RESILIENCE AND LESSONS LEARNED IN COLOMBIAN FAMILY FARMING DURING THE COVID-19 PANDEMIC †

[RESILIENCIAS Y LECCIONES APRENDIDAS DE AGRICULTORES COLOMBIANOS DURANTE LA PANDEMIA DEL COVID-19]

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SUMMARY

Background: A health crisis exposes people to food vulnerability by restricting the mobilization and commercial exchange of food. During the COVID-19 pandemic, an ample food supply was available to ensure the basic consumption of the population, prompting two questions: What resilient practices did farmers adopt to produce under conditions of high sanitary restriction, and what lessons did they derive to confront future crises? **Objective:** The article presents and collects the experiences of 59 small family farmers in Colombia in implementing good practices for economic and financial resilience and the lessons learned from the Covid-19 pandemic, constituting a new source of knowledge to understand human behaviors and actions in the face of adversity and the experiential learnings gained to act in future crisis scenarios. **Methodology**: To characterize the resilient practices of agricultural producers in the department of Norte de Santander, Colombia, amid the COVID-19 pandemic crisis, researchers conducted interviews with 59 smallholder farmers from 12 municipalities. The study encompassed 11 agricultural products and 6 animal products, ultimately identifying three overarching categories: economic resilience, financial resilience, and lessons learned. **Main Results:** The results indicate strategies for diversification of production, use of local resources, solidarity-based family work, short marketing chains and an economy of scarcity in family spending. **Implications:** These lessons can inform future policies and practices to better prepare for and respond to similar challenges. **Conclusion:** The study's findings provide valuable insights for policymakers and small farmers, emphasizing the importance of local resource utilization, community cooperation, and adaptive strategies to enhance resilience and sustain livelihoods during crises.
Key words: Family farming; Agriculture; Crisis; Food security; Good practices; Learnings.

RESUMEN

Antecedentes: Una crisis de salud expone a las personas a la vulnerabilidad alimentaria al restringir la movilización y el intercambio comercial de alimentos. Durante la pandemia de COVID-19, se disponía de un amplio suministro de alimentos para garantizar el consumo básico de la población, lo que generó dos preguntas: ¿Qué prácticas resilientes adoptaron los agricultores para producir bajo condiciones de alta restricción sanitaria y qué lecciones derivaron para enfrentar futuras crisis? **Objetivo:** El artículo presenta y recoge las experiencias de 59 pequeños agricultores familiares en Colombia en la implementación de buenas prácticas de resiliencia económica y financiera y las lecciones aprendidas de la pandemia del Covid-19, constituyendo un insumo de nuevo conocimiento para comprender los comportamientos y acciones humanas ante la adversidad y los aprendizajes experienciales obtenidos para actuar en escenarios de futuras crisis. **Metodología**: Para caracterizar las prácticas resilientes de los productores agrícolas en el departamento de Norte de Santander, Colombia, en medio de la crisis de la pandemia de COVID-19, los investigadores realizaron entrevistas con 59 agricultores de pequeña escala de 12 municipios. El estudio abarcó 11 productos agrícolas y 6 productos animales, identificando en última instancia tres categorías

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principales: resiliencia económica, resiliencia financiera y lecciones aprendidas. **Resultados principales:** Los resultados indican estrategias para la diversificación de la producción, el uso de recursos locales, el trabajo familiar basado en la solidaridad, cadenas de comercialización cortas y una economía de escasez en el gasto familiar. **Implicaciones:** Estas lecciones pueden informar futuras políticas y prácticas para estar mejor preparados y responder a desafíos similares. **Conclusion:** Los hallazgos del estudio brindan valiosas perspectivas para los formuladores de políticas y pequeños agricultores, resaltando la importancia del uso de recursos locales, la cooperación comunitaria y las estrategias adaptativas para mejorar la resiliencia y sostener los medios de vida durante crisis.
Palabras clave: Agricultura; Aprendizajes; Buenas prácticas; Crisis; Seguridad alimentaria.

INTRODUCTION

From March 25 to September 1, 2020, the general quarantine in Colombia lasted, 5 months of uncertainty, fear and paralysis of the daily life of society. Among the multiple and complex difficulties experienced, in addition to preserving health, ensuring food was essential. Panic purchases (Hassen and El Bilali, 2022) due to fear of market shortages, derived from restrictions on the movement of people, closure of commercial establishments and paralysis of marketing processes (Escobar, 2022) announced an eminent risk of food insecurity (Paganini *et al*., 2020) in the face of a growing demand for food (Núñez-Rodríguez *et al*., 2022).

The Covid-19 pandemic finds in Colombia, as in Latin American countries, an important group of small farmers dedicated to subsistence family agriculture (IFAD, 2014), producers of highly perishable agricultural and livestock products with a short time. Commercially useful between harvest and consumption, therefore, a continuous flow marketing of the products. The quarantine resulted in the cessation of marketing processes, leading to the damming and loss of products within the production cycle (FAO, 2020). This, in turn, had adverse effects on the sustainability of farms, encompassing economic income losses, unavailability and high costs of inputs, and a reduction in the hiring of workers (Dixon *et al.*, 2021; Boyacı-Gündüz, 2021). These challenges posed high social risks for vulnerable rural groups (Štreimikienė *et al*., 2022).

However, despite the imposed health restrictions, food continued to reach urban homes in the quantity, price and quality affordable by consumers. This factual evidence prompts us to ask about the resilience processes and good practices implemented by farmers to produce and market in a health crisis scenario. Studies referred to suggest that the resilience of agroecosystems and their biodiversity enhanced farmers' capacity to confront the crisis (Romero-Mero, 2021). Additionally, these studies highlight the development of farmers' inherent and local resilience (Viegas *et al.*, 2022), individual efforts, and the formation of spontaneous networks among nearby producers and consumers, along with the utilization of social networks for marketing purposes (Campos, 2022). Furthermore, the implementation of novel distribution and logistics strategies (Marusak, 2021) enabled numerous farmers to absorb the impacts of the pandemic (Panchana, 2021).

