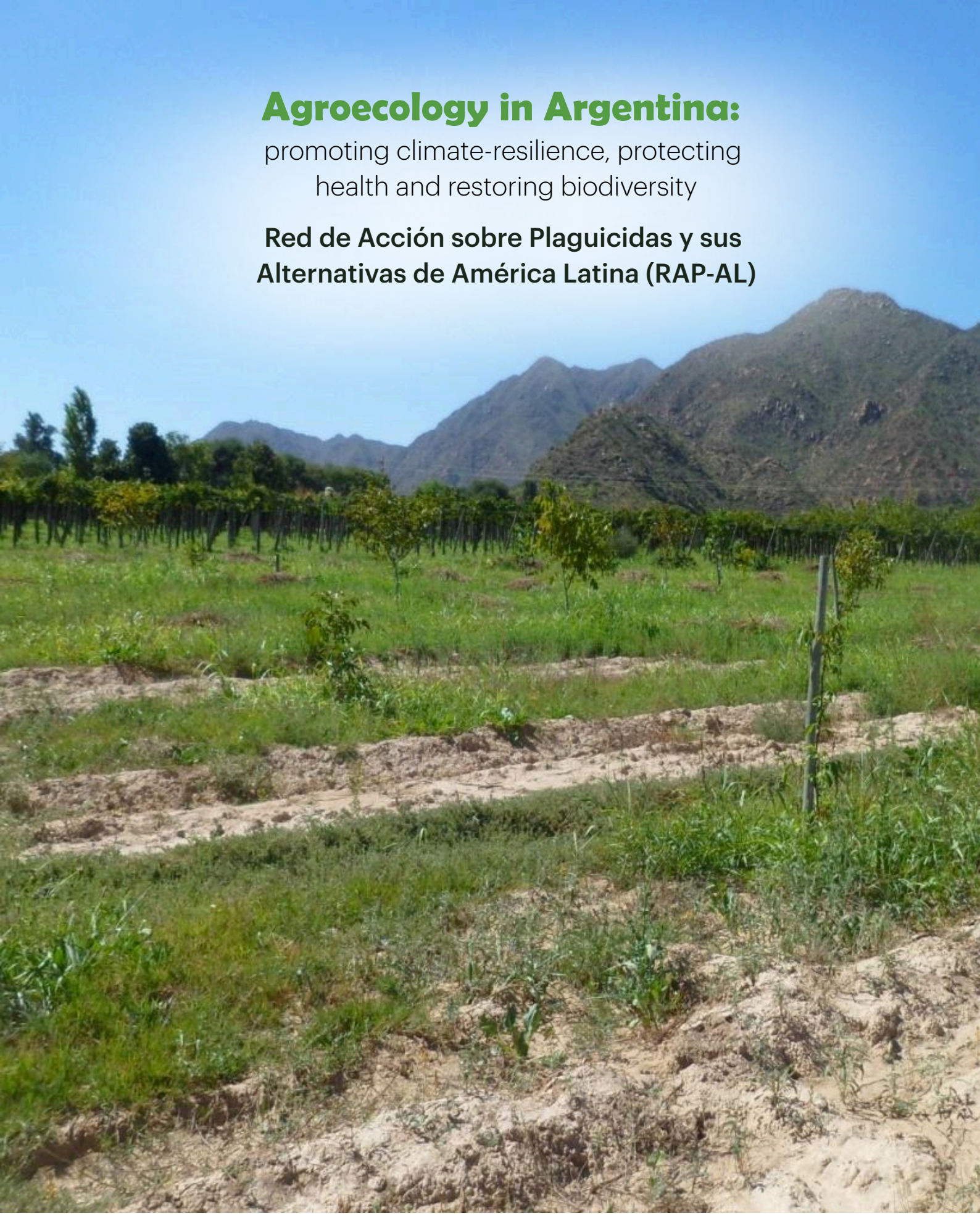
Agroecology in Argentina:

promoting climate-resilience, protecting health and restoring biodiversity

Red de Acción sobre Plaguicidas y sus Alternativas de América Latina (RAP-AL)



