produce*", the Decree 486 of 2020 (MADR, 2020a) defined economic incentives for farmers and farm workers older than 70 years during confinement, which can positively impact this vulnerable part of the population if information is disseminated adequately and accessibility can be guaranteed.

Rural extension – technical assistance: According to FAO (2020a), the COVID-19 crisis can reduce livestock producers' access to necessary services, such as public rural extension. The Colombian rural extension system is in transformation since the Congress enacted the so-called SNIA (*Sistema Nacional de Innovación Agropecuaria* - National Agricultural Innovation System) law at the end of 2017 (Congreso de la República de Colombia, 2017). For the Colombian beef and dairy sector, the reach of public rural extension is still very limited and the COVID-19 pandemic is further aggravating this situation. On the one hand, the implementation of departmental extension plans had to be accelerated and done virtually (*Planes Departamentales de Extensión Agropecuaria*, PDEA), reducing their effectiveness in the prioritization of crops and territories that should receive rural extension. On the other hand, producers requesting extension are facing problems in delivering the required documentation and procedures on time, resulting in a mismatch of demand for and offer of rural extension (MADR, 2020e). Distortions in rural extension and the fact that the extension and agricultural credit systems are not interlinked could in the medium- to long-term affect the credit repayment capacity of producers (especially smallholders). In 2019, 85% of the credit repayment defaults (-215 billion COP; -57.4 million USD) corresponded to smallholders (FINAGRO, 2019), although development credits usually involve so-called "*investment control visits*" provided by the

financial institutions. The COVID-19 pandemic affects such farm visits and this, combined with a limited access to productive inputs and distorted rural extension, severely affects farm productivity, resulting in reduced farm incomes and credit repayment capacity (including COVID-19 emergency credits). In the medium- to long-term, important setbacks in the transformation of the rural extension system could occur due to crisis-related public health measures (e.g. confinement, quarantine, lockdown of people working on the transformation) or reallocation of public funds (to more urgent matters of public health or food security). Positive developments are occurring regarding virtual extension efforts: Agrosavia (the national agricultural research institution) and the Chamber of Commerce of Magdalena Medio and Northeastern Antioquia (as well as other institutions) have started extension services for producers using e.g. Facebook, WhatsApp and local radio stations (FEDEGAN, 2020c; CONtextoganadero, 2020g). Some Colombian dairy and beef companies, as well as input suppliers, private agencies and supermarkets, have developed their own systems and programs of rural extension and technical assistance, mostly focusing on supporting the transition towards a sustainable bovine livestock sector. It is not yet clear how much the crisis will affect these efforts and cause interruptions in reaching dairy and cattle producers. Yet, many of these companies struggle with a declining demand for their products (i.e. the beef industry), strategic reallocation of funds (e.g. from their sustainability/technical assistance departments to other departments), dismissal of personnel (e.g. from their sustainability/technical assistance departments), the application of strict biosafety measures (e.g. logistical burdens to reach their farms, social distancing during technical assistance), or even bankruptcy – all issues that might affect the continuance, frequency and quality of their support programs.

Vaccination cycles: On February 5 2020, Colombia recovered its status as foot-and-mouth-disease free country for the first time since September 2018 (ICA, 2020a; CONtextoganadero, 2020e,f; FEDEGAN, 2018). In order to maintain this status over time and to recover lost access to or penetrate new (higher priced) international beef and cattle markets (e.g. Russia, Chile, Turkey, Vietnam or the U.S. and the European Union), the country aims at continuing its bi-annual national-level vaccination cycles, even during the pandemic. For the first vaccination cycle in 2020, scheduled from May 18 to July 1 (ICA, 2020b, ICA, 2020c), investments in new technologies were made (e.g. paper-free data obtainment). Various state institutions (e.g. FEDEGAN, ICA, MADR, Minsalud) developed a 28-point biosafety protocol for the >5,500 vaccinators, administrative

officials and >500,000 cattle/dairy producers, taking into account new requirements related to the current health emergency (CONtextoganadero, 2020f).

Animal and beef transport: In April 2020, the Ministry of Transport (Mintransporte, 2020a), the Ministry of Health (Minsalud, 2020) and the National Institute for Food and Drug Surveillance (Invima, 2020a) issued measures and recommendations for the Colombian transport sector, with special focus on the transport of food and animals. At toll stations, vehicle-washing and disinfection points were established. Food transporting vehicles as well as all used utensils (e.g. food baskets) now need to be washed and disinfected more frequently, and the cold chain needs to be strictly maintained during transport. Regarding the transport of beef and animals, FEDEGAN reports problems: transporters demand higher freight rates, since they are unable to find lodging and food along the roads as a direct consequence of confinement and biosafety measures (CONtextoganadero, 2020b). This is occurring despite declining average fuel prices since March 17 2020 (-9.3% for diesel fuel and -13.3% for gasoline; Ministerio de Minas y Energía, 2020) and temporarily suspended toll fees (Mintransporte, 2020b), leading to disruptions in food supply and increased consumer prices.

Abattoirs: People working at abattoirs are especially exposed to COVID-19 infections, and local outbreaks have occurred in various parts of the world (e.g. in Germany or the UK; Askew, 2020; Perrett, 2020), making precautionary measures essential for assuring staff health, food safety and food security. On May 1 2020, the National Institute for Food and Drug Surveillance (Invima, 2020b) generated a series of biosafety and other recommendations for operating Colombian abattoirs. These include, among others, a strict compliance with health protocols (for workers, carriers and any other person entering the plant) and entry restrictions for contractors, suppliers or service providers. In order to assure the health of employees and clients and to comply with biosafety measures (e.g. social distancing), some of the larger abattoirs (e.g. F.S.I., BLE and Guadalupe) have reduced their slaughter hours and days (CONtextoganadero, 2020d), causing disruptions in the beef value chain. Since long before the COVID-19 crisis (precisely since 2007 and as defined by Decree 1500; Ministerio de la Protección Social, 2007), Colombia is undergoing a restructuring process of the beef value chain, including the shift from informal slaughtering facilities to formal abattoirs. The implementation of Decree 1500, however, was postponed eight times and only became effective in 2016, although with prorogations in specific cases