From their experience in surviving a pandemic, farmers raise the second question of applying assertively the lessons learned in other future crises, whether related to health, social issues, or the environment. Faced with the imperative to produce amidst restrictions and secure income for their families while sustaining their productive processes, small farmers proactively embraced a set of empirical strategies to enhance their productive, competitive, and adaptive capacities (Thapa *et al.*, 2021). They undertook the restructuring of marketing forms and traditional distribution circuits (Silva, 2021) utilizing everyday digital tools and establishing short food supply chains (Grigorescu *et al.*, 2022; Lazzaretti, 2021). These initiatives unfolded in territorialized markets supported by solidarity networks of exchange (Altieri and Nicolls, 2021), ensuring the continuous outflow of crops and marginal economic income, despite encountering significant losses in the economic, productive, and human life spheres.

The article presents the experiences of 59 small Colombian family farmers in the implementation of good practices of economic and financial resilience and the lessons learned from the Covid-19 pandemic, constituting an input of new knowledge to understand human behaviors and actions in the face of the adversity and the experiential learning obtained to act in future crisis scenarios.

This study aims to understand and highlight the empirical strategies adopted by small farmers in navigating pandemic-induced restrictions and sustaining their livelihoods. By investigating the restructuring of marketing practices, utilization of digital tools, and the establishment of short food supply chains, the research aims to shed light on the innovative approaches small farmers employed to enhance their productive,

competitive, and adaptive capacities. Furthermore, this study seeks to underscore the significance of territorialized markets supported by solidarity networks of exchange in maintaining the continuous outflow of crops and marginal economic income. Through a comprehensive exploration of these practices, the research contributes valuable insights into the resilience of small-scale agricultural systems amidst crisis scenarios, offering practical implications for sustainable agriculture and rural development.

THEORETICAL FRAMEWORK

Small Latin American farmers have historically been subjected to continuous social, economic and environmental crises (Veltmeyer and Petras, 2009) and, therefore, have naturalized appropriate adaptation and mitigation processes to survive conditions of social vulnerability, precariousness and limitations (López *et al* . 2020). However, on this occasion the covid-19 pandemic was presented as an unusual, abrupt and lethal crisis that structurally disrupted peasant ways of life (UNESCO, 2022; Zuniga, 2021), forcing them to quickly assume contingent behaviors and strategies to preserve health, crops and animal husbandry and, at the same time, obtain economic income for family support.

The concept of resilience in the analysis of complex systems has been useful to describe the permanence of ecosystems to remain in a particular condition in the face of disturbances experienced in their environments (Castillo-Villanueva and Velázquez-Torres, 2015). Nowadays, it is relevant to study the capacity of systems to absorb external pressures, at the same time, they internally reorganized and change without losing the function structure, identity and feedback (Seekell *et al.* 2017). Typical of systems autopoietic to reproduce and maintain themselves in different states of dynamic equilibrium (Maturana, 1995) and in varied spaces and time scales (Downes *et al*,. 2013).

In the economic context, resilience defined as the capacity of a region or entity to withstand and adapt to changing forces, manifested in a stable and positive growth trajectory that remains relatively unchanged even in the aftermath of external economic shocks (González and Oliva, 2017:151). This characterization transforms resilience into an organization's persistence during a crisis (Yoshida and Long, 2021).

Núñez Espinosa *et al.* (2021) conceive resilience as a community and temporary construction aimed at facing adversities, wherein systems internally absorb changes to restore balance in response to the sudden onset of phenomena such as disasters. Natural disasters (Cerón *et al*., 2019) and emerging and recurrent zoonotic crises (Vega, 2009). In the field of family farming, it is evident that rural communities that share local resources rebuild more easily and survive crises better (Štreimikienė *et al.,* 2022). Pulcherio et al. (2022) identified the profiles, capacities, and limitations of actors, while Boyacı-Gündüz *et al.* (2021) and Dixon et al. (2021) highlighted the strengths of agroecosystems in sustaining production cycles despite risks such as deficiencies in external agricultural inputs (fertilizers, seeds, pesticides, concentrated foods), challenges in product distribution to markets, and issues in the hiring of workers.

MATERIALS AND METHODS

The research was carried out during the period of August 2022 and May 2023 in the northeastern region of Colombia (coordinates 06º56'42'- 09º18'01" N and 72º01'13"- 73º38'25" W) with small family producers of 11 agricultural and 6 livestock species, located in 12 municipalities of the Norte de Santander department (Table 1). The city of Cúcuta, the capital of the department, prioritized the consumption of the most essential foods during the COVID-19 pandemic. A team conducted fifty-nine semi-structured interviews, involving 38 men aged between 23 and 80, and 21 women aged between 29 and 69. The selected number of producers in this study was justified by ensuring a representative sample that encompasses a diverse range of contexts and situations within the studied region. The selection process considered both the diversity of agricultural and livestock species as well as the geographic distribution across various municipalities in the Norte de Santander department. This substantial participation provides a comprehensive insight into the practices and experiences of producers in the region during the study period. The farmers interviewed fall within the typology of peasant family farming, with planting and animal raising areas of less than 10 hectares, low technological and educational levels, and a focus on producing perishable goods for local markets and household consumption (Boamah *et al*., 2020). The utilization of intermediaries for agricultural marketing is also a common practice among these farmers. The municipalities served correspond to warm climatic zones (Cúcuta, El Zulia, Puerto Santander, San Cayetano, Villa del Rosario, Sardinata and Los Patios) and temperate zones (Bochalema, Pamplonita, Chinácota, Toledo and Lourdes), the main agricultural producers in the department.

Table 1. Characteristics by species and interviews of the study units.

