

Research Paper

The impact of COVID-19 on the sustainable intensification of forage-based beef and dairy value chains in Colombia: a blessing and a curse

Las bondades y condenas del COVID-19 en la intensificación sostenible de las cadenas de valor de carne y leche en Colombia

STEFAN BURKART¹, MANUEL DÍAZ¹, KAREN ENCISO¹, ANDRÉS CHARRY², NATALIA TRIANA¹, MARTÍN MENA³, JOSÉ LUIS URREA-BENÍTEZ¹, IRIELETH GALLO CARO¹ AND REIN VAN DER HOEK⁴

¹Tropical Forages Program, Alliance Bioversity-CIAT, Cali, Colombia. alliancebioiversityciat.org

²Food Environment & Consumer Behavior, Alliance Bioversity-CIAT, Cali, Colombia. alliancebioiversityciat.org

³Tropical Forages Program, Alliance Bioversity-CIAT, Managua, Nicaragua. alliancebioiversityciat.org

⁴Tropical Forages Program, Alliance Bioversity-CIAT, Turrialba, Costa Rica. alliancebioiversityciat.org

Abstract

The COVID-19 pandemic has exacerbated the difficulties associated with the need to transition the cattle sector in Latin America towards achieving sustainability and created a “double crisis” of pandemic and climate change. The increasing demand for animal sourced foods and the need to address the negative environmental impacts of cattle production, including greenhouse gas emissions, biodiversity loss and deforestation, and the implications of climate change on cattle production (prolonged droughts, prolonged rainy seasons, heat stress), have placed strong emphasis on sustainable intensification of forage-based beef and dairy systems for climate change mitigation and adaptation. This is needed to meet the commitments made by many Latin American countries to reduce greenhouse gas emissions under the Paris Agreement. Through a qualitative approach, this perspective paper reviews the present and potential impacts of the COVID-19 pandemic on progress towards sustainable intensification of the Colombian cattle sector. It also outlines new opportunities for sustainable intensification in Colombia that may provide useful examples for other Latin American countries. Short-term impacts such as: (i) increased input prices, (ii) limited access to inputs, credit, and technical assistance, and (iii) reduced incomes, have limited investment in sustainable intensification along the value chains. Reduced resources for research and development funding, unavailability of skilled and experienced staff, restrictions to travel and person-to-person interactions, in tandem, have caused setbacks in the development and application of sustainable technologies and programs. This has been addressed by increased use of technology for communication but there are difficulties with the broad availability of such technologies, especially for farmers. A long-term shift of consumer demand towards more sustainable animal products is occurring and expected to continue, and this should lead to new opportunities for sustainable intensification.

Keywords: Cattle, climate change, crisis management, pandemic, tropical forages.

Resumen

La pandemia de COVID-19 ha provocado una nueva crisis, interconectada con la ya existente crisis ambiental, que entorpece los esfuerzos del sector ganadero latinoamericano en su transición hacia la sostenibilidad. La creciente demanda de alimentos de origen animal, los impactos ambientales de la producción ganadera (emisiones de gases de efecto invernadero, pérdida de la biodiversidad, deforestación) y las consecuencias del cambio climático en la producción ganadera (períodos

Correspondence: Stefan Burkart, Tropical Forages Program,
Alliance of Bioversity International and CIAT, Cali, Colombia.
Email: s.burkart@cgiar.org

prolongados de sequía o lluvias, estrés de calor) son algunos de los desafíos que enfrenta la intensificación sostenible de los sistemas de carne y leche basados en forrajes, para lograr una reducción significativa de las emisiones de gases de efecto invernadero, uno de los compromisos adquiridos por varios países latinoamericanos en los Acuerdos de París. Lo anterior también dificulta que los productores locales de dichos sistemas ganaderos accedan a las herramientas y asistencia necesaria para su adaptación al cambio climático. Mediante un enfoque cualitativo, este documento tiene como objetivo evaluar los impactos existentes y potenciales, así como las oportunidades provocadas por la pandemia del COVID-19 en la intensificación sostenible del sector ganadero en Colombia, y se espera que esta información sea útil para otros países de América Latina. Los principales hallazgos muestran que los impactos a corto plazo, como el aumento de los precios de los insumos, el acceso limitado a los mismos, al crédito, la asistencia técnica y la reducción de los ingresos limitan las inversiones en intensificación sostenible a lo largo de las cadenas de valor. La reducción de la financiación para la investigación y el desarrollo provocaron retrocesos en la aplicación de tecnologías y en los programas de sostenibilidad. En el largo plazo, se espera un cambio en la demanda de los consumidores hacia productos sostenibles, lo que generaría nuevas oportunidades para la intensificación sostenible.

Palabras clave: Cambio climático, forrajes tropicales, ganadería, manejo de la pandemia.

Introduction

In 2020, COVID-19 was declared by the World Health Organization ([WHO 2020](#)) as a pandemic, affecting humankind in an unprecedented way. Since then, measures have been taken, and are continuing, by national governments to protect public health. These have included travel bans, temporary closures of public/private establishments, confinement of individuals and nationwide lockdowns that have caused significant economic downturns. Compared to other sectors where negative impacts often become visible very quickly, it appears that agriculture and livestock have been little affected ([FAO 2020a](#); [ECLAC 2020a](#)). However, this perception may not reflect reality in Latin America, since many of the effects have not been quantified due to monitoring difficulties, slow updates of databases and general data scarcity, or the effects have not yet been communicated ([Burkart et al. 2020](#)). Disruptions in agricultural value chains have been noticeable and are likely to grow over time ([Burkart et al. 2020](#); [FAO 2020b](#)). Although most of the impacts are not yet visible or fully analyzed, and despite the increased cattle slaughter and beef exports in some Latin American countries in 2020 ([Urrego 2021](#); [Villamil 2020](#); [Garza 2020](#)), there have also been negative impacts. These include increasing input prices and reduced consumer demand which, in the short-term, affects the livelihoods of low-income cattle producers. Since the beef and dairy sector is key to food security, nutrition and livelihoods, it is crucial for the involved stakeholders to identify and understand present and potential negative impacts, and where possible implement actions to mitigate their effects. The COVID-19 crisis will indeed shape the future

of Colombian food systems and improving resilience is one of the major challenges in the medium- to long-term. This is also likely to create opportunities along the beef and dairy value chains through, for example, formalization of processes and adaptation to changing consumer demands ([Burkart et al. 2020](#)).