where slaughtering facilities have shown advances in their gradual compliance plans. Consequently, many of the rural (but formal) abattoirs were shut down, since they neither complied with the additional health, environmental and safety standards nor adjusted their operations due to insufficient funds. This has derived into several bottlenecks, which are largely unsolved until the present. These include a) a spread of illegal, clandestine slaughtering facilities on farms or in private houses (no traceability, no control, precarious hygiene), b) undermined food security, i.e. in rural areas (public health issues, less production, distribution problems), c) increased rural unemployment (less incentives for getting involved in the livestock sector), and d) increased cattle rustling (Díaz and Burkart, 2019). It is likely that the current COVID-19 crisis will contribute to aggravate these problems, i.e. in remote rural areas.

Milk collection and processing: As for animal and beef transport, several State institutions (Mintransporte, 2020a; Minsalud, 2020; Invima, 2020a) established new standards and recommendations for milk/dairy product collection, transport and processing. This has caused disruptions in milk collection and transport as well as in dairy processing. Although the consumer demand for (long-life) liquid milk has increased since COVID-19, important reductions occurred in the demand for processed dairy products, such as yogurt or cheese (especially from the informal sector) principally destined for restaurants or bakeries in cities, which are currently closed or operating to a limited extent. In the Nariño Department, informal milk collection has reduced by at least 50% (500,000 liters per day) and this has affected more than 40,000 dairy producers and artisanal dairy processors (Bravo, 2020). In the Huila Department, informal milk collection destined for cheese and yogurt production has strongly decreased (Durán, 2020). This has not only affected milk producers and informal dairy processors but also leaves the informal milk value chains (which make up ~57% of the national milk production, USP, 2020) and the involved intermediaries, without cash flow. This limits the purchasing power of smaller dairy plants and directly affects dairy producers who have no other option than selling their milk on the informal market due to quantity and quality restrictions. These effects are more visible for dairy producers in the country's lower tropics, where most of the informal milk production happens under double-purpose systems (beef and milk; Bravo et al., 2018; Enciso et al., 2018). On May 15 and as a response to that, the Ministry of Agriculture and Rural Development (MADR, 2020b) assigned 2.7 billion COP (~686,000 USD) to reactivate the decreased milk collection. The resolution is initially being applied in the departments of Nariño, Caquetá, Huila,

Arauca and Meta, where a reduction in milk collection was observed. It comprises a compensation value of 120 COP (~0.03 USD) for any liter of milk purchased, if surpassing the total sales level registered for the same month in 2019. The crisis is also affecting the (more) formal dairy sector, although to a lower extent. Lácteos El Pomar, a dairy manufacturer from Bogotá specialized on long-life milk and yogurt, announced that their yogurt sales decreased by 20% during quarantine due to school closures and the resulting decrease in demand for lunch boxes (González Bell, 2020). Regarding milk payments to the producers, Resolution 017 of 2012 (MADR, 2012) defines hygienic and compositional quality criteria to establish the reference price for one liter of milk. The big dairy companies operating in Colombia (e.g. Alquería, Alpina or Nestlé) have expressed that their capacity to send milk samples to laboratories for quality assurance has been limited due to the current crisis (Sectorial, 2020). Addressing such dynamics, the Ministry of Agriculture and Rural Development issued Resolution 072 of 2020 (MADR, 2020c), which temporarily modifies the price setting system for raw milk payments to the producer. This modification allows purchasing agents and processors of raw milk to pay a price based on the average of the last three quality analyses conducted before March 15 2020 and/or on the last records of the national average milk prices registered and published by the Milk Price Monitoring Unit (Unidad de Seguimiento de los Precios de la Leche). Although this measure is aimed at maintaining the formal dairy sector stable during the pandemic, it might be a short- to medium-

term disincentive for dairy producers to invest in their dairy system, e.g. in the improvement of forages or the establishment of silvo-pastoral systems, aiming at increasing milk quality and obtaining higher prices on the raw market.

Research: Agricultural research plays a fundamental role in moving global agriculture towards more productivity, efficiency and sustainability. Especially in the global tropics and subtropics, (international) agricultural research also contributes to the reduction of poverty, hunger and environmental degradation and the strengthening of food systems and food security. The COVID-19 crisis with its related public health measures and the resulting global economic downturn, are putting agricultural research at risk in different ways, jeopardizing short-, medium- and long-term undertakings for solving imminent and urgent global problems that affect billions of (rural) people. This includes, on the one hand, reductions in research budgets, since donors might shift their resources away from medium- and long-term perspective or exploratory research towards short-term emergencies, such as the development of vaccines or remedies, the search of immediate responses to the crisis and addressing evolving humanitarian crises. Research conducted or funded by the private sector might also perceive reductions, since companies are facing e.g. declined demand for their products and thus perceive less income, disruptions in their value chains and productivity loss due to restrictions for their employees. On the other hand, public health