Items	Species	Interviews
Agricultural crops	Cocoa (*Theobroma cacao*, L)	7
	Rice (*Oryza sativa*)	6
	Coffee (*Coffea arabica*, L)	5
	Yucca (*Manihot esculenta*, Crantz)	4
	Plantain (*Musa paradisiaca*)	3
	Fruit trees (*Persea Americana*, Mill.*; Citrus lemon*, L; *Citrus sinensis*, L)	3
	Vegetables (*Solanum lycopersicum*, L; *Capsicum annuum*)	2
	Reed (*Saccharum officinarum*)	2
	Oil palm (*Elaeis guineensis*)	1
	Auyama (*Cucurbita maxima*)	1
	Corn (*Zea mays*)	1
Total Agricultural		**36**
Livestock production	Fish (*Diplodus vulgaris*; *Prochilodus magdalenae*)	7
	Livestock (*Bos Taurus*)	5
	Pigs (*Sus scrofa domestica*)	5
	Birds (*Gallus gallus*)	4
	Goats (*Capra aegagrus hircus*)	1
	Beekeeping (*Apis mellifera*)	1
Total livestock		**23**
Total interviews		**59**

The methodology selected to approach the research was part of the interpretive paradigm (Gichuru, 2017; Esquivel, 2016). Based on the specific objectives of the research, 4 initial reference categories were identified (economic resilience, organizational resilience, financial resilience and lessons learned) and a semi-structured interview script was developed, consisting of 22 open questions for the units of analysis, derived from the categories under study. In person, the researchers conducted the interviews on the farmers' farms, obtained informed consent, recorded the interactions on electronic media, and transcribed the content using the Transkriptor tool. Systematizing the responses into an Excel matrix, we applied open, axial coding, and categorization methods following the Grounded Theory by Strauss and Corbin (2012). In the initial reference categories, the researchers identified seven subcategories for economic resilience, three subcategories for financial resilience, and one for lessons learned. The researchers merged the organizational resilience category with the economic resilience category (Figure 1, Table 2).

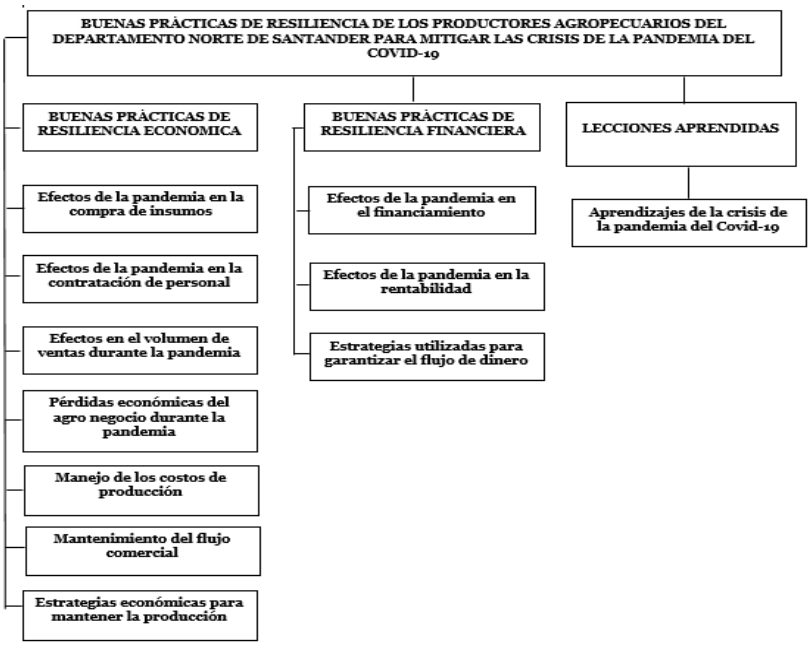

Figure 1. Category map of qualitative data.

Table 2. Categorization of farmers' responses.

Categories	Subcategories	Open codes
Economic Resilience	Effects of the pandemic on the purchase of agricultural inputs	High prices; Shortage; Price speculation; Delay in delivery to farms; Farm stores closed; Restriction on mobility; Increased cost of transportation; Loss of food quality; Decrease in animal performance
	Effects of the pandemic on the hiring of workers on the farm	Family labor work; Reduction in hiring of essential workers; Insecurity due to Covid infection among workers and employers; Quarantine isolation; Day rotation; Owner's job
	Effects of sales volume during the pandemic	Decrease in crop yields; Loss in the weight of the animals; Reduction of planted areas; Stoppage of marketing; Increase in production costs; Unavailability of workers; Losses of crops and livestock products
	Economic losses on the farm during the pandemic	Stoppage of marketing; Losses of crops and perishable livestock products; Economic losses due to a decrease in sales income and increases in production costs (inputs, food, medicines); Impacts on productivity due to crop abandonment; Impacts on livestock productivity due to feeding limitations (Zuniga, 2023).
	Management of farm production costs	Decrease in animal food rations; Food with products from the farm; Prolong sale of animals; Produce food for animals on the farm; use of organic fertilizers in crops; Reduce quantity and frequency of chemical applications; Use input reserves; Take advantage of soil fertility
	Maintenance of the commercial flow of products to the markets	Decrease in the number of animals in production; Reduction of planted areas; Reduction of prices at the farm level; Direct sales to neighbors and local markets; Credit sales to locate products; Support from associations
	Strategies used to economically maintain the agribusiness	Diversification and complementarity in production; Decrease in prices at the farm level; Decrease in food rations; Use natural food sources; Direct home sales; Versatility and management in the marketing and purchase of inputs; support from associations, institutions and banks; Training of workers in biosafety; Agro transformation and storage of products
Financial Resilience	Effects of the pandemic on the financing of the productive system	Low profitability; Low sales volumes; dependence on bank loans; Debts; Trade closed for financial transactions; High cost of borrowed money; Lack of money for survival; Sell at a loss to obtain income
	Effects of the pandemic on the profitability of agribusiness	Losses due to price reductions; Increases in production costs; Stoppage of marketing; Balance points; Impacts of rain on production; No affectation
	Strategies used to guarantee the flow of money during the pandemic	Own resources; Personal loans with interest; Bank loans and credit cards; Sell products on credit; Reduce the price of products; Income from complementary agricultural products; Support from associations; Buy fewer inputs: wholesale financing
Learned lessons	Learnings from the covid-19 pandemic crisis	Diversify agricultural production to reduce dependence on a single sector. Foster family unity in the workplace through community organization and collaboration networks. Establish producer associations to ensure effective marketing, financing, and support. Embrace sustainable practices and learn to live within the means of available resources. Strengthen short marketing chains and leverage local agrobiodiversity resources. Efficiently manage work schedules and practice assertive communication with workers. Adhere to biosafety standards for a safe working environment. Appreciate the countryside as a crucial space to navigate crises. Uphold family values, engage in agro-transformation, and implement proper storage practices for agricultural products. Cultivate greater patience and tranquility in everyday life. Effectively manage costs and strategically plan agricultural activities.