Sustainable intensification of the cattle sector has been part of the political agendas of Latin American countries for at least a decade prior to the pandemic. The most important drivers have been increasing demand for animal sourced foods ([OECD/FAO 2019](#)), negative environmental impacts of some aspects of cattle production ([FAO 2006](#); [FAO 2018](#)) and effects of enteric methane emissions of ruminants on climate change ([FAO 2016](#)). Sustainable intensification has become a central element for governments to meet the commitments made under the Paris Agreement of the United Nations Framework Convention on Climate Change for greenhouse gas emission reductions. Sustainable intensification of forage-based cattle systems consists of 3 pillars ([Rao et al. 2015](#); [Rudel et al. 2015](#)): (i) genetic intensification (the development and use of improved forages and improved animal breeds for increased productivity); (ii) ecological intensification (the development and application of improved farm and resource management options for increased efficiency); and (iii) socio-economic intensification (the development and improvement of policies, institutions, and markets to support and increase technology uptake). The transition towards sustainable intensification comes with numerous livelihood and environmental benefits, including income generation and diversification, food security, climate change mitigation and adaptation, restoration of degraded lands and biodiversity

conservation ([Rao et al. 2015](#)), which contribute in turn to the achievement of several Sustainable Development Goals ([UN 2021](#)). In Colombia, significant advances have been made in the past decade, such as the establishment of improved forages, protein banks or silvo-pastoral systems ([Ganadería Colombiana Sostenible 2018](#)), market improvements ([Charry-Camacho et al. 2019](#); [Ruden et al. 2020](#)) and public policies ([Ministerio de Agricultura y Desarrollo Rural 2019](#); [Ministerio de Agricultura y Desarrollo Rural 2020a](#); [Presidencia de la Nación Argentina 2018](#); [Ministerio de Agricultura y Ganadería 2011](#)). Annex 1 provides an overview on the achievements for Colombia as an example for other Latin American countries, focusing on public and private sector initiatives, public policy, finance mechanisms and market developments. Despite these advances and the yet limited visible effects of COVID-19 on the cattle sector, the pandemic is expected to have significant impacts on ongoing sustainable intensification efforts, i.e., when it comes to technology adoption, product differentiation, information sharing and financing ([Burkart et al. 2020](#)).

Our objective is to describe and discuss how the pandemic is affecting sustainable intensification of the cattle sector in Colombia, putting emphasis on both potential negative impacts and future opportunities.

Materials and Methods

A qualitative approach that included reviewing the trends in current literature (scientific and non-scientific), examination of archives and databases (from national and international organizations, public sector, and primary sources such as newspaper coverage), and ensuring personal communications with key representatives of the cattle sector (e.g. cattle producers, beef and dairy companies, distributors, public sector actors, researchers, input suppliers, credit providers) was applied to understand the impact of the COVID-19 pandemic on the livestock sector in Colombia. This allowed us to gain a general perspective on the implications of the crisis, reflecting on how the subject is addressed by key actors, media, and relevant literature, providing us with a wider context on different perceptions, implications and responses. Data was obtained in 2020 and 2021, with personal communications taking place via email or telephone due to the public health measures related to the COVID-19 pandemic. We completed the analysis to cover three topics to assess and discuss the impacts at the levels of (i) markets and consumers; (ii) public policies and the value chain framework; and (iii) primary

producers. In the discussion we provide our perspective on how it should be possible to mitigate negative impacts to take advantage of opportunities, and to support the sector in building resilience as well as in climate change adaptation and mitigation.

Results

COVID-19 and sustainable intensification at the market and consumer level

Food consumers have been subjected to an economic downturn caused by COVID-19 with increasing unemployment rates, part-time work and salary reductions. This is evident especially in countries with little or no social safety net and a large proportion of employment being in informal jobs ([FAO 2020a](#); [ECLAC 2020b](#); [OIT 2020](#)), such as in Colombia ([NielsenIQ 2020](#)). According to the National Department for Statistics ([DANE 2021a](#)), the country's unemployment rate increased from an average of 10.5 % in 2019 to 15.1 % in April 2021 as a direct result of the crisis. In May 2020, 79 % of Colombian households were already experiencing financial difficulties ([Kantar 2020](#)) and it is projected that during 2020, the number of people living in poverty increased from 35.7 to 42.6 % and in extreme poverty from 9.6 to 12.8 %, respectively ([DANE 2021d](#)). These factors have reduced purchasing power, led to a lower demand for beef and some dairy products, and affected resource availability along the value chains ([CONtextoganadero 2020a](#)).

In the prevailing uncertainty, consumers have lost confidence and have been spending less income on less-essential items ([Sullivan and Amos 2020](#)). Although food demand is generally considered as not very elastic and to have little effect on overall food consumption, reduced purchasing power can often lead to substitution effects and changes in the food basket towards more affordable foods. The National Federation of Cattle Producers in Colombia (Fedegan) projected a partial substitution of beef with more economic protein sources, such as legume grains or poultry, at least in the short- to medium-term ([CONtextoganadero 2020a](#)). Beef consumption and cattle slaughter was estimated to have declined by ~2.5 % in the first quarter of 2020 ([CONtextoganadero 2020b](#); [DANE-ESAG 2020a](#); [DANE-ESAG 2020b](#)), and by 30–40 % in April 2020 ([Manrique 2020](#)), respectively. Although cattle slaughter appears to have recovered slightly in the first quarter of 2021, with a growth of 2.4 % compared to the same period in 2020, this increase was mainly related to

exports ([DANE 2021b](#)), suggesting a negative effect of the pandemic on the national beef industry. The dairy industry has not been affected to the same extent, likely because most alternatives (e.g., soy or almond milk) are more expensive than cow milk. There has been some reduction for processed dairy products, such as cheese and yogurt, which is largely related to school and restaurant shutdowns ([Morais 2020](#); [Durán 2020](#); [González Bell 2020](#)).