measures (i.e. lockdowns) directly affect the execution of planned research (e.g. in the field and in laboratories), causing interruptions, postponements or a complete cancellation of activities. Where research activities can still be conducted, strict biosafety measures have to be followed, requiring stronger efforts in terms of planning and time. Agricultural research is also partially competing with the health sector for required protection gear, such as masks, gloves or suits (Lyseng, 2020), which could lead to conflicts of interest. The bovine livestock research system in Colombia comprises a multitude of international (e.g. The Alliance of Bioversity International and CIAT, CIPAV or international universities), national (e.g. Agrosavia, the Alexander von Humboldt Institute or national universities) and private sector (e.g. forage seed companies, fertilizer or vaccine developers) actors. The COVID-19 crisis will affect these actors in different magnitudes. Some effects, like (temporal) budget cuts and suspension of (less urgent) research activities or the strict application of biosafety and public health measures are already visible. A shift in research focus towards finding short-term solutions to mitigate the effects of the crisis on agriculture and finding medium- and long-term solutions for the development of more resilient food systems and healthier diets has already begun (e.g. CGIAR, 2020; The Alliance of Bioversity International and CIAT, 2020). In the course of the pandemic, the Colombian Ministry of Science, Technology and Innovation (Minciencias) approved the historically high amount of 249 billion COP (~65 million USD) for the strengthening of 88 public molecular biology laboratories in 27 departments (Minciencias, 2020a). The resources were reallocated from the Science, Technology and Innovation Fund of the General Royalty System of Colombia (*Fondo de Ciencia, Tecnología e Innovación del Sistema General de Regalías*, SGR), which also funds research projects for the bovine livestock sector. Minciencias, together with the National Learning Service (*Servicio Nacional de Aprendizaje*, SENA), support the initiative “*Mincienciación*” with 32 billion COP (~8.3 million USD), aiming at research and development of technologies that can contribute to solve the pandemic (Minciencias, 2020b). Agrosavia is starting to conduct COVID-19 tests in their laboratories (Agrosavia, 2020a,b). These examples show that a reallocation of funds (SGR) or a shift in priorities (SENA, Agrosavia) can affect research activities for the bovine livestock sector in Colombia and lead to important setbacks, i.e. in the transition towards more sustainability. Nonetheless, it can also lead to new opportunities, i.e. in strengthening the food systems with particular focus on the consumer, or in supporting the formalization of the dairy and beef value chains taking into account traceability and food

safety more than before. The full magnitude of the crisis on research and the implications for the sector, however, have yet to become visible in order to be fully analyzed and understood.

Multi-actor platforms and roundtables: Colombia counts on numerous multi-actor initiatives for supporting its bovine livestock sector, i.e. in the transition towards sustainability and adaptation to and mitigation of climate change. These include the Colombian Roundtable for Sustainable Livestock (*Mesa de Ganadería Sostenible* - MGS, since 2014) with its 12 local roundtables, the Tropical Forest Alliance (TFA, since 2017), which established the Zero-Deforestation Agreements (*Acuerdos Cero Deforestación*, for beef and dairy since 2019), and the Local Technical Agroclimatic Committees (*Mesas Técnicas Agroclimáticas* - LTACs, since 2013); (MADS, 2019; Martínez Barón et al., n.d.; FEDEGAN, 2020d). The COVID-19 pandemic is affecting the diverse initiatives in different ways. What they all have in common is a shift from frequent face-to-face meetings and workshops to virtual encounters, which might be less frequent, productive or efficient. They also count on the active participation of the public sector, private companies, NGOs, academia and primary producers, among others, which are – to different extents – facing the downturn of the global economy. Staff and budget reductions have led to a discontinuance of institutional representatives and resulted in a (temporary) reduction of inter-institutional connections and networks, arising issues regarding the compliance with contributions, and reduced (financial) compromises. The local roundtables of the MGS, usually organizers of capacity building events, cannot conduct such activities because of the lockdown measures. The implementation of the Zero-Deforestation Agreements has slowed down and the committed companies and institutions cannot properly visit their producers to verify compliance with the established sustainability agreements. It is yet too early to see the full magnitude of the crisis on the described initiatives but important setbacks are to be expected. As a mitigation measure to face the current emergency and to keep the discussions in the country active, the MGS has established a virtual seminar series (from May to August 2020) on the transition of the bovine livestock sector towards sustainability (“*Conversatorios sobre Ganadería Sostenible*”), focusing on elements like climate change, biodiversity, sustainable markets/consumption and rural extension (Mesa de Ganadería Sostenible, 2020).

Communication for advancing the bovine livestock sector: Before COVID-19, the communication of research advances or new ideas and developments for the Colombian bovine livestock sector has mostly happened



face-to-face during e.g. meetings, workshops, farmer-field-days, trainings or larger events (such as fairs or conferences), organized by the actors involved in the knowledge and innovation system. Since these events require large monetary and logistic investments, the number of participants and reach were quite limited. The pandemic and the resulting restructuration processes within the (public and private) institutions, as well as the mandatory public health measures, have led to a rethinking about how to reach potential next- and end-users of information better. Many institutions are now offering virtual events, such as seminars, seminar series, conferences or courses, most of them free of charge, attracting an unexpectedly high number of participants. It is likely that these efforts will continue after the crisis has ended, leading to a wider spread of valuable information and positive impacts on the livestock sector. Although connectivity to the internet has gone up by 40% during the pandemic (MinTic, 2020a), 52% of the population still do not have direct access to the internet (with a huge gap between rural and urban areas; Revista Semana, 2020), limiting the positive effects of digitalization to certain parts of the livestock sector in the short- to medium-term. One of the aims of the Colombian Government is to increase internet connectivity to 70% of the population by 2022 (Revista Semana, 2020). The current situation is contributing to accelerating this process (MinTic, 2020b) and enhancing digital literacy among the population.

Vulnerability and rural education: gender, youth and minorities

Potential societal impacts of the COVID-19 crisis are and will be far from gender neutral. While not yet fully assessed, the pandemic will have lasting effects on rural livelihoods, altering family dynamics and endangering historical gains in terms of inclusion and gender equality (UN, 2020; ONU Mujeres, 2020). The cattle and dairy sector will not be exempt from these disruptive transformations, and female producers will endure the exacerbation of existing hardships, such as increasing unpaid reproductive labor, decreasing sources of income and the incisive repercussions of social tensions and conflicts that will arise from the crisis in fragile contexts, such as Colombia's countryside (ECLAC, 2020b).