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An integrated agroecological wheat–pasture–livestock system

The Calderón family's transition from conventional agriculture to agroecology in the province of Buenos Aires

Abstract

The El Paraíso production unit is located near Baigorrita, General Viamonte District, Province of Buenos Aires, Argentina. It is a 200-hectare integrated crop production-livestock system under family management, where wheat system—livestock under family management, where wheat is grown in association with legumes, which after harvest is ground to produce agroecological whole wheat flour, adding value. Various species of pasture are also grown, which are used for sheep and cattle under holistic management. No synthetic agrochemicals (fertilizers or pesticides) are used. Ninety hectares are managed agroecologically and the remaining 109 hectares are leased to other producers.

Photo credits: Mariana Cecilia Moya

Characteristics of the farm

The Calderón family owns the land and employs five workers, three of whom are family members. The production unit covers an area of 200 hectares: 90 hectares are managed agroecologically and the remaining 109 hectares are leased to other producers. Water is extracted from wells (from subsurface water tables).

The agricultural system used on the production unit includes:

- Wheat production for human consumption, milled to obtain agroecological wholemeal flour;
- Production of pastures with a diversity of associated species, which feed the animals under the Holistic Grazing model, while promoting the fertility and biodiversity of insects, bacteria, and fungi in the soil;
- Rearing and fattening of sheep and cattle under the regenerative grazing model and in harmony with the environment; and
- Preparation of bales of hay from grass sown in previous years to generate a reserve of hay for animal feed.

Production unit: El Paraíso
Producers: Calderón family (Marcos, Patricia, Marcela, Ana María, and Ana Clara)
Location: Baigorrita, General Viamonte District, Buenos Aires

Membership in community and regional organizations

The Calderón family participates in a group of farmers called "Semillas de Alcaraz" (Seeds of Alcaraz), which previously belonged to the Rural Change Program of the National Institute of Agricultural Technology. The Calderón family is also part of the Sheep Producers' Committee of General Viamonte.

Link to national and district public policies

The Calderón property has been certified as agroecological, by the Province of Buenos Aires. They have received free fruit trees and subsidies from the Ministry of Agricultural Affairs of the province of Buenos Aires, and have had access to loans (with longer repayment periods and lower interest rates than conventional producers receive) from the National Ministry of Agriculture.

Type of biome and dominant vegetation systems

The surrounding area is characterized by temperate grasslands composed of fertile soils, which have been greatly transformed by agricultural activity. Much of the original vegetation has been replaced by crops and pastures. The dominant vegetation system originally included pampas grasslands, perennial grasses, and some annuals.

Vegetation in areas with low slopes has a low density of native trees, due to deforestation processes that began in the 19th century. Today, the landscape is dominated by agriculture and livestock farming, with a low number of species (soybeans, corn, wheat, and sunflowers), no crop rotation, and high demand for synthetic inputs from external sources.

Sketch of El Paraíso establishment

The Calderón family's productive unit is characterized by the existence of planted pastures: alfalfa, fescue, and clover. There are also areas of planted forest (eucalyptus, poplar, and willow) on the edges of fields or fences. Naturalized wild plants (such as sorghum, thistles, etc.) are common on roadsides and uncultivated areas. They also grow annual crops such as wheat and corn.

Type of soil

The soils are characteristic of the Pampas region of the sandy loam zone, with dunes present to the west. Taxonomically, most of the soils are of the Hapludol entico type.

Area's climate

The climate is temperate, with warm, humid summers and cool, dry winters. Average annual precipitation is around 900-1000 mm, although the last four years have been dry, with 600-700 mm. The prevailing winds are from the west and southwest. Relative humidity ranges between 70 and 80%, which contributes to a humid climate during the summer.