RESULTS AND DISCUSSION

GOOD PRACTICES OF ECONOMIC RESILIENCE

Effects of the pandemic on the purchase of agricultural inputs

One of the components of agricultural production systems with the greatest negative effect during the quarantine was access to agricultural inputs. Farmers claimed to have had high impacts on the availability and prices of inputs (fertilizers, seeds, plants, food and veterinary medicines) to maintain the nutrition, health and yields of the species in production. The following testimonies demonstrate the situation experienced with respect to agricultural inputs:

"...Everything went up, the inputs went up 80% and there were no...and what was arriving is very bad...(the) fish food" (E15); "Salt was priced at $100,000 per package, too expensive... medicines were not available" (E19); "No product, no fertilizer, no poison, nothing, to put on those crops, (the) very high price of poisons" (E35); "Costs increased and what was done with 1 or 2 subscribers often had to stop paying or stop applying inputs that were necessary for production" (E39).

The restrictions imposed on the mobility of people, the closure of commercial houses and the general paralysis of the marketing of inputs left agricultural producers with productive processes in the development of crops and animal husbandry, without the support of fertilizers, seeds and biocides to control weeds, pests and diseases and, in the livestock sector, lacking concentrated foods, vitamins and veterinary medicines. During the analysis of the interviews, it was evident that the producers of perishable items were the most affected by the shortage or high prices of inputs, generating product losses, low prices and low profitability in their agribusinesses. Faced with this difficulty, farmers adopted a set of actions to replace and complement inputs related to the nutrition of plants and animals or reduce rations and the size of the farm.

Effects of the pandemic on the hiring of workers on farms

Small Colombian agriculture is predominantly dependent on manual wage labor. The restrictions imposed on people's mobility, the low income obtained due to decreased sales of production and the fear of contagion of the disease forced farmers to reduce the number of workers on the farms and rely on family work and solidarity with the neighbors. This is what the interviewees reported:

"Before there were 10 workers, (and in the pandemic) we had to reduce 2 there because… there weren't any left, they were being lost…" (E8); "Yes, it affected me a lot because I always have a staff... so that the coffee plants don't grow weed and harm me, since (the) employees had to be locked up, so I had to find a way for myself, measure myself to the work what the workers did to me "(E41); "It decreased, those who were there remained and no more could be hired. The employees could hardly come because of the risk of the pandemic" (E47).

It was observed that the crisis pushed the strengthening of the family union and the traditional relationships of peasant reciprocity (hand in return, loin for loin, treats), respecting the prescribed biosafety measures, alternation and rotation of work shifts, hiring of workers essentials and physical distancing in production areas to avoid infection.

Effects of sales volume during the pandemic

Peasant family agriculture produces fresh food, generally unprocessed, intended for immediate consumption in the homes of urban families. This characteristic makes the products highly perishable and requires a continuous, rapid and permanent flow of mobilization between the producing areas and the consumption centers. The pandemic and restrictions caught farmers unprepared and unprepared to take contingent actions to market products on time and guarantee productive and family sustainability of economic income. The informants reported the effects of the crisis on sales volume as follows:

"The sales volume decreased because there were not the same number of employees and there was not the same amount of final product…" (E10); "They lowered everything to the sale and all because of the fact that people were even afraid to go out on the street and it seemed like one ate a little because of the fright" (E13); (egg production) was maintained for 6 months, we had to finish the chickens, because the eggs go to delicatessens, for fast foods and with the issue of the pandemic all those businesses were closed" (E1); "(Fish farming), I went down to zero, it is only sold to restaurants, there was no one to sell the cachama to" (E15).

The pandemic caused small producers to lose crops and perishable products (vegetables, fruits, fish, eggs, milk), decrease the size of the farm and the yields of crops and animals, due to the scarcity and high cost of products, inputs and the lack of availability of workers. Two important findings evidenced in the

interviews were the low impacts of the pandemic on the sales volume of grains or processed and stored agricultural products (cheese, coffee, cocoa, panela and rice), which were gradually marketed with advantages in the markets. product prices and; the second, the membership of farmers in associations or cooperatives (milk, rice, coffee, cocoa) that guaranteed them the purchase of production, sale of inputs, financing to sustain production and the family, and remote technical assistance. Some farmers, faced with the impossibility of marketing their products, opted to transform them into cheese, ground coffee, cocoa paste and pickles for family consumption, or later commercialize them in nearby markets.