Women in the cattle and dairy sector in Colombia (and also Latin America) have largely experienced the prevalent inequities of labor division based on gender identity, often carrying out productive and reproductive labor simultaneously without major monetary compensation (Triana and Burkart, 2019). While migration and the exponential growth of markets have contributed to a destabilization of gender roles and female empowerment becomes a tangible reality, restrictions to mobility and nationwide lockdown measures due to the present COVID-19 emergency are confining women to their homes and constraining them to unpaid forms of labor. Forced

confinement is undoubtedly increasing domestic work carried out by women both in rural and urban areas (UN, 2020), with the aggravating factor of precarious subsistence familiar economies immensely affected by an uncertain national panorama. In Colombia, local associations and media have begun to alert of the dangers of such contingent dynamics, unveiling how COVID-19 affects rural women with full force. Livestock producing regions, such as Cauca, Urabá and Caquetá, have reported a worrisome increase in domestic labor exploitation, gendered violence and convoluted intra-family dynamics at the onset of the pandemic, a panorama further complicated by the emerging presence of armed actors in rural areas (Valdés, 2020).

Besides the rather obvious, harmful consequences of lockdown measurements at the individual level, female livestock producers also experience economic restrictions that affect household survival. Studies in the subject have signaled the centrality of informal markets for women and ethnic minorities in Colombia and Latin America, who rely on such spaces for the artisanal fabrication and commercialization of dairy products (Gumucio et al., 2015; Toruño-Morales, 2012; Vázquez-García, 2015). The necessary enforcement and introduction of new hygiene protocols and the persecution of informal markets failing compliance with such standards will affect women and minorities more incisively, hindering their much necessary contributions to household economies (FAO, 2020d). COVID-19 challenges, although surmountable, will (and are) surely deepen gender inequities in the cattle and dairy sector in Colombia, an already pervasive dynamic in urgent need of transformation.

The COVID-19 crisis also surfaces existing emergencies affecting children and youth in rural Colombia. The indeterminate closure of public schools poses several, serious risks to literacy amongst peasant communities. An already insufficient access to education is now further complicated with the suspension of the academic year or the utopic virtualization of learning processes in rural areas (Bult, 2020). Impoverished rural families lack appropriate material conditions to ensure children and youth can indeed continue their studies though a virtual format and accessing internet is not only difficult but also highly expensive outside capital centers. This holds true for many livestock producing families, as highlighted by Mauricio Ariza (personal communication, May 15 2020), Senior National Coordinator of Livestock Development at Alquería, one of the country's major dairy companies. One of their rural education programs (*Herederos de Tradición* - Heirs of Tradition; Triana and Ariza, 2019), aimed at empowering and educating future generations

of livestock farmers in matters of soil management, animal care and better environmental practices, is currently suffering the consequences of a prolonged lockdown. Most students are unable to continue with their training due to unstable or impossible connectivity or lacking equipment – a common experience among rural students that jeopardizes an equal access to information, resources, and technology.

In Colombia, numerous media headlines echo this disparity: access to education, especially in times of contingency (as in the present pandemic) can certainly become a class privilege. Rural children and youth are more vulnerable to delays in their training and education plans, and are often facing the treacherous reality of having to drop out of school to help their families cope with economic scarcity. Many students, i.e. in peasant communities, depend on schools to cover some of their most basic needs, such as food (Duque Vergara, 2020; Tabora, 2020), and are now being deprived of such services (González Bell, 2020). Furthermore, the harmful consequences of lacking appropriate connectivity and a fair access to education hits vulnerable communities, such as ethnic minorities and young women, even harder. Daughters and sisters continue to play critical roles within rural households, combining their academic duties with domestic responsibilities, now also incremented by the COVID-19 crisis, which renders evident that larger societal effects of the pandemic are always gendered, even among children and young females. Given the present difficulties to guarantee network connectivity and virtual education in rural settings, alternatives such as radio schools are making an important comeback (Izquierdo, 2020). Commonly used in Colombia's countryside as means to promote and ensure literacy, radio schools are resurging as useful mechanisms to overcome the many difficulties posed by the current crisis and as means to provide, at least to some extent, a certain equality in the always-urgent access to education.

Impacts on the sustainable intensification of the bovine livestock sector

Sustainable intensification (e.g. Rao et al., 2015) in the Colombian bovine livestock sector is one of the most important debates in the country over the past years. Numerous efforts and advances have been made by the public sector, private companies, NGOs and academia in the transition of the sector, including research and development, the formulation of policies and agreements, the creation of incentives, the development of sustainable products, the establishment of platforms and roundtables or the restructuring of capacity building. The COVID-19 pandemic jeopardizes these achievements

and limits further advances significantly, from many different angles.

Cattle and dairy producers can now perceive disincentives for investing in sustainable systems, originating from increased input prices and limited access to inputs (i.e. forages seeds mainly imported from Brazil and Mexico), a reduced income and investment capacity (due to decreasing demand for their products), or limited possibilities of their buyers for paying differentiated prices and providing technical assistance. Young livestock producers, potential investors for sustainable production systems, could be less motivated to seek a future in the livestock sector and thus migrate to cities in large numbers (even more than before the crisis), aggravating problems of generational transfer. Female livestock producers, often bearers of critical roles as agents of change in the adoption of new technologies (Triana and Burkart, 2019), could lose their access to markets (where they sell e.g. cheese or yogurt) if informal markets are being persecuted, leading to lower household incomes and reducing the capacities for investing in new technologies that support their uptake.

Research on new technologies for sustainable intensification, such as improved forages, vaccines or fertilizers, will face budget cuts and reduced new funds, and will (partially) shift its focus, leading to mid- and long-term technology and knowledge gaps. NGOs, public sector, multi-stakeholder platforms and private companies will endure reductions in personnel and

budgets, which will disturb their proper function in this transition process, as before the crisis. There could be less pilot and scaling projects for implementing sustainable technologies at a larger scale, fewer capacities for technical assistance, less rural extension and less support at policy- and decision-making levels – at least in the short- to medium-term.