Before the COVID-19 pandemic, sustainable food production was rapidly developing in Colombia in response to a growing demand by more discerning and better off consumers (which still make up only a small minority of the rather price-oriented consumer base). These same consumers show a high willingness to pay for sustainable beef products ([Charry-Camacho et al. 2019](#)) that creates opportunities along the value chain ([Burkart et al. 2021](#); [Charry-Camacho et al. 2018](#)). Several beef and dairy companies, NGOs and research institutions have developed, or are in the process of developing, differentiated beef and dairy products through certification or technical assistance and sustainable beef labels have already been launched (Annex 1). The pandemic might lead to 2 opposing effects ([Trujillo 2020](#); [Sullivan and Amos 2020](#)). First, the substitution effect could lead to a declining demand for sustainable beef and dairy products in the short-term, since they are generally more expensive, and this would negatively affect the development of more sustainable value chains and the implementation of sustainable production practices at farm level. This effect has already been noted by private beef and dairy industries and has caused delays in the development or refinement of differentiation efforts. Since resources became scarce, projects have been stopped and employees terminated. A recent study by Ramirez et al. ([2021](#)) confirms that beef consumer preferences in Colombia have been affected by the pandemic, with a decline in beef consumption, especially amongst surveyed consumers from lower-income households or those facing economic reductions due to the pandemic. Second, a more optimistic scenario considers that, once incomes recover in the medium- to long-term, consumer preferences will shift towards more sustainable products, improved traceability, food safety and animal welfare. This second scenario would boost the development of more sustainable value chains and the implementation of sustainable production practices, and both encourage and require investments on the part of the beef and dairy industries ([Sullivan and Amos 2020](#); [Manrique 2020](#)). However, for most of the Colombian beef and dairy consumers, price will continue to play the most important role in consumption decision-making.

COVID-19 and sustainable intensification at the public policy and value chain level

Financial credits are a fundamental requirement for investments in sustainable intensification but are difficult to access for the many already indebted smallholder cattle producers with low-productivity farms. To mitigate effects of the pandemic, the Colombian Government ([FINAGRO 2020](#)) provided an emergency credit line in 2020 that helped cattle producers pay interest on existing credits to reduce bankruptcies. However, this credit line was not intended for new investments in sustainable production alternatives and thus did not provide incentives to revive pre-pandemic advances. To foster the adoption of sustainable production systems, the Government launched another credit line in 2020 for establishing silvo-pastoral systems with emphasis on improved tree species and the implementation of living fences. This is the first initiative of this type in the country ([Ministerio de Agricultura y Desarrollo Rural 2020a](#)) and it is expected to further advance efforts regarding sustainable intensification.

Another important factor for the transition towards sustainable cattle systems is access to rural extension and technical assistance. Despite the ongoing transformation of the rural extension system in Colombia through the SNIA (Sistema Nacional de Innovación Agropecuaria - National Agricultural Innovation System) law of 2017 ([Gobierno de Colombia 2017](#)), the reach of public rural extension is still very limited. The pandemic has aggravated this situation, leading to several consequences: (i) implementation of departmental extension plans (Planes Departamentales de Extensión Agropecuaria) had to be accelerated at the expense of effectively prioritizing land areas and crops for interventions; (ii) disruptions in procedures for requesting extension caused a mismatch of demand and supply ([Ministerio de Agricultura y Desarrollo Rural 2020c](#)); and (iii) limited on-farm extension combined with reduced access to productive inputs affected farm productivity, resulting in reduced farm incomes and credit repayment capacity. However, there have been positive developments too. Virtual extension efforts have increased with social media and local radio stations ([Fedegan 2020](#); [CONtextogadero 2020c](#)). Also, some Colombian dairy and beef companies, input suppliers, private agencies and supermarkets have developed their own rural extension and technical assistance systems, and many of these are focused on sustainable production (Annex 1). Although the impacts of the pandemic on their efforts are not yet fully evident, they include some

important setbacks. Nevertheless, on-farm visits, face-to-face rural education programs (e.g., Alquería's Heirs of Tradition Program), and farm planning and monitoring (e.g. AngusAzul, GANSO) can only partly be provided or are being offered virtually, at the expense of producers with limited internet connectivity.

Research institutions and networks that focus on the development of sustainable production technologies, such as improved forages, have been facing budget reductions (e.g. the Colombian Forages Network) and there have been shifts of focus towards crisis mitigation rather than gradual improvements (CGIAR 2020; [The Alliance of Bioversity International and CIAT 2020](#)). This might lead to lesser progress in developing technologies and reducing knowledge gaps in the mid- and long-term. In addition, institutions in charge of implementing sustainable intensification piloting and scaling projects are facing reductions in their budgets and staff that will likely lead to delays in scaling-up processes. These setbacks can, however, also represent new opportunities since new elements can be considered in the reshaping or formulation of projects, such as a stronger focus on a potentially changing consumer demand.

Colombia has established numerous multi-actor initiatives for supporting sustainable intensification of the cattle sector, such as the Colombian Roundtable for Sustainable Cattle (Mesa de Ganadería Sostenible) with its 15 regional roundtables, the Tropical Forest Alliance (TFA), which established the Zero-Deforestation Agreements (Acuerdos Cero Deforestación), and the Sustainable Colombian Cattle Project (Proyecto Ganadería Colombiana Sostenible), which ended in 2019 ([Fedegan et al. 2020](#); [Ganadería Colombiana Sostenible 2018](#); [Mesa de Ganadería Sostenible Colombia 2019](#); [Burkart and Urrea-Benítez 2020](#); [Rodríguez 2020](#); [Triana-Ángel and Burkart 2021](#)). The pandemic is affecting these initiatives to different extents, including through reduction of budgets, limitations in reaching target groups, extended virtuality, delays in achieving agreements or in public policy development, forcing the involved actors to seek for alternatives. The implementation of the Zero-Deforestation Agreements, for example, has slowed down and the committed companies cannot properly visit their producers to verify compliance with the established agreements. To counteract these developments, the Colombian Roundtable for Sustainable Cattle launched a virtual seminar series (from May to August 2020) on sustainable cattle (Conversatorios sobre Ganadería Sostenible), focusing on elements like climate change, biodiversity,

sustainable markets/consumption and rural extension ([Mesa de Ganadería Sostenible 2020](#)), which reached over 20,000 attendees ([Burkart and Urrea-Benítez 2020](#)).

The increased use of virtuality for capacity building and rural extension has attracted an unexpected high number of participants, yet concerns about inclusiveness, quality (versus quantity) and the applicability of such virtually spread information remain valid. Around 52 % of the Colombian population have limited internet access ([Revista Semana 2020](#)) without the required equipment such as smartphones and computers. The proportion in rural areas, where the principal target group of cattle producers live, is likely to be substantially higher. A positive trend shows that internet use grew by 40 % during the pandemic ([Morales 2020](#)) and there were large increases in the number of both fixed (+300 %) and mobile access points (+1.5 million), compared to pre-pandemic levels of 2019 ([Revista Semana 2021](#)). Also, the Colombian Government plans further increases to reach 70 % of the population by 2022 ([Revista Semana 2020](#)). Despite these promising trends, internet access is a major issue that constrains the sustainable intensification of the sector.