Economic losses on the farm during the pandemic

The situation generated by the uncertainty and fear of contagion of Covid-19 in 2020, combined with vulnerable socio-productive systems of family farming, broke a traditional economic system of generating income from the sale of products without benefit and reuse. Immediate impact of monetary returns on family subsistence and the sustainability of their small businesses. Significant economic losses compelled many individuals, according to those interviewed, to forfeit their production and even give it away:

"…we had to release the animals because there really was no food to support them" (E1); "The economic losses were always considerable, (in) the sale of pigs for such a low price and such expensive food" (E17); "around 5 hectares of sugarcane were lost in their entirety, they could not be used due to the pandemic…" (E24); "That was a loss, we had about 5 hectares of melon at that time of the pandemic, we sold 200 kg and we had to throw the rest away because who was selling a lot of it to" (E36).

Producers attributed economic losses during the pandemic to various factors, including marketing paralysis due to health restrictions, the deterioration of crops and perishable livestock products, a decline in sales income, and increases in production costs (such as inputs, seeds, food, and medicines). Additionally, they identified impacts on productivity resulting from the lack of agronomic practices, labor shortages, and limitations on livestock productivity due to feeding constraints.

Management of production costs

The management of production costs, according to the producers' testimonies, was quite complex; many of those interviewed were forced to reduce their production in order to survive, reduce animal feed rations and replace commercial agricultural inputs with organic products available on the farms, among other actions, as reported by the producers:

"…The truth is (the costs) could not be managed at any time. Just trying to solve all the shortage of inputs that existed at the time (and) the prices because there were freight charges that were much more expensive…" (E14); "Well, reduce the inputs, it was time to stop production, the planting of crops because…because of the marketing that was not there…because…as one sells, one makes money to buy inputs again, to continue with the crops and like everything else. that stopped" (E36); "We had to deal with the cattle manure, we had to collect it and take it and put it on the bushes because there was no more to avoid leaving the bushes without food" (E35); "It was time to lower the purine and look for…cassava bananas to make assorted meals" (E26).

In the scenario of the health crisis, and given the imperative to maintain agricultural and livestock production and reduce production costs, Farmers used recursiveness by implementing empirical contingency strategies. Thus, to guarantee the feeding of the animals, they prepared food with agricultural species produced on the farm (cassava, corn, banana, fruits, cane) and natural plant sources (grass and mouse bushes), balancing the protein and energy components in the food rations. . In the case of agricultural inputs, farmers prepared organic fertilizers from crop remains and animal manure, reduced the quantity and frequency of chemical applications and used seeds selected from their crops in new plantings. Likewise, in reducing production costs by hiring workers, the measures implemented were the use of family labor and the compensation of services, without payment of wages, among the neighbors closest to the farms.

Maintenance of the commercial flow of products to the markets

The dependence of production cycles on the environmental variables of agro-ecosystems and the genetic potential of the species produced in family farming, and their perishable nature, force producers to adapt to unchangeable periods for harvests or the end of their crops, animal products. In this sense, the volumes of vegetables, fruits, milk, pigs, eggs and fish (highly perishable products) had be marketed in a short time to avoid economic losses. Given the restrictions of the pandemic, informants tell the strategies implemented by farmers to maintain the flow of products to consumers:

"…Well, sales practically stagnated because many establishments (were) closed…we worked based on neighbors, working around selling, as best we could to survive…" (E5); "Since I am an associate of COAGRONORTE, they bought the harvest from us and they also have agricultural inputs and we buy from them there…" (E27); "Well, with the coffee, thank God we didn't have any problems because we have a very important organization... that kept its doors open, we were able to sell the coffee" (E33); "At the end, we practically had to give away the cachama (fish), it was very worrying, we didn't sleep, what were we going to do with that fish there to let it die" (E42); "what I produce is milk and the milkman always came to receive it" (E12); "Well, I went out to the street and sold milk or cheese and with that I bought food and salt for the livestock" (E19).

In the case of perishable products, the marketing strategies followed by farmers were based on short marketing chains between neighbors and nearby markets, direct sales on farms, the use of social networks (especially WhatsApp), and reduction in product prices, products and credit sales. Producers associated with organizations reported that the purchase of coffee, brown sugar, cocoa, milk, and rice during the pandemic quarantine minimally affected the commercial flow. Once the restrictions were relaxed, the exchange gradually recovered, easing the economic crisis for farmers.

Economic Maintenance Strategies for Agribusiness

Resilience out of necessity put pressure on farmers' creativity and resourcefulness during the pandemic. Despite the difficulties that producers had during the crisis, they found alternatives to make sales that would allow them to survive. The testimonies of those interviewed reveal the actions implemented:

"… "he went around" the neighborhoods, from side to side to distribute at home, practically, door to door…" (E3); "it was to grow pumpkin and cassava and sugarcane (to) reduce the purine feed for the pigs, replace them with sugarcane... it was time to add banana strains and mouse kills" (E5); "we had a banana plantation… we sold corn and bread crops, with that we were supporting ourselves" (E30); …we store the coffee (and) to survive with the plantain, the cassava, the chicken…" (E41); "I had to feed them with the same thing that the farm was producing for me because I couldn't get anything in from outside" (E25); "The products were not sold due to the difficulty of transportation, so those products were retained a little and later they were able to be removed with a little more added value" (E39).

In the farmers' experience of obtaining economic income for their families and sustaining productive systems, four important concepts emerge diversification and complementarity strategies, the valuation of ecosystem biodiversity, the potential of agricultural transformation, and the strengths of associativity. In the first, the crisis allows peasant families to value the importance of not depending on a single item of production and that the diversification of their productive systems guarantees the complementarity of their economic income at times in that their main products encounter limitations for marketing. In the second, the richness of local biodiversity and its potential use in the agro-ecosystems of family farming as energy and protein sources. In the third, those farmers who develop transformation processes for their perishable products obtain advantages in marketing due to the added value they incorporate and the longer available storage time and. In the fourth, as mentioned above, farmers' membership in producer organizations protects them from the uncertainties of the markets in times of crisis.