Health and environmental concerns related to pesticide use

The pesticides atrazine, 2,4-D, glyphosate, chlorpyrifos, and cypermethrin are the most widely used. The effects and damages are varied, such as the appearance of residues in soil, water, and food. There are effects due to the wind carrying pesticide particles (drift) and the impact on flora, fauna, and pollinating insects. In many cases, these pesticides are overused, with detected effects on human health (cancer, respiratory disorders, birth defects), which has prompted the community to seek to establish a framework for limiting the use of pesticides through the enactment of municipal ordinances.

Agroecological practices and approaches

When they began the transition to agroecology, the Calderón family started to enrich themselves with information and knowledge: first through self-teaching, then together with other producers who had already begun the agroecological transition. They were advised by technicians and researchers, exchanged ideas, and received visits to learn which strategies to implement or apply to recover the diversity of life in the soil.

Soil regeneration

In the agricultural system, the first subsystem is the soil, because the priority is to regenerate the microbiology, the life in the soil, protecting it from erosion with surface residues and incorporating organic matter and minerals, which will be the generators of the nutrients necessary for the plant subsystem and the livestock subsystem, which in the case of the production unit includes sheep and cattle. The process of burning bone and hide remains, etc., produces calcium that is used by poultry.

Crop diversification and animal husbandry

With regard to crop associations and rotations, these make it possible to generate diversity in space and time. Furthermore, corn, sorghum, soybeans, and wheat are species that provide resilience (the ability to respond to climatic, ecological, and commercial changes) through agroecological practices. Sheep and cattle farming enables direct fertilization of the soil, which, together with crop residues, improves its chemical, physical, and biological characteristics.

Crop systems

For the crop subsystem, the work and sowing are carried out with the farm's own machinery, which requires the use of externally sourced fuel. In some situations, depending on the needs, intermediaries with agricultural machinery are hired for sowing and harvesting.

The crop subsystem consists of perennial pastures and annual crops. Perennial pastures belong to the botanical families of grasses and legumes; the varieties were chosen for their functionality (red clover, white clover, *Lotus corniculatus*, alfalfa, ryegrass, fescue, triticale, rye, chicory, arugula). It is extremely important to keep the soil covered with plants, which capture and store the sun's energy, rainwater, nitrogen from the air through symbiosis with bacteria, and carbon through photosynthesis. All of this in turn sustains life in the soil.

Thus, recovery is maximized and ecosystem processes are activated, which, when managed, generate a virtuous circle, achieving better meat production at lower costs, soil regeneration without synthetic chemicals, a positive balance to the carbon footprint, and increased work for families with roots in rural areas. Today, all of the seeds are of external origin. The initial investment cost is high, with a pro-rated recovery in approximately four years.

Wheat and rye are sown as annual crops associated with pastures. When they are mature, they are harvested, ground in a traditional stone mill, and turned into agroecological whole wheat flour, which is how it leaves the production system. Depending on the yield of the annual crop, a percentage is set aside for seeds. In due course, the pasture is grazed by sheep and cattle for food. In the 2025/26 season, 30 hectares will be cultivated.

- *Corn:* native seeds from the area are used, meaning that they are neither hybrid nor genetically modified. This allows the farmers to preserve the seed and make healthier corn flour (polenta). In this way, corn leaves the system with greater added value. The stubble (harvest residues) is used for the sheep and cattle.
- *Sorghum* is used for grazing (animal feed) and for the dual purpose of harvesting grain. The stubble (harvest residues) and the grains obtained are used by the sheep. It is also possible to save the seed for the next cycle. Harvest residues, together with animal manure, make excellent fertilizers for the soil.
- *Soybeans* are used in crop rotation to enable the fixation of atmospheric nitrogen thanks to symbiotic bacteria, as well as to increase monetary income. They are sold as grain at a local grain store.

Agroecological wheat cultivation

Integrated livestock systems

Sheep are managed using a method called Intensive Rational Grazing (herd effect), with a stocking rate of 10 animals per hectare, with the aim of obtaining natural meat (animals fed naturally in the field). Females are reserved for breeding (to obtain lambs). At 4-5 months of age, healthy lambs are sold, having been fed only their mother's milk and grazing directly on pasture. The animals are dewormed for both internal and external parasites with diatomaceous earth, and other health products are used when necessary (injectable antiparasitics).