The reduced income of consumers and the resulting declined demand for beef and some dairy products will lead to resource scarcity within the value chains. This could strongly affect the development of differentiated products and interrupt the market pull for sustainability, usually one of the strongest drivers for transition. In the long-term, a new consumer conscience, developed or strengthened as a response to the crisis, could lead to an increasing demand for sustainable products – if they financial means are available (Trujillo, 2020; Sullivan and Amos, 2020).

These factors could not only entail a setback in environmental sustainability but also endanger livestock producers' adaptive capacity to climate change, hinder social sustainability and engender social tensions (especially in rural Colombia), threaten economic sustainability (less productivity, less income), and finally affect the nutrition and, to some extent, food security among vulnerable communities in the country. Colombia, a nation striving for a place amidst the international high-value beef market, could become even less competitive if no rapid mitigation strategies are found.



Potential short-, medium- and long-term mitigation options

Based on the analysis of the current and potential impacts of COVID-19 on the bovine livestock sector in Colombia as described in the previous sections, this chapter presents suggestions on how to mitigate the crisis in the short-, medium- and long-term. The authors also estimate the magnitude of existing and potential impacts, based on the already visible developments and the projections described in the sources analyzed.

Table 2. Mitigation options for supporting the consumption of beef and dairy products

Short-term (i.e. during lockdown)		Medium- and long-term	
Potential impact and magnitude	Potential mitigation strategies	Potential impact and magnitude	Potential mitigation strategies
Consumer price increases due to panic buying and supply shortages	<ul style="list-style-type: none"> Provision of information to the consumer to reduce panic Restrictions on food purchase (e.g. defined quantities/capita) Price monitoring to avoid artificial price increases Support of value chains: exceptions from movement restrictions, logistical support 	More permanent consumer price increases (resulting from permanent biosafety measures, value chain disruptions and a loss in productivity)	<ul style="list-style-type: none"> Support the formalization and efficiency of beef and dairy value chains Encourage and support primary producers in investing in technologies for sustainable intensification Price monitoring to avoid artificial price increases
Substitution of beef and dairy products by cheaper alternatives or due to shutdowns of schools, bakeries and restaurants	<ul style="list-style-type: none"> Support informal beef and dairy value chains with short-term emergency measures (e.g. compensation payments) to ensure cash flow Develop biosafety measures for schools, bakeries and restaurants to speed up a safe reopening Support the development of other (virtual) distribution channels 	Long-term substitution of beef and dairy products due to a change in consumer preferences (e.g. healthier diets, vegetarianism, veganism)	<ul style="list-style-type: none"> Promote the consumption of animal source food in recommended quantities and from sustainable production systems Emphasize on the importance of animal source food for child development Support the development of sustainable production systems, value chains and markets Strengthen export of beef and dairy products
Reduced consumption of beef and dairy products due to fake news on the transmission of COVID-19 through animals	<ul style="list-style-type: none"> Provision of information to the consumer to reduce panic 	Increased demand for more food safety, hygiene and traceability	<ul style="list-style-type: none"> Support the development of traceability systems for beef and milk Support the formalization of the beef and dairy value chains Define uniform hygiene, food safety, sustainability and animal welfare standards for beef and milk value chains Support research on sustainable food systems
Reduced demand for sustainable beef and dairy products	<ul style="list-style-type: none"> Support the transformation of the beef and dairy sector towards more sustainability in order to reach economies of scale along the value chains and reduce consumer prices Provision of information to the consumer to stimulate demand 	Reduced demand for sustainable beef and dairy products	<ul style="list-style-type: none"> Support the transformation of the beef and dairy sector towards more sustainability in order to reach economies of scale along the value chains and reduce consumer prices Develop national sustainability standards for beef and milk products Provision of information to the consumer to stimulate demand Support research on sustainable food systems Strengthen export of beef and dairy products
Bankruptcy of local shops important for food access in poorer neighborhoods resulting from	<ul style="list-style-type: none"> Support the shops in adjusting their food offer to a changing demand, in formalizing and crisis management Short-term credits or financial support to assure business survival and local food supply 		
Increased demand for products offered by supermarkets	<ul style="list-style-type: none"> Provide quality control and biosafety standards necessary to assure staff and consumer health and food safety, i.e. for beef and fresh dairy products Support the development of delivery platforms for supermarkets 	Increased demand for products from supermarkets	<ul style="list-style-type: none"> Provide quality control and biosafety standards necessary to assure staff and consumer health and food safety, i.e. for beef and fresh dairy products Support the development of delivery platforms for supermarkets
Increased use of virtual food purchase	<ul style="list-style-type: none"> Support the development of virtual options Provide quality control and biosafety standards necessary to assure staff and consumer health and food safety, i.e. for beef and fresh dairy products 	Increased use of virtual food purchase	<ul style="list-style-type: none"> Support the development of virtual options Provide quality control and biosafety standards necessary to assure staff and consumer health and food safety, i.e. for beef and fresh dairy products

Magnitude: | Low ■ Medium ■ High ■

Short-term (i.e. during lockdown)		Medium- and long-term	
Potential impact and magnitude	Potential mitigation strategies	Potential impact and magnitude	Potential mitigation strategies
Closure of restaurants and limited food access	<ul style="list-style-type: none"> Support the development of delivery and catering options Provide quality control and biosafety standards necessary to assure staff and consumer health and food safety, i.e. for beef and fresh dairy products Short-term credits or financial support to assure business survival and food supply 	Permanent change in the operational model of restaurants	<ul style="list-style-type: none"> Provide quality control and biosafety standards necessary to assure staff and consumer health and food safety, i.e. for beef and fresh dairy products Support traceability and sustainability in the food supply
Children from vulnerable households have limited access to dairy products due to school closure	<ul style="list-style-type: none"> Ensure access to dairy products during confinement 		

Table 3. Mitigation options for supporting the export of beef and dairy products.