GOOD PRACTICES OF FINANCIAL RESILIENCE

Effects of the pandemic on the financing of productive systems

A high percentage of small agriculture self-finances as producers depend on a continuous flow of cash to support families and production processes. Therefore, the paralysis of exchanges between producers and consumers significantly affected monetary availability. The farmers' testimonies reveal the situations they experienced:

"...you couldn't work with financial entities because they were evasive about the situation you were experiencing...so only with some friends did you look for credit to be able to work..." (E5); "The buyers did not come down and it was always restricted a little, because that is where the talk comes in, where the sale of livestock is and that…" (E7); "What I did was get into debt and right now I owe money…" (E45); "for the peasants it was hard because we were left in debt paying money to the banks paying money at interest and without knowing where from, because what we cultivated was all lost" (E36); "You couldn't go to the market because where do you get money, if you live off of a crop that produces, you would even endure hunger because there was no food coming in" (E35)

The testimonies of the informants imply the vicissitudes experienced to survive financially during the pandemic. The limitations in obtaining income from sales of crops and livestock products collapsed

the weak working capital of farmers, pressuring them to seek bank or personal loans, many with high interest rates. In the adverse conditions, farmers adopted strategies to obtain money for family expenses, among which were mentioned aid from family remittances, support from local governments, barter exchanges of food between neighbors and sales of secondary food products.

Effects of the pandemic on the profitability of agribusinesses

In most agricultural sectors, in the opinion of the farmers interviewed, low profitability was evident, with the exception of products that were agro-transformed, stored and marketed gradually. The high perishability of meat, dairy and agricultural products put pressure on immediate sales or, consequently, losses in production areas. Let us look at respondents' statements about economic gains:

"… it was very little, actually, because that habit of having a sale (and) getting used to a fixed limit… and when the pandemic started it was a blow, everything went to the floor…" (E9); "…sometimes it didn't give the cost, it didn't give any profit. At that time we had to sell the pound (of chicken) cheap because it wasn't enough. What I produced was not enough to cover the food" (E2); "the price of the product remained the same, but production costs increased" (E39); "If I start doing the math, you'll end up in trouble... (E45)

Two intervening variables, acting in opposite directions due to the influence of the pandemic crisis, affected the financial fragility of traditional agricultural systems for small producers: a) the increase in production costs due to high commodity prices and; b) the decrease in the yields of crops and animals in development. In family agriculture, plant and animal species predominantly belong to genetic improvements and, consequently, their expressions in yields and quality are subject to the availability of modern inputs, including the technological knowledge of farmers, so any alteration of the process productive has a direct impact on the economic profitability of production.

Strategies used to guarantee the flow of money during the pandemic

Obtaining money for family support, in the first instance, and to sustain production units, merited the implementation of a set of actions, among which are: the use of own resources (savings), personal loans with interest, bank loans, sale of products on credit, reduction in product prices, income from complementary products, support from associations, humanitarian aid and family remittances, among others. This is what the informants thought:

"…since there was no demand, it was more necessary to extract and struggle even until the product was secured, but with the hope that tomorrow I would be paid, to be able to continue subsisting…" (E5); "The flow of money was maintained by the corn, the bananas, the cassava, the fish that we had...it was what helped not let the company die because if it had been only for the livestock we would not have stayed afloat during this difficult process that It was the pandemic" (E11); "a man gave us a talk to be able to bear the food, the expenses and… he was paid when the pandemic was over, and with the little savings one had…" (E34); "I have always used to having my reserves, because one has to learn that what the land produces takes out the expenses and what remains (is the savings)" (E41).

In relation to financial support from institutions, the greatest support was from producer organizations (associations and cooperatives), and private banks, with the almost total absence of government institutions.

LESSONS LEARNED FROM THE COVID-19 PANDEMIC CRISIS

Learnings from the COVID-19 pandemic crisis

The experience of farmers studied and their families of experiencing a pandemic allowed them to reflect on the meaning of life, the value of the family and their dedication to rural work, configuring an amalgamation of lessons learned with high relevance for future health and environmental crises, and social (Table 3). The testimonies of those interviewed are eloquent in this regard:

"…we have to be very well organized and hopefully belong to an association, where we all take care of each other" (E11); "We learned to manage schedules, shorter days" (E34); "now I lead life more slowly and plan my projects in the short and maximum medium term" (E32); "We learned that with the little we have, we have to survive, plant food to survive" (E15); "There was more time to be with family and that is the positive thing I saw in that pandemic" (E25); "it taught us to manage costs better to manage expenses better" (E47); "The experience is that you have to start thinking about storing to produce and have it there" (E41).

Table 3. Lessons learned from farmers in the COVID-19 pandemic.

Learned lessons	Meanings in times of crisis
Diversify agricultural production so as not to depend on a single main item	Complementarity of agricultural supply
Plan agricultural activities	Rationalization in the use of time and resources
Strengthen family unity and participation at work	Family values
Promote community organization and networks of solidarity collaboration between neighbors	Community solidarity
Strengthen the association of producers for marketing, financing and technical assistance	Community organization
Learn to live with the necessary resources	Scarcity economy
Strengthen short marketing chains and use of social networks	Emerging marketing strategies
Assess the uses of local agrobiodiversity resources in productive agroecosystems	Use of local resources
Establish flexible work shifts and hours	Labor flexibility
Comply with biosafety standards to avoid infections	Health care
Value the countryside as an appropriate space to face quarantines in pandemics	Peaceful rural life
Learn how to transform and store products to incorporate added value and increase the life cycle of the products.	Small scale agribusiness
Assume daily life with greater patience and calmness	Life's sense

The findings from the experiences of small Colombian farmers studied correspond to homologous Latin American, Asian and African studies developed post-pandemic and predominantly under quantitative approaches. The health emergency and quarantine measures imposed by the WHO to prevent the spread of the COVID-19 virus created significant uncertainty for farmers producing perishable products (Paganini *et al.,* 2020). This situation added pressure on the need for survival and resilience responses to adverse conditions (Gómez and Posada, 2021). To address these challenges, farmers adopted a set of practical strategies aimed at mitigating the negative economic impacts on production processes, family health, and economic income.