In July 2024, cattle farming was incorporated through a capitalization agreement with other investor producers, adding 37 cows to the production unit, of which 35 mother cows are currently feeding their 35 calves, which weigh approximately 200 kg. This incorporation is part of a strategy to accelerate soil regeneration processes through Holistic Grazing.

The animal system also has an animal subsystem consisting of poultry: chickens, turkeys for self-consumption, and geese and ducks as natural alarms.

If necessary, injectable or drinkable antiparasitic drugs, such as Curabichera, are purchased.

Natural mineral salts: Diatomaceous earth, ashes, salt, sulfur, shell (calcium), sugar.

Supplies: Sunscreen (to provide shade for the animals), cattle fence (electric fence), rods, and wire.

Marketing

The flour is marketed through direct sales by local intermediaries at various points throughout the country and at fairs. When the wheat is ripe, it is harvested and ground in a traditional stone mill to produce Agroecological Whole Wheat Flour, which is how it leaves the system. The milling process produces approximately 25% waste, both from wheat (bran and middlings) and from rye and corn, which is used as supplementary feed for sheep and cattle as needed. The animals are sold on the local market.

Sheep grazing on pasture

Outcomes

- Understanding of the need to integrate systems and activities within the production unit;
- Reappearance of birds and other wild animals and insects in the system, and an increase in flora and fauna of the territory;
- More trees introduced to form part of the summer and winter fruit cultivation (for own consumption), forestation for shade, and windbreak forestation;
- Productive and management activities distributed equitably among siblings;
- Respect for nature, its cycles, and its laws in order to obtain a product that is truly healthy and natural in origin;
- Contributions to food sovereignty, roots in the territory, and a different relationship with the environment, sovereignty in decision-making, and generation of networks of cooperation between consumers and other producers;
- Spreading awareness of "Good Living" (Buen Vivir); the basis of its philosophy of life is Knowledge, which is why we open the doors of the place to conduct training sessions or visits from different schools; and
- The farm's generation of resilience, autonomy, and economic viability through the re-creation of biodiverse agroecosystems and comprehensive soil nutrition.

Benefits

Climate change mitigation

- The carbon footprint is reduced by 80% by not using external chemical synthetic inputs (pesticides) or nitrogen fertilizers;
- Intensive Rational Grazing allows carbon to be fixed in the soil through the deep roots of various species of pasture grasses;
- Organic waste is integrated into the production unit by producing an adequate humification process, avoiding the release of methane gas; and
- Less carbon dioxide is released from the soil by reducing seedbed preparation work.

Climate adaptation

- Trees, pastures, and annual crops absorb carbon dioxide;
- The amount of organic matter in the soil increased, making the system more resilient to droughts and floods;
- Crop diversity and permanent soil cover led to greater production stability and lower risk of total losses;
- Diversification of activities provides economic stability in the face of extreme weather events; and
- The use of plants with extensive and deep roots in animal feed pastures improves water capture.

Biodiversity

- Sowing pastures with 10 to 15 different species makes it possible to take advantage of various ecological micro-niches (water and soil). These species also produce seeds for the regeneration of new pastures. This methodology leads to the appearance of native plant species, especially grasses (honey grass, *Chloris*, horquilla grass), which are very important because of the amount of roots and aerial plant material they produce;
- The population of adventitious (wild) plants that form part of the system increases, generating a larger plant population and, therefore, increasing the amount of organic matter in the air and soil, as well as wildlife (flora and fauna);
- Different populations of species appear, which, depending on their needs, preferentially occupy low or high areas of the terrain, such as hills. In the lowlands, there is a higher concentration of legumes such as *Lotus corniculatus*, and on the hills, native grasses appear, some of which are perennial;
- With the abandonment of monoculture, different habitats have emerged, dominated by species adapted to them, and the tropical cycle, which was not previously perceived, can now be seen, where functional diversity is realized;
- Since pesticides are no longer used, pollinating insects and wildlife have returned to the agroecosystem;
- Genetic variability in crops and animals reduces vulnerability and disease; and
- A greater number of trees regulate the water cycle, buffer winds, temper extreme temperatures, and contribute organic matter.