Short-term (i.e. during lockdown)		Medium- and long-term	
Potential impact and magnitude	Potential mitigation strategies	Potential impact and magnitude	Potential mitigation strategies
Reduced demand for cattle and beef from countries currently importing from Colombia	Market diversification: Develop for new markets in countries not able to produce sufficient beef to satisfy their demand (e.g. Middle East countries, China)	Reduced demand for cattle and beef from countries currently importing from Colombia	<ul style="list-style-type: none"> Market diversification: Develop for new markets in countries not able to produce sufficient beef to satisfy their demand (e.g. Middle East countries, China). Investments in formalizing the cattle and dairy value chains with focus on sustainable production as differentiating factor for entering high-value markets (e.g. U.S., European Union).
Reduced availability of imported forage seeds	Encourage agro-input distributors to revise and promote the use of existing seed stocks	Reduced availability of imported forage seeds	Encourage and support the local production of legume seeds for sustainable intensification

Table 4. Mitigation options for supporting livestock producers and value chains.

Short-term (i.e. during lockdown)		Medium- and long-term	
Potential impact and magnitude	Potential mitigation strategies	Potential impact and magnitude	Potential mitigation strategies
Input supply, distribution and prices			
Increased input prices (difficulties with imports, national production and distribution)	<ul style="list-style-type: none"> Price monitoring (SIRIAGRO) Give equal attention to imports Exceptions from movement restrictions for transport, distribution and sales of inputs Subsidies or low-interest credits for input purchase 	Increased input prices	<ul style="list-style-type: none"> Price regulation or direct price control Strengthen bilateral negotiations and agreements Strengthen national input production capacity Favorable credits for input purchase
Reduced access to inputs (due to lockdown)	<ul style="list-style-type: none"> Exceptions from movement restrictions for the purchase of inputs Support delivery services of inputs 	<ul style="list-style-type: none"> Reduced access to inputs (due to bankruptcy of agro-input distributors) Decline in productivity and production volumes 	<ul style="list-style-type: none"> Support of distributors in reestablishing their businesses (subsidies, credits) Focus on incentives for sustainable intensification (e.g. silvo-pastoral systems)
Rural extension – technical assistance			
Cancelled face-to-face extension	Encourage and support models for virtual extension via social networks or radio	Reduced face-to-face extension	<ul style="list-style-type: none"> Harmonize the content of different models for virtual extension Encourage and support development of virtual extension platforms Biosafety measures, guidelines and controls for assuring health of people involved in face-to-face extension

Short-term (i.e. during lockdown)		Medium- and long-term	
Potential impact and magnitude	Potential mitigation strategies	Potential impact and magnitude	Potential mitigation strategies
Cancelled technical assistance by private companies (resulting in wrong application of technologies)	Encourage models for virtual technical assistance via social networks or radio	Interruptions in the transformation of the public rural extension system (lack of funds, staff)	Encourage and support creation of private extension systems Encourage and support farmer-to-farmer extension approaches
Credit			
Declining productivity affects farmer's capacities for repaying loans Limited accessibility of "Colombia agro produce" for small- and medium-scale producers	"Colombia agro produce" as measure for reducing interests during the crisis Ensure and preserve the resources for small- and medium-scale producers Identify mechanisms for increasing the physical access to the measure, i.e. in remote rural areas Accompany emergency credits with technical assistance and extension to ensure repayment capacity	Structural bottlenecks in the accessibility of credits for small- and medium-scale producers are visible and affect medium- and long-term credit measures to combat the crisis	Open more branches, i.e. in remote rural areas Provide clear and understandable information to producers on the reach of a credit and the requirements for obtaining it Provide support in compiling and organizing required documentation Link the credit system with the extension system and departmental extension plans (PDEA) to ensure investment efficiency Accompany credits with extension and technical assistance to increase efficiency of investments and credit repayment capacity
Vaccination cycles			
Additional requirements for assuring public health	Investments in technologies Development of biosafety protocols	Additional requirements for assuring public health	Revision and adjustments of new technologies and biosafety protocols
Animal and beef transport			
Increased freight rates (lockdown-related limited lodging and food options on roads) Food hygiene and safety affected during transport New animal health concerns (due to longer routes)	Suspension of toll fees Exceptions for lodging and food provision along main roads following strict biosafety measures and controls Measures and recommendations for transport of food and animals during the crisis Establish strict protocols and controls for animal health during transport	Increased freight rates continue Food hygiene and safety affected during transport	Monitor prices in order to prevent price manipulation Revision and adjustment of measures and recommendations for transport of food and animals during the crisis
Abattoirs, milk collection and dairy processing			
Labor shortages at abattoirs/dairy plants, health and food safety risks Clandestine slaughtering increases, risking public health Milk and dairy product hygiene and safety affected during collection, transport and processing	Exceptions from movement restrictions for people working in food processing Biosafety measures, guidelines and controls for assuring staff and contractor health/food safety Pause the requirements established by Decree 1500 of 2007 or extend deadlines for compliance in order to facilitate reopening of small, formal slaughtering facilities and reduce clandestine slaughtering Measures and recommendations for collection, transport and processing of milk and dairy products	Labor shortages at abattoirs/dairy plants, health and food safety risks More delays in implementing Decree 1500 of 2007 (reduced financial capacities) Milk and dairy product hygiene and safety affected during collection, transport and processing	Support investments for mechanization of food processing Revise and adjust biosafety measures, guidelines and controls for assuring staff and contractor health/food safety Pause the evaluation process of formal abattoirs during the crisis and extend deadlines for compliance with Decree 1500 of 2007 Support development of a digital platform for registering new evaluation processes Develop an online system for sharing gradual compliance plans Revision and adjustment of measures and recommendations for collection, transport and processing of milk and dairy products Support investments for mechanization of dairy processing

Magnitude:

Low



Medium



High



Short-term (i.e. during lockdown)		Medium- and long-term	
Potential impact and magnitude	Potential mitigation strategies	Potential impact and magnitude	Potential mitigation strategies
Reduced milk collection in some departments, i.e. in informal value chains	Compensation payment of 120 COP per liter of milk collected, provided by the Ministry of Agriculture and Rural Development	Informal dairy value chain without capital and dairy producers without alternatives for selling their milk	Incentivize formalization processes of informal dairy value chains Incentivize investments in sustainable intensification of smallholder dairy farms in order to assure access to formal dairy value chains
Limited possibilities for milk quality analysis in formal dairy value chain	Decree 072 of 2020 on modification of price setting system for milk	Reduced incentives for dairy producers to invest in sustainable intensification as a result of Dec. 72/2020	Assure the temporary character of Decree 072 of 2020 as an immediate crisis measure Incentivize investments in sustainable intensification of dairy farms
Research			
Difficulties in executing (urgent) research activities in the field or in laboratories	Exceptions from movement restrictions for researchers involved in urgent research activities Development of strict biosafety protocols for researchers in laboratories and the field	Limited advances in research for the livestock sector (due to suspension or interruption of research activities)	Revision of technologies, methodologies or results already generated and identification of scaling strategies for the time after the crisis
Reduced budgets for national and international research institutions	Maximizing efficiencies and collaboration within and among the institutions involved in research for the livestock sector	Technology and knowledge gaps in the livestock sector, resulting from interruptions in research, reduced budgets and shift in focus	Funding of the most critical research for the most affected areas Pooling of resources and funding of few large projects instead of many small projects in order to assure impact generation
Shift in research focus or in the use of facilities towards short-term responses to the crisis at the expense of medium- and long-term strategic research	Reallocation of existing funds Capacity building of researchers	More permanent shift in research focus to prepare the livestock sector and food system for the post-COVID-19 era	Provision of new funds Capacity building of researchers
Multi-actor platforms, roundtables and communication			
Stop of face-to-face encounters limits interaction and advances in supporting the transition towards a sustainable livestock sector	Support the use of virtual options for interacting, knowledge sharing and reaching more people	Virtual options become more important	Capacity building in the use of virtual options Support the purchase of licenses for linking more people virtually at the same time
Reduction of inter-institutional connections and networks, problems regarding the compliance with contributions, and reduced (financial) compromises (due to budget/staff reductions of member institutions)	Postponement of planned compromises	Financial instability and no sustainability of the platforms jeopardize medium- and long-term support for the transition of the bovine livestock sector towards sustainability	Financial support of the initiatives Harmonization of different efforts from different platforms Encourage collaboration among the different platforms Encourage merger of different platforms Foster the use of digital tools/apps among the target groups to ensure effective engagement with virtual meetings.
Restricted access to knowledge due to lack of connectivity to the internet (i.e. in rural areas)	Strengthen knowledge networks through simple and more accessible platforms such as social media and group chat apps	Restricted access to knowledge due to lack of connectivity to the internet	Strengthen and develop infrastructure for internet connectivity, i.e. in rural areas

Table 5. Mitigation options for reducing the vulnerability of primary producers.

Short-term (i.e. during lockdown)		Medium- and long-term	
Potential impact and magnitude	Potential mitigation strategies	Potential impact and magnitude	Potential mitigation strategies
Increased vulnerability of primary producers	Short-term subsidies or credits for crisis mitigation	Increased vulnerability of primary producers to future crises and climate change	<ul style="list-style-type: none"> Support income diversification of cattle and dairy producers (e.g. legume seed production, hay- and silage-making as businesses; or off-farm opportunities) Support diversification in the production of staple crops essential for local and smallholder household food security (e.g. livestock and grains) Support implementation of technologies that help producers to adapt to climate change (e.g. sustainable intensification) Finance research and development projects that support primary producers in adaptation to climate change and crisis preparation Support product differentiation (e.g. denominated origin) and linking producers to markets
Rural education reduced due to school closure and limited internet access	Development of an emergency plan for rural youth education based on available technologies (e.g. mobile phones, radio stations, TV)	Migration of rural youth to cities – problems with generational relief	<ul style="list-style-type: none"> Support market-oriented education initiatives linking with private sector (e.g. dairy processors, beef companies) Support generational transfer processes and clear succession planning Support access of young producers to credit for sustainable intensification Invest in infrastructure to ensure internet connectivity in rural areas
Female smallholder livestock producers lose access to informal markets for artisanal products (e.g. yoghurt, cheese)	Short-term subsidies or credits for crisis mitigation	Female smallholder livestock producers lose access to informal markets for artisanal products (e.g. yoghurt, cheese)	<ul style="list-style-type: none"> Support in formalization processes Support associativity Support product differentiation (e.g. denominated origin) and linking female producers to markets Involve female producers in research and development projects as agents of change

Conclusions

The analysis of the existing information and data has revealed that COVID-19 is affecting the Colombian bovine livestock sector and its associated value chains in multiple dimensions and magnitudes. This includes all actors directly involved in or supporting the beef and dairy value chains, consumers, as well as rural communities and vulnerable segments of the population. The impacts are or will be negative in many cases and adequate mitigation measures need to be identified and implemented in order to assure food production, access and security in the short- and long-term. Nevertheless, the pandemic has also engendered positive developments that will uplift the sector in the future. There is no doubt that both the negative and the positive impacts will shape the future of the sector and its associated value chains.

Consumer perceptions and preferences will become more salient and their demand for food safety and traceability will change the way value chains operate, pushing them towards more formality. Sustainability and sustainable products will certainly become more important. However, their chance to stand out on the market will depend on the purchasing power of consumers, which will be reduced for an extended period after the crisis. Providing consumers with information on traceability, sustainability, animal welfare, food origin and risks, will be more crucial than ever for assuring market shares. The substitution of beef with cheaper protein sources will remain for some time and the internal market will suffer, but this will open additional possibilities for exports. Colombia can develop new export markets and obtain higher prices if it manages to stay foot-and-mouth disease free.