Mobility restrictions and the closure of agricultural stores, caused by the paralysis of commercial activities for the sale and distribution of agricultural inputs, impacted crop development and animal husbandry (FAO 2020; Pereira, 2021). In response to these challenges, farmers adapted by altering animal feeding patterns, decreasing input quantities (Gómez and Posada, 2021), and resorting to relational capital to acquire necessary inputs on their farms, albeit at higher prices (Loli and Rengifo, 2021). The research findings showed the substitution of animal feed based on concentrated formulas for natural protein and caloric sources available in the agro-biodiversity of their farms and; the preparation of organic fertilizers from crop residues and farm animal manure. These two alternatives were useful to reduce production costs and guarantee the continuation of production processes during the months of mandatory confinement due to the pandemic.

The fear of contagion caused a labor shortage (FAO, 2020), causing a reduction in the number of workers (Gómez and Posada, 2021). The contingency to attend to the production activities of animal farms or planting in development was to activate the participation of family labor (Panchana, 2021) and the relationships of peasant reciprocity in rural work (Riquelme and Vera, 2018) with the neighbors. These strategies made it possible to reduce costs, given reduced income, and strengthen family relationships and community solidarity in rural work.

The damming of crops and livestock products created uncertainty and significant economic losses at the beginning of the pandemic. Then, as survival mechanisms, farmers were rebuilding and innovating in the mobilization of products to consumers. The short marketing chains (Pulcherio *et al.,* 2022; Pereira, 2021). The direct home sales (Viegas *et al.,* 2022; Campos, 2022), mobile food markets (Devaux *et al.,* 2021), family food exchange networks (Loli and Rengifo, 2021), alternative food networks (Bacha *et al.,* 2020), and the use of social networks in digital marketing (Lazzaretti, 2021; Viegas *et al.,* 2022; Campos, 2022) demonstrated significant

effectiveness in distributing agricultural production. This was despite the existing digital gaps in rural territories due to the low levels of schooling, age, and internet access among farmers (Pereira, 2021).

The good economic resilience practices of Colombian farmers studied were focused on the generation of economic income for the sustainability of agribusinesses and their family units by implementing a set of contingent and empirical strategies to reduce production costs and losses of agricultural and livestock items. Managing to move food from farms to consumers; breaking traditional logics and reconstructing culturally instituted processes as a survival mechanism to the Covid-19 health crisis.

The abrupt drop in income generated losses and uncertainty for farmers due to financial problems caused by payment of obligations, reduction in the number of workers and reduction in profit margins (Paladines-Morocho *et al*., 2020; Preciado and García, 2021) and money to cover the costs of food for families and the continuity of production processes. The losses in agricultural profitability occurred, mainly, due to the decrease in sales, and increases in production costs (Luque Zúñiga *et al*., 2021; Mena-Coronel and Gutiérrez-Jaramillo, 2021; Macías-Villacreses *et al*., 2022). Leading to the depreciation of purchasing power, unemployment, poverty and food insecurity (ILO, 2020; Mhlanga and Ndhlovu, 2020) by altering payment chains and reducing liquidity due to the volatility of financial markets and economic paralysis (UNECLAC, 2020)

Paladines-Morocho *et al*. (2020) state that in the health crisis stage, farmers made a set of strategic decisions to generate opportunities in the face of adversity. In the Colombian case, financial need forced us to seek monetary resources to satisfy the basic needs of production units and peasant families. The main source was the use of own resources and family loans, coinciding with the studies carried out by Loli and Rengifo (2021) in Peru and Pinargote-Cedeño *et al*. (2020) in Ecuador, due to the lack of credit culture and complicated requirements and high interest rates of banking entities (Popescu and Popescu, 2022).

Likewise, farmers without financial capacity worked outside their farms to guarantee subsistence (Pu and Zhong, 2020) and to diversify their income (Loli and Rengifo, 2021), taking advantage of the job offer on neighboring farms, despite the risk of contagion of the virus. A notable fact affirmed by the farmers interviewed was the obtaining of economic income from the sale of secondary products, generally grown or raised on the farms for the sustenance of families and workers. Tripathi *et al.* (2021) and Panchana (2020) also reported this finding in Tanzania and Ecuador, respectively.

Practicing good financial resilience involves implementing contingent strategies to alleviate the economic impact of the pandemic on peasant families and production processes. This includes utilizing personal savings, securing interest-free loans from family and neighbors, and capitalizing on the sale of bread and secondary animal species. Peasant families take these measures in response to challenges in marketing the primary products obtained on their farms to the markets.

The economic and health security implications experienced by Colombian farmers studied as a life experience during the pandemic find correspondence with published studies on the impacts of Covid 19 on family farming. These learnings will be useful in the face of new zoonoses, political, environmental and economic crises latent in contemporary society.

One of the most important lessons learned was the strategy of complementarity of agricultural supply through the diversification of the production of agricultural, livestock products and new input substitution practices, evidenced in the findings of Panchana (2021), in Ecuador, and Durant *et al*. (2023), in the United States, who observed a positive relationship of resilience between the diversification of production. The size of the farms and the digital marketing of products; also showing an increase in the sustainability of agri-food systems in Italy (Mastronardi *et al*. 2022). Relying less on an agricultural or livestock product and strengthening the production of a set of complementary products was a lesson generated in the health crisis.