COVID-19 and sustainable intensification at the primary producer level

According to ECLAC ([2020a](#)), the pandemic-caused downturn of the global economy, particularly in the United States, China, and Europe, has had negative impacts in Latin America and the Caribbean, affecting the trade of raw materials (volumes, unpredictable price changes). In Colombia, the US Dollar-Colombian Peso exchange rate increased by 12.6 % during the pandemic ([DolarWeb 2021](#); [Banco de la República 2021](#)) (Annex 2). Both the Colombian beef and dairy sectors depend on imported agricultural inputs, such as forage seeds, feed concentrates, vaccines, salt, minerals and machinery. Some of these inputs, particularly forage seeds and fertilizer, are essential for the sustainable intensification of traditional cattle systems. Forage seed exports from Brazil, the principal tropical forage seed producer, decreased by 27 % between March and April 2020, and by 11 % compared to April 2019 ([Legiscomex 2020](#)). Data regarding forage seed imports into Colombia are not yet available but it appears that there has been both a reduced demand from the Colombian cattle sector and a reduced supply from Brazil. Urea fertilizer prices have on average increased by 9 % between March and April 2020 ([DANE 2020a](#)). In 2020, urea was more expensive

in 35 % of the municipalities and in 2021 (until May), in 69.12 %, respectively ([DANE 2020b](#); [DANE 2021c](#)). The combination of reduced input quantities and increased prices results in additional burdens for cattle producers to access the required means for sustainable intensification, leading to disincentives.

Owing to the effects of the pandemic, young cattle producers, who are potential investors in sustainable production practices, perceive less incentives for pursuing a future in the sector and thus might migrate to cities in larger numbers, aggravating the problems of generational transfer, already critical prior to the pandemic ([Parra Cortés and Magaña Magaña 2021](#)). Female cattle producers, who have crucial roles in the adoption of new technologies ([Triana-Ángel and Burkart 2019](#)) and often focus on deriving specialty products such as ‘branded’ cheese or yogurt, are likely to lose market access and be discouraged if dairy products are being substituted with non-dairy products, leading to lower household incomes and reducing the capacities for investing in sustainable intensification.

Discussion

During the last decade, Colombia has made significant advances in the transition towards a more sustainable beef and dairy cattle sector. The COVID-19 pandemic has caused adverse impacts on both existing and planned initiatives but also provides some opportunities for the future. The critical impacts are certainly the reduction of budgets in many of the involved research and development institutions, a temporary shift in priorities, reduced consumer incomes, substitution of beef and dairy products with other protein sources, disruptions in rural extension and technical assistance programs, and reduced ongoing monitoring of on-farm interventions and commitments. All of these disturb the implementation of sustainable production practices. Positive effects of the pandemic on sustainable intensification are an apparently increased consumer consciousness towards more environmentally friendly products, animal welfare, and traceability, which can be harnessed through product differentiation. While the shift towards virtual capacity building and rural extension can reach larger numbers of participants, internet accessibility and connectivity in rural areas remain challenging and lead to questions about inclusiveness.

To preserve the achieved progresses and to take advantage of new opportunities, actors at different levels, e.g. public policy, market, primary producer, should

increase their support for sustainable intensification of the cattle sector despite the setbacks caused by the pandemic. The occasion represents a major opportunity with various confluent demands of local populations, such as increasing food security and sovereignty, ensuring incomes and livelihoods of the most vulnerable and affected population, promoting rural justice and redistribution, and addressing the national and international commitments of environmental protection, climate change mitigation and adaptation. Positive examples for this are the new credit line for the establishment of silvo-pastoral systems by the Colombian government, and the development of the GANSO label for sustainable beef. Both initiatives were launched during the peak of the pandemic in 2020.

Although this study focuses on Colombia, there are some similarities with other Latin American countries, such as Costa Rica and Argentina, not only in the similarity of their cattle systems but also their advances towards achieving sustainability. Other studies, although not directly related to sustainable intensification, have come to similar conclusions regarding the impacts of the pandemic on the agricultural sector. For example, Hammond et al. ([2022](#)) found that in several African and Asian countries, the measures employed during the pandemic have affected food purchase, product sales (volumes and prices), and access to productive inputs and markets, with a tendency towards more severe effects in those countries with stricter measures. Siche ([2020](#)), in a more general analysis, found that the pandemic had strong impacts on food supply chains, mostly regarding food demand, ultimately affecting the most vulnerable actors. Sridhar et al. ([2022](#)) consider the adoption of sustainable agricultural practices and use of digital tools as suitable options for building a more resilient food system that can more easily absorb disruptions.

Acknowledgments

This work was undertaken as part of the CGIAR Research Program (CRP) on Livestock. In addition, it was supported by the LivestockPlus project funded by the CRP on Climate Change, Agriculture and Food Security (CCAFS), which is a strategic partnership of CGIAR and Future Earth and by the OneCGIAR Initiative on Livestock, Climate and System Resilience (LCSR). We thank all donors that globally support the work of the CRP programs through their contributions to the CGIAR system. We gratefully acknowledge funding from the Biotechnology and Biological Sciences Research Council Project Advancing

sustainable forage-based livestock production systems in Colombia - CoForLife (BB/S01893X/1) and the UK Research and Innovation (UKRI) Global Challenges Research Fund (GCRF) GROW Colombia grant via the UK's BBSRC (BB/P028098/1).

References

(Note of the editors: All hyperlinks were verified 1 September 2022).