The formalization of value chains can lead to benefits for cattle and dairy producers, if they receive adequate support in the transformation from extensive production systems with low productivity towards more profitable, competitive and sustainable production systems (e.g. silvo-pastoral systems; Enciso et al., 2019). This includes many forms of assistance such as the provision of information (rural extension, technical assistance), capital (as credits for sustainable

intensification), inputs (e.g. forage seeds) or market incentives (e.g. product differentiation, quality payments, payments for ecosystem services). New business opportunities could arise for livestock producers and farmers, such as the production of legume seeds for sustainable intensification, or hay and silage production, contributing to diversifying their incomes. This transformation of the primary sector can make the food system more resilient, not only to crises like the current COVID-19 pandemic, but also to the aggravating effects of climate change and persisting inequality.

Digitalization and virtualization have become important channels during the crisis in all links of the value chains, which has opened up opportunities to rethink and reshape the future. Food purchase via applications, virtual seminars and capacity building events, digital extension, or digital tools for farm improvement are only a few examples.

The bundling of resources and efforts in research, extension, policymaking or multi-actor platform initiatives will become more important in the upcoming years and, if well managed, could lead to a harmonization of concepts, a more stable support for the sector and higher impacts when it comes to technology adoption. Research will need to shift its focus to prepare the beef and dairy sector and the food system in general to be able to better navigate through future crises, including the increasing threats posed by climate change.

Recommendations for future research

This study has shown that the full impact of the COVID-19 on the Colombian beef and dairy sector cannot yet be fully analyzed, since the crisis is still ongoing and much of the required data for in-depth analyses and understanding are still missing or remain in the collection process. For the development and implementation of effective, tailor-made and long-term mitigation strategies, and to find better responses to future crises, it is important to assess and understand the full panorama and magnitude of the current crisis.

In the short-term, research can help in obtaining and analyzing data, monitoring the impacts and providing information for crisis-related decision- and policymaking. For the cattle and dairy sector, this includes monitoring the impacts of the crisis on the productive sector and value chains, analyzing consumer behavior and evaluating short-term responses to the crisis (such as policies).

In the short- to medium-term and once the impacts are fully comprehended, research can contribute to recovering production systems and value chains

and strengthening them during the on-going global downturn. This includes the application of existing methodologies, knowledge and technologies, such as implementing silvo-pastoral systems for increasing beef and dairy quantities and quality, fomenting collaboration and transparency along the value chains through interactive methodologies, or developing evidence-based consumer communication.

In the longer term, new research and the development/improvement of technologies will help in building resilience of the beef and dairy sector and the national food system, preparing them for future crises and the challenges posed by climate change. This includes, among others, development and improvement of technologies for sustainable intensification of beef and dairy farms under a changing climate (e.g. new grass/legume species, animal/pasture management systems) or an adequate support in the formalization of value chains (e.g. development of traceability systems, product differentiation).

Transferability of the results to other countries

This study was conducted with information obtained from Colombian sources, reflecting the developments of the national livestock sector in relation to the COVID-19 pandemic. The results, impacts and potential mitigation strategies are thus valid and relevant for the Colombian context. Nonetheless, considering the similarities between the bovine livestock sector in Colombia and other Latin American countries, many of the principal trends and impacts presented in this document might be applicable to other countries, too, although likely with different magnitudes. Likewise, some of the proposed mitigation strategies could be adapted and applied in other latitudes.



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Note: All hyperlinks were verified on 28 may 2020.

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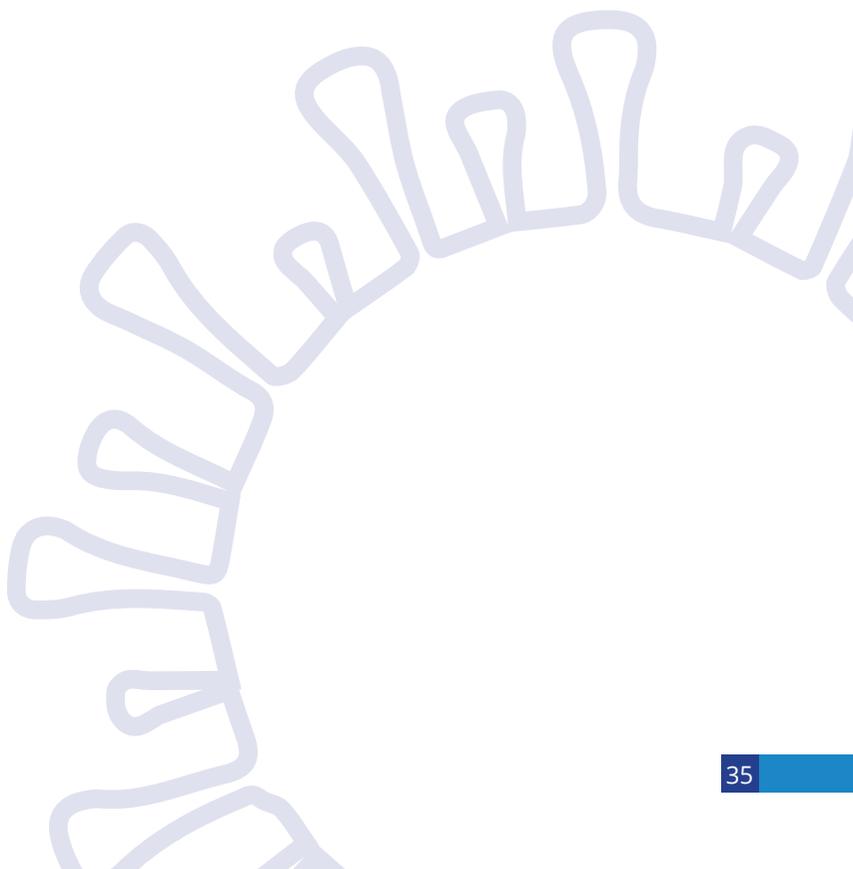
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