The abrupt rupture of product flows to consumers and income from sales created chaos among farmers during the initial period of the health quarantine. Sowing in the process of development and harvest, preparing animals and products for the market, and initiating new ventures at their initial stages came to a standstill. Faced with these adverse realities, farmers rebuilt marketing processes and channels, generating resilience out of the need for survival. In response to this, they, accustomed to historically naturalize empirical distribution channels, faced the necessity of implementing various strategies. These included establishing short, direct sales marketing chains (Yoshida and Yagi 2021; Tittonell *et al*., 2021) in nearby communities and local markets. Additionally, they embraced the use of social networks for everyday

use and digital marketing (Grigorescu *et al.,* 2022; Quayson, Bai and Osei, 2020). Furthermore, they engaged in processing, agro-transforming, and storing products (García *et al.,* 2022) to add value, extend the useful life, and implemented mobile market strategies (Devaux et al. 2021) and participated in agricultural fairs. They employed these strategies, among others, to sustain the flow of products, secure income and economic resources, and ensure the availability of basic foods to households. The learning experiences experienced by farmers show the need for the diversification of marketing channels, the preparation of farmers in the digital marketing of products and the strengthening of agro-transformation and storage capacities of agricultural goods.

Likewise, the dependence of family farming on the immediate marketing of perishable products caused high vulnerability in the peasant economy during the health quarantine. Farmers who incorporated agro-transformation processes of vegetable or animal raw materials withstood the crisis better due to the possibility of storage and gradual distribution of products to consumers. These findings are corroborated by Loli and Rengifo (2021) in Peru and García *et al*. (2022) in Brazil, showing better prices for added value and reduction of losses due to waste on farms. This learning points out the importance of implementing policies and programs to promote small-scale rural agro industries to strengthen the capacities for agro-transformation of agricultural products and, consequently, the resilience of farmers.

In times of crisis and social isolation, relations of solidarity with neighboring farmers and participation in producer organizations constituted two important pillars to mitigate the effects of the pandemic. In this sense, farmers who received the collaboration of family and close peers in rural work and; Producers belonging to marketing associations showed greater strengths to overcome the problems of production and sale of their products. These findings coincide with the reports of Romero-Mero (2021) in Ecuador; López (2022) in Colombia and; Bacha *et al*. (2020) in Brazil, on the contribution of family and neighbors in rural work; the benefits of organizations for farmers and; the formation of alternative food networks to increase resistance capacities, respectively.

On a personal level, farmers valued family, health and the meaning of life as lessons learned, as superior axiological assumptions. The necessity of social confinement resulted in increased closeness and interaction within the family group in daily home activities and their involvement in farm tasks due to the absence of hired workers. Simultaneously, it heightened awareness of health and life care, prompted by the numerous infections and deaths of family members, neighbors, and friends. Additionally, it fostered, particularly in older adults, spaces for deep reflection on the essential elements of human well-being.

The mandatory confinement due to the quarantine contributed to family reunion, unity and sharing together again (Cabrera *et al*., 2020), altering the daily family dynamics by increasing interactions, negative emotions, convergences and divergences between members of the family group. (Méndez and Robles, 2021), being pressured to implement strategies for contingent coping with the basic needs of dedicating themselves to raising animals and planting crops (Amaya, 2020). This same uncertainty regarding food security was also evident in the protection of the health and life of their family group, understanding new concepts and adopting biosafety measures to prevent infections (FAO, 2020), even combining medical techniques modern with traditional peasant and indigenous knowledge (Hernández *et al*., 2021) during the isolation and treatment of the disease.

Peasants, as a final lesson learned, gained awareness of their ability to endure in an economy marked by scarcity, stemming from limitations in food, medicine, money, employment, recreation, and family health (López, 2022). This realization became a foundational principle in the peasant mentality for confronting future crises. The mediation occurs through the appreciation and sustainable utilization of resources within local agro ecosystems (Vanoli and Mandrini, 2021). It also involves adopting gentler and more intelligent forms of interaction with nature (Altieri and Nicolls, 2021).

CONCLUSIONS

The COVID-19 pandemic posed significant challenges to agricultural production, resulting in substantial economic losses, particularly in perishable products such as milk, eggs, and fish, vegetables, and fruit trees. These challenges stemmed from disruptions in marketing channels, scarcity and high costs of agricultural inputs, and restrictions on labor hiring due to biosafety measures.

To mitigate these impacts and ensure the sustainability of production and food security, small farmers implemented various strategies. These included reducing food rations and agricultural inputs, utilizing diverse nutritional resources on farms, establishing short marketing chains, generating

income from the sale of complementary products, and involving family members in farm work.

The pandemic-induced disruptions significantly affected production volumes, thereby impacting income and the profitability of production systems. Small farmers responded by leveraging their own resources, seeking personal loans from family and neighbors, accessing support from associations and financial institutions, reducing production costs, adjusting product prices, and diversifying income streams through the sale of complementary products.

Lessons learned from the pandemic underscore the importance of diversifying plant and animal product offerings, prudent investment planning, community organization, formation of farmer associations, product transformation, strengthening of family and community engagement, and adoption of digital communication and marketing platforms. These lessons reflect a philosophy of valuing life and maximizing resources within the framework of an economy of scarcity.

Compliance with ethical standards. The research adhered to the standard farm practices and did not involve additional direct work with animals. It followed research guidelines accepted by Santander University Colombia. Formal ethical approval was required for this study as per the 'The 2012 Data Protection Law (Ley 1581) in Colombia pertains to the regulation and assurance of individuals', regarding Bioethical approval requirements for this type of study. The questionnaire included a verbal statement requesting the consent of the producers in accordance with the provisions of the general law on the protection of personal data held by obligated subjects. Verbal as opposed to written consent was used because the aforementioned law does not require written.

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Data availability. Underlying data**.** "Data for: Resilience and lessons learned in Colombian family farming during the COVID-19 pandemic" Mendeley Data, V1, (Zuniga & Núñez, 2024) https://doi.org/10.17632/m5z85bpmrv.1

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