- Alquería. 2020. Programa para el desarrollo de proveedores: Herederos de tradición [PowerPoint slide]. Alquería, Bogotá, Colombia. bit.ly/3Kzy6XK
- Banco de la República (Banrep). 2021. Serie Histórica de la Tasa representativa del Mercado 1991–2021. Banrep, Bogotá, Colombia. bit.ly/3TuIxzR
- Burkart S; Díaz MF; Enciso-Valencia K; Urrea-Benítez JL; Charry-Camacho A; Triana-Ángel N. 2020. COVID-19 and the bovine livestock sector in Colombia: Current and potential developments, impacts and mitigation options. CIAT Publication No. 498. International Center for Tropical Agriculture (CIAT). Cali, Colombia. hdl.handle.net/10568/108354
- Burkart S; Urrea-Benítez JL. 2020. The Colombian Roundtable for Sustainable Beef and Dairy: 2020 activities. Alliance of Bioversity International and CIAT, Cali, Colombia. hdl.handle.net/10568/111099
- Burkart S; Arango J; Enciso-Valencia K; Ruden A; Charry-Camacho A; Díaz MF; Gutierrez JF; Castro JP. 2021. Business opportunities along sustainably-intensified beef and dairy value chains. Business Model Brief. Alliance of Bioversity International and CIAT, Nairobi, Kenya. hdl.handle.net/10568/116579
- CGIAR. 2020. A food systems response to COVID-19. CGIAR. bit.ly/3cDGyZi
- Charry-Camacho A; Jäger M; Enciso-Valencia K; Romero M; Sierra L; Quintero M; Hurtado JJ; Burkart S. 2018. Cadenas de valor con enfoque ambiental y cero deforestación en la Amazonía colombiana – Oportunidades y retos para el mejoramiento sostenible de la competitividad regional. CIAT Políticas en Síntesis No. 41. Centro Internacional de Agricultura Tropical (CIAT), Cali, Colombia. hdl.handle.net/10568/97203
- Charry-Camacho A; Narjes M; Enciso-Valencia K; Peters M; Burkart S. 2019. Sustainable intensification of beef production in Colombia - Chances for product differentiation and price premiums. Agricultural and Food Economics 7:22. doi: [10.1186/s40100-019-0143-7](https://doi.org/10.1186/s40100-019-0143-7)
- CONtextogadero. 2020a. Así sería el efecto del COVID-19 para el agro. Federación Nacional de Ganaderos (Fedegán), Bogotá, Colombia. bit.ly/2XBFuJN
- CONtextogadero. 2020b. Cambios en los horarios de algunas plantas de beneficio. Federación Nacional de Ganaderos (Fedegán), Bogotá, Colombia. bit.ly/2Mi2OHZ
- CONtextogadero. 2020c. Coregán capacita a sus afiliados por WhatsApp. Federación Nacional de Ganaderos (Fedegán), Bogotá, Colombia. bit.ly/2Ziic7L
- DANE. 2020a. Informe especial-Componente de insumos y factores asociados a la producción agropecuaria de SIPSA. Departamento Administrativo Nacional de Estadística (DANE), Bogotá, Colombia. bit.ly/3gnLb6K
- DANE. 2020b. Boletín mensual insumos y factores asociados a la producción agropecuaria. Departamento Administrativo Nacional de Estadística (DANE), Bogotá, Colombia. bit.ly/3cuPPzp
- DANE. 2021a. Tasa Global de Participación, Ocupación y Desempleo. Departamento Administrativo Nacional de Estadística (DANE), Bogotá, Colombia.
- DANE. 2021b. Encuesta de Sacrificio de Ganado (ESAG). Departamento Administrativo Nacional de Estadística (DANE), Bogotá, Colombia. bit.ly/3vaKeoF
- DANE. 2021c. Boletín mensual N°104. Insumos y factores de la producción agropecuaria. Departamento Administrativo Nacional de Estadística (DANE), Bogotá, Colombia. bit.ly/3v6PVny
- DANE. 2021d. Pobreza Monetaria En Colombia-Resultados 2020 [PowerPoint slide]. Departamento Administrativo Nacional de Estadística (DANE), Bogotá, Colombia. bit.ly/3wnf1Qo
- DANE-ESAG. 2020a. Encuesta de Sacrificio de Ganado (ESAG) [Database]. Departamento Administrativo Nacional de Estadística (DANE), Bogotá, Colombia. bit.ly/2yI5CdK
- DANE-ESAG. 2020b. Censo Sacrificio de ganado total y departamental: vacunos, porcinos y otras especies. Marzo 2020 [Database]. Departamento Administrativo Nacional de Estadística (DANE), Bogotá, Colombia. bit.ly/2XQbOcj
- DolarWeb. 2021. Dólar histórico en Colombia. bit.ly/3iw7NWj
- Durán C. (April 20, 2020). Ganaderos “en jaque” por el Covid-19. eDairyNews. bit.ly/3AIBuL0
- ECLAC. 2020a. Dimensionar los efectos del COVID-19 para pensar en la reactivación. Informe Especial COVID-19 No. 2. Economic Commission for Latin America and the Caribbean (ECLAC), Santiago, Chile. hdl.handle.net/11362/45445
- ECLAC. 2020b. América Latina y el Caribe ante la pandemia del COVID-19: efectos económicos y sociales, Informe Especial COVID-19 No. 1. Economic Commission for Latin America and the Caribbean (ECLAC), Santiago, Chile. hdl.handle.net/11362/45337
- FAO. 2006. Livestock's long shadow. Environmental issues and options. Food and Agriculture Organization of the United Nations, Rome, Italy. bit.ly/3Q5A8Qb
- FAO. 2016. Livestock & Climate Change. Food and Agriculture Organization of the United Nations, Rome, Italy. bit.ly/3eg39vh
- FAO. 2018. FAO's role in livestock and the environment. Food and Agriculture Organization of the United Nations, Rome, Italy. bit.ly/3pZwnBt
- FAO. 2020a. Mitigating the impacts of COVID-19 on the

- livestock sector. Food and Agriculture Organization of the United Nations. Rome, Italy. doi: [10.4060/ca8799en](https://doi.org/10.4060/ca8799en)
- FAO. 2020b. Nueva enfermedad por coronavirus (COVID-19). Preguntas frecuentes: pandemia del COVID-19, su impacto en la alimentación y la agricultura. Food and Agriculture Organization of the United Nations, Rome, Italy. shar.es/aHRYip
- Fedegan. 2020. Redes sociales y radio comunitaria, alternativas para capacitar productores (May 20, 2020). Federación Nacional de Ganaderos (Fedegán), Bogotá, Colombia. bit.ly/2X6euTI
- Fedegan; CIPAV; TNC; Fondo Acción. 2020. Resultados Proyecto Ganadería Colombiana Sostenible [PowerPoint slide]. Federación Nacional de Ganaderos (Fedegán), Bogotá, Colombia. bit.ly/3Q5NUCm
- FINAGRO. 2020. Línea Especial de Crédito Colombia Agro- Produce. Circular reglamentaria P-11 2020. FINAGRO. , Bogotá, Colombia. bit.ly/2ZHdPtK
- Fundación Alpina. 2019. Informe de Sostenibilidad Alpina 2019. Fundación Alpina, Bogotá, Colombia. bit.ly/3czoek1
- Ganadería Colombiana Sostenible. 2018. ¿En qué consiste el proyecto Ganadería Colombiana Sostenible?. bit.ly/32IkHat
- GANSO. 2020. GANSO: Creando Paisajes Productivos y Sostenibles. Ganadería Sostenible (GANSO), Villavicencio, Colombia. ganso.com.co
- Garza J. 2020. Ganadería es inmune a la crisis. La República. bit.ly/2SuM6uV
- Gobierno de Colombia. 2017. Por medio de la cual se crea el Sistema Nacional de Innovación Agropecuaria y se crean otras disposiciones. Ley 1876 del 29 de diciembre de 2017. Diario Oficial No. 50.461. Gobierno de Colombia, Bogotá, Colombia. bit.ly/2M4HKUz
- González Bell J. 2020. La venta de yogures ha disminuido 20% por la falta de estudiantes y loncheras. Diario La República. bit.ly/36zz8ik
- Hammond J; Siegal K; Milner D; Elimu E; Vail T; Cathala P; Gatera A; Karim A; Lee J-E; Douxchamps S; Thanh Tu M; Ouma E; Lukuyu B; Lutakome P; Leitner S; Wanyama I; Pham Thi T; Hong Phuc PT; Herrero M; van Wijk M. 2022. Perceived effects of COVID-19 restrictions on smallholder farmers: Evidence from seven lower- and middle-income countries. *Agricultural Systems* 198:103367. doi: [10.1016/j.agsy.2022.103367](https://doi.org/10.1016/j.agsy.2022.103367)
- Kantar. 2020. Consumer Thermometer Colombia 3º Edición, Mayo 2020. Kantar, Barcelona, España.
- Legiscomex. 2020. Detalle de las importaciones y exportaciones por país [Database]. bit.ly/3Twf88n
- Londoño M. 2019. AGROSAVIA y el CIAT articulados en pro del desarrollo de una ganadería sostenible. AGROSAVIA. bit.ly/3pWd7Vo
- Manrique F. 2020. Estas son las acciones que propone Fedegán para enfrentar la pospandemia. CONtextoganadero. bit.ly/2X6aeUe
- Mesa de Ganadería Sostenible Colombia. 2019. Bases técnicas para la formulación de la política nacional de ganadería bovina sostenible. n9.cl/3ziy3
- Mesa de Ganadería Sostenible. 2020. Conversatorios sobre Ganadería Sostenible. Bogotá, Colombia. bit.ly/2Ad9pzY
- Ministerio de Agricultura y Desarrollo Rural. 2019. Política agropecuaria y de desarrollo rural 2018-2022: un campo para la equidad. n9.cl/yjgle
- Ministerio de Agricultura y Desarrollo Rural (MADR). 2020a. MinAgricultura Rodolfo Zea lanza nueva línea para financiar los sistemas silvopastoriles MADR, Bogotá, Colombia. bit.ly/3sNo6ze
- Ministerio de Agricultura y Desarrollo Rural (MADR). 2020b. Actualización de la Contribución Determinada a Nivel Nacional de Colombia (NDC). MADR, Bogotá, Colombia. bit.ly/3R66CuW
- Ministerio de Agricultura y Desarrollo Rural (MADR). 2020c. Circular 002 de 2020. MADR, Bogotá, Colombia. bit.ly/3ddTkZp
- Ministerio de Agricultura y Ganadería (MAG). 2011. Política de Estado para el sector agroalimentario y el Desarrollo Rural Costarricense 2010-2021. MAG, San José, Costa Rica bit.ly/2QlzRjr
- Morais D. 2020. Cuarentena redujo el acopio de la leche. eDairyNews. bit.ly/3KA3ZPU
- Morales C. 2020. Acceso a Internet está garantizado en Colombia durante pandemia: MinTic. RCN Radio bit.ly/2ZNpuXN
- NielsenIQ. 2020. In Latin america COVID-19 will hit low income consumers the most. bit.ly/3B0L3Xj
- OECD/FAO. 2018. OECD-FAO Agricultural Outlook (Edition 2018). OECD Agriculture Statistics [Database]. doi: [10.1787/d4bae583-en](https://doi.org/10.1787/d4bae583-en)
- OIT (Organización Mundial del Trabajo). 2020. Observatorio de la OIT: La COVID-19 y el mundo del trabajo. Tercera edición. Estimaciones actualizadas y análisis. bit.ly/3Ttfnky
- Parra Cortés RI; Magaña-Magaña MA. 2021. Características técnico-económicas de sistemas de producción bovina de las razas criollas colombianas Romosinuano y Hartón del Valle. *Revista MVZ Córdoba* 26(2):e2079. doi: [10.21897/rmvz.2079](https://doi.org/10.21897/rmvz.2079)
- Presidencia de la Nación Argentina. 2018. Objetivos de desarrollo sostenible. Buenos Aires, Argentina. bit.ly/3tIDzbb
- Ramirez O; Charry-Camacho A; Diaz MF; Enciso-Valencia K; Mejía D; Burkart S. 2021. The effects of COVID-19 on beef consumer preferences and beliefs in Colombia: A logit model approach. *Frontiers in Sustainable Food Systems* 5:725875. doi: [10.3389/fsufs.2021.725875](https://doi.org/10.3389/fsufs.2021.725875)
- Rao IM; Peters M; Castro A; Schultze-Kraft R; White D; Fisher M; Miles J; Lascano C; Blümmel M; Bungenstab D; Tapasco J; Hyman G; Bolliger A; Paul BK; Van der Hoek R; Maass BL; Tiemann TT; Cuchillo M; Douxchamps S; Villanueva C; Rincon A; Ayarza M; Rosenstock T; Subbarao GV; Arango J; Cardoso J; Worthington M; Chirinda N; Notenbaert A; Jenet A; Schmidt A; Vivas N; Lefroy R; Fahrney K; Guimaraes EP; Tohme JM; Cook S; Herrero M; Chacón M; Searchinger T; Rudel T. 2015.

- LivestockPlus-The sustainable intensification of forage based agricultural systems to improve livelihoods and ecosystem services in the tropics. *Tropical Grasslands-Forrajés Tropicales* 3(2):59–82. doi: [10.17138/tgft\(3\)59-82](https://doi.org/10.17138/tgft(3)59-82)
- Revista Semana. 2020. Día internacional del internet: ¿Cómo está Colombia en conectividad? Revista Semana, Bogotá, Colombia. bit.ly/3gzkImM
- Revista Semana. 2021. Acceso a internet en Colombia se aceleró durante la pandemia. Revista Semana, Bogotá, Colombia. bit.ly/3vplwRk
- Rodríguez R. 2020. Acuerdos de Cero Deforestación con Cadenas Productivas [PowerPoint slide]. MinAmbiente-Alliance Bioversity CIAT-BID. bit.ly/3AYJcSG
- Rudel TK; Paul BK; White D; Rao IM; Van der Hoek R; Castro A; Boval M; Lerner A; Schneider L; Peters M. 2015. LivestockPlus: Forages, sustainable intensification, and food security in the tropics. *Ambio: a journal of the human environment* 44(7):685–693. doi: [10.1007/s13280-015-0676-2](https://doi.org/10.1007/s13280-015-0676-2)
- Ruden A; Castro JP; Gutiérrez JF; Koenig S; Arango J 2020. GANSO: New business model and technical assistance for the professionalization of sustainable livestock farming in the Colombian Orinoquia region. CCAFS Info Note. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Cali, Colombia. hdl.handle.net/10568/110456
- Siche R. 2020. What is the impact of COVID-19 disease on agriculture? *Scientia Agropecuaria* 11(1):3–6. doi: [10.17268/sci.agropecu.2020.01.00](https://doi.org/10.17268/sci.agropecu.2020.01.00)
- Sridhar A; Balakrishnan A; Jacob MM; Sillanpää M; Dayanandan N. 2022. Global impact of COVID-19 on agriculture: role of sustainable agriculture and digital farming. *Environmental Science and Pollution Research* 8:1–17. doi: [10.1007/s11356-022-19358-w](https://doi.org/10.1007/s11356-022-19358-w)
- Sullivan R; Amos N. (May 15, 2020). How consumer concerns impact farm animal welfare. *Innovation Forum*. bit.ly/36CmMWI
- The Alliance of Bioversity International and CIAT. 2020. La respuesta de la Alianza frente al COVID-19. ciat.cgiar.org/covid-19
- Triana-Ángel N; Ariza Aya M. 2019. Youth in livestock, the engine for change: strategic partnerships with a private company (CIAT/CCAFS-Alquería): The beginnings, incentives, and objectives of the Herederos de Tradición (Heirs of Tradition) initiative carried out by Alquería's farmer training programs. CCAFS Info Note. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Cali, Colombia. hdl.handle.net/10568/106800
- Triana-Ángel N; Burkart S. 2019. Between silences and opportunities: Gender and bovine livestock in Latin America, a state of the question. Info note. International Center for Tropical Agriculture (CIAT). Cali, Colombia. hdl.handle.net/10568/101292
- Triana-Ángel N; Ariza Aya M; Burkart S. 2020. Youth in livestock and the transformative power of rural education: the case of Heirs of Tradition, 2012–2020. CCAFS Info Note. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Cali, Colombia. hdl.handle.net/10568/111012
- Triana-Ángel N; Burkart S. 2021. Managing changes, transforming the sector: the case of the Colombian Roundtable for Sustainable Cattle. CCAFS Info Note. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), Wageningen, The Netherlands. hdl.handle.net/10568/116074
- Trujillo CA. 2020. ¿Puede el confinamiento por COVID 19 propiciar un estilo de vida y un consumo más sostenible? bit.ly/2B4JCue
- UN. 2021. The 17 Goals. United Nations – Department of Economic and Social Affairs, Sustainable Development. New York City, NY, USA. sdgs.un.org/goals
- Urrea JL. 2018. Segundo taller de la Red Colombiana de Forrajés CIAT-AGROSAVIA. CIAT. bit.ly/3B4cGP2
- Urrego A. 2021. Los sectores de ganadería bovina y de producción lechera crecieron el año pasado. *Agronegocios*. bit.ly/3CHYYT9
- Villamil L. 2020. El coronavirus no pudo frenar el boom exportador de la carne argentina. *Clarín Rural*. bit.ly/3vH4m2d
- WHO (World Health Organization). 2020. WHO Director-General's opening remarks at the media briefing on COVID-19. <https://bit.ly/2B6xj0w>

Annex 1. Sustainable intensification of the Colombian cattle sector: initiatives and achievements

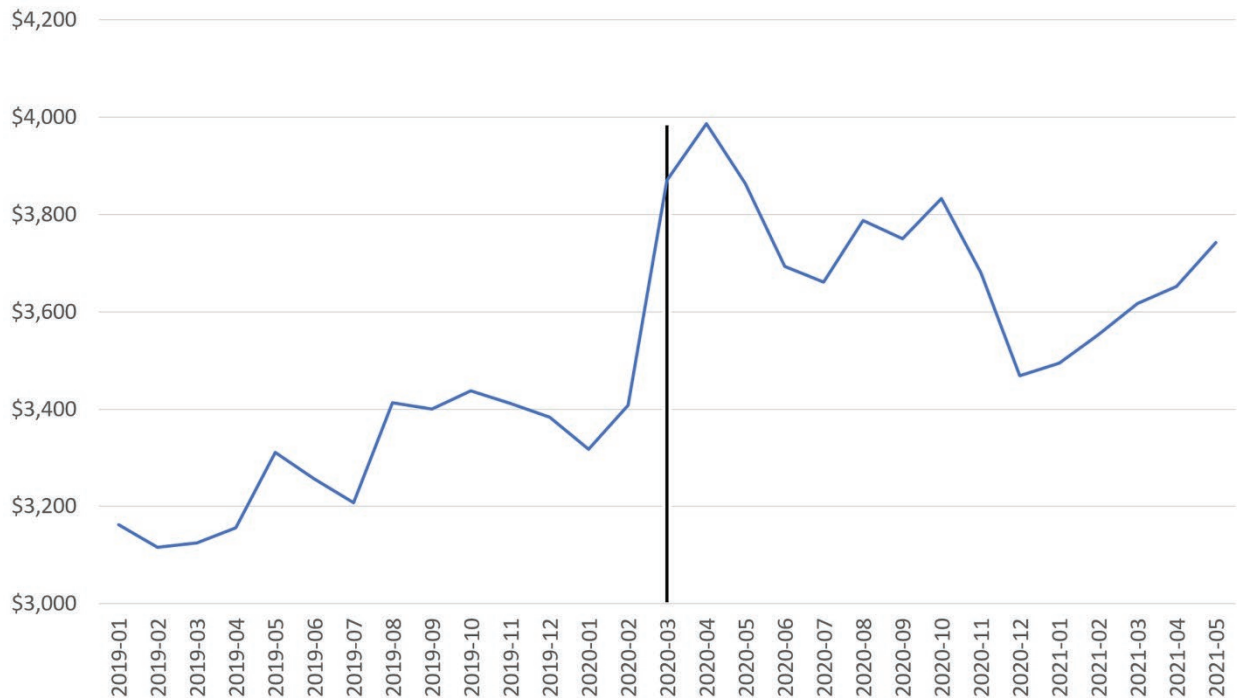
Initiative/project and duration	Level of intervention	Interventions and achievements	Sources
Sustainable Colombian Cattle Project ^{1,d} (2010-2019)	Primary producer	<ul style="list-style-type: none"> • 4,100 cattle farms from 5 regions participated • 18,300 ha under conservation • 38,400 ha under sustainable land-use • 4,800 ha under intensive silvo-pastoral systems (effect of payments for ecosystem services) • 25% increase in milk production • 10% increase in forage digestibility and quality • 3% increase in milk quality • 25% increase in forage biomass 	Fedegan et al. (2020); Ganadería Colombiana Sostenible (2018)
Colombian Forages Network ^{2,a} (2018-present)	Primary producer Forage seed sector Research institutions	<ul style="list-style-type: none"> • Development, evaluation, and release of forage materials for different Colombian agro-ecosystems • Development of forage niche products • Release of various new forage materials e.g., <i>Megathyrus maximus</i> cultivar ‘Sabanera’, <i>Urochloa brizantha</i> CIAT 26124 cultivar ‘Caporal’, <i>Avena sativa</i> AV25T cultivar ‘Altoandina’ • In release process: <i>Cenchrus ciliaris</i> 	Urrea (2018); Londoño (2019)
Alquería-SENA rural education program Heirs of Tradition ^{3,b} (2012-present)	Primary producer (i.e., youth)	<ul style="list-style-type: none"> • 2-year technology level formal training program for young dairy producers • Capacity building through farmer field schools and farm planning • Agreement with SENA to facilitate technical skills for integrated cattle management • Agreement with the Alliance of Bioersity International-CIAT (since 2020): trainings on improved pasture management, sustainable dairy production, value chains and the role of women in agriculture • 188 young graduates: 60 women and 129 men (graduates of the program) • Training of 3,350 farmers (mainly women and young farmers) provided on good management practices, milk quality and milking routines 	Alquería (2020); Triana Ángel et al. (2020); Triana Ángel and Ariza Aya (2019)
Fundación Alpina ^{4,c}	Primary producer Dairy value chain	<ul style="list-style-type: none"> • 2,374 participants in productive projects aimed at strengthening technical capacities to improve income and livelihoods and support the reconversion of cattle systems • Participation in the national roundtable for rural development • 400 women increased their milk sales by 16% due to training and assistance in their economic and social empowerment • 18% increase in the creation of new cooperatives 	Fundación Alpina (2019)
Zero-Deforestation Agreements for Beef and Dairy ^{1,b} (2018-present)	Public policy Monitoring Communication	<ul style="list-style-type: none"> • Identification of strategies for monitoring deforestation in the cattle sector • 35 public and private sector actors already signed their commitment • Development of tools for monitoring, reporting and verification (MRV) of zero-deforestation • Development of governance mechanisms for the execution of programs for the reduction of deforestation 	Rodríguez (2020); Burkart and Urrea Benítez (2020)

Continued

Initiative/project and duration	Level of intervention	Interventions and achievements	Sources
Colombian Roundtable for Sustainable Cattle ^{1a,b} (2014-present)	Primary producer Dairy and beef value chains Public policy	<ul style="list-style-type: none"> >60 members from the public (30%) and private sectors, academia, NGOs, among others (70%) Contribution to the development of public policy frameworks on sustainable cattle 13 established regional roundtables in the main cattle regions of Colombia Face-to-face and virtual capacity building events on sustainable cattle production and value chains Seminar series on sustainable cattle in 2020 with >20,000 participants from >15 countries Member of: Global Roundtable for Sustainable Beef Draft public policy on sustainable cattle under review by the Ministry of Agriculture 	Personal comm. technical secretary (May 10, 2021); MGS-Col (2019); Burkart and Urrea Benítez (2020)
Sustainability Program AngusAzul ^{4,b} (2012-present)	Primary producer	<ul style="list-style-type: none"> Establishment of a protocol for the evaluation of sustainable practices in cattle farms 12% of the total area of cattle farms that sell to AngusAzul are protected forests (>4,000 ha) Member: Zero-Deforestation Agreements and the Colombian Roundtable for Sustainable Cattle 	Personal comm. AngusAzul (May 12, 2021)
Sustainable Cattle (GANSO) ^{3,b} (2018-present)	Primary producer Beef value chain	<ul style="list-style-type: none"> Technical assistance on sustainable beef farming to primary producers in the Meta and Casanare Departments Development of sustainable and scalable business models Development of the sustainability seal Aval GANSO together with a major supermarket chain Establishment of 7 pilot and 1 demonstration farms 	GANSO (2020); Ruden et al. (2020)
Nationally Appropriate Mitigation Actions (NAMA) for the cattle sector ^{1,c} (2014-present)	Primary producer Financing	In the planning phase, but with tentative commitments: <ul style="list-style-type: none"> 69,000 ha made available for restoration purposes 2.2 million ha under improved pastures 601,000 ha planted with shattered trees 3,800 ha planted with mixed-forage banks 660 ha with integrated living fences 61,000 ha planted with forage hedges 61,000 ha under intensive silvo-pastoral systems 	Ministerio de Agricultura y Desarrollo Rural (MADR 2020b)
Credit line program for silvo-pastoral systems ^{5,c} (2020-present)	Primary producer	<ul style="list-style-type: none"> Implemented at a regional level (mainly in 82 municipalities) Promotion of sustainable practices in the different cattle regions of the country Credits are directed to the purchase and planting of tree species First initiative in this regard 	MADR (2020a)
Departmental Agricultural Extension Plans ^{5,b}	Primary producer Extensionists	<ul style="list-style-type: none"> Prioritizes crops and regions that receive public rural extension 	MADR (2020c)
SNIA law 1876 ^{5,b} (2017-present)	Primary producer Extensionists	<ul style="list-style-type: none"> Establishes the restructuring of the national agricultural innovation system Purpose of improving the productivity and sustainability of the national agricultural sector Focus on public rural extension 	Ley 1876 de 2017 (2017)

Type of initiative = ¹Multi-actor initiative, ²Research agreement, ³Public-private partnership, ⁴Private sector initiative, ⁵Public sector initiative.

Effects of the COVID-19 pandemic = ^abudget reductions/constraints, ^bdifficulties in reaching target groups, ^ceffects still unknown, ^dinitiative ended before the pandemic started, ^einitiative has not yet started.



Annex 2. US\$-COP exchange rate 2019-2021, with reference to the start of the COVID-19 pandemic. Source: own elaboration based on Banco de la República (2021).

(Received for publication 6 December 2021; accepted 29 August 2022; published 30 September 2022)

© 2022



Tropical Grasslands-Forrajes Tropicales is an open-access journal published by *International Center for Tropical Agriculture (CIAT)*, in association with *The Tropical Crops Genetic Resources Institute of The Chinese Academy of Tropical Agricultural Sciences (TCGRI-CATAS)*. This work is licensed under the Creative Commons Attribution 4.0 International (CC BY 4.0) license.