Observation of agroecological crops

Benefits (continued)

Economy

- External inputs have been reduced from 80% to 10%. This allows for greater autonomy and food sovereignty; and
- Production costs are lower because the farmers produce their own seeds and do not buy fertilizers, relying instead on crop rotation and animal manures. Direct revenues are lower, as they have reduced the area under production, but their gross margin is higher than that of other producers in the area, since they receive a higher price for their flour, which is produced agroecologically. Overall, the economic results are better. There are still many fixed costs to consider (taxes, for example).

Gender equality

- Active participation of women in decision-making, farm management, and marketing; and
- The family unit is an example of shared responsibility, where tasks are distributed according to abilities and not traditional gender roles.

Community participation

- The conventional system is individualistic, while this system focuses on human beings and their relationships. More social networks are created;
- The system encourages networking and cooperation;
- Opening up the countryside to schools, farmers, and the community in general, creates spaces for education and exchange;
- Participation in the Sheep Roundtable and in farmer groups with an agroecological focus;
- The production unit is open to external visitors and various stakeholders, such as producers and students from different educational levels, who seek to exchange knowledge, obtain data, or conduct research on what is happening in different dimensions of the agroecosystem; and
- The production unit has become a beacon of reference.

Naturally fed cattle

Health and environment

- By eliminating synthetic pesticides, reduced risk of acute and chronic diseases for families, workers, and consumers;
- Decreased soil, air, and water pollution; and
- Production of food that contains no traces of pesticides and is truly nutritious, improving the quality of life of those who consume it.

Lessons Learned

- Changing the production model promotes life in all its manifestations: the perseverance, persistence, and conviction that nurture the family.
- Recovering the identity of farmers: looking again at the soil and its characteristics, valuing microbiology, respecting the cycles of nature. We see how the birds return, how native species sprout, how the countryside comes back to life.
- Most importantly, the food that is produced truly nourishes people, cares for their health, and tells a story of resilience and hope.
- Food sovereignty is built and living the Good Life (Buen Vivir) is sought.

Challenges

- *Social:* Limited understanding that agroecology is a paradigm based on the creation of an agroecosystem and on a system of knowledge-centered technological processes, rather than the use of synthetic chemical inputs, as is the case with the agro-industrial model. This limited understanding contributes to the isolation of the pioneers of the agroecological paradigm in Argentina's main fertilizer and pesticide producing area.
- *Knowledge exchange:* Lack of ongoing agroecological advice; limited knowledge exchange among farmers. Consumers also lack knowledge about healthy foods, the differences between organically produced foods and agroecology, and impacts on health.
- *Economic:* Low productivity and profitability at the beginning of the transition; high fixed costs; limited bank financing for agroecological agriculture.
- *Marketing:* Insufficient support for the marketing of agroecological products, added value, and customer recruitment.
- *Lack of public policy support:* fiscal pressure from the state that does not take into account the particular difficulties generated by the transition process.
- *Agroeconomic:* Low soil fertility.

Many of the challenges identified can be addressed through the recommendations below.

Graphic courtesy of El Huerto Interior

Recommendations

Producers

- Start in a small area of the production unit and increase the area as you gain experience;
- Step outside your comfort zone, lose your fear of change, of the new, of the unknown. Lose your fear of the (negative) perception of "being" a "marginal" producer (crazy, weird, hippie, anti-establishment). Accept the possibility of new positive experiences that accompany change.

Policies and institutional support

- Develop infrastructure and services in rural areas to ensure the stability and quality of life of farming families;
- Generate state policies that prioritize agroecology as a sustainable and resilient production model;
- Provide specific lines of credit for the transition, with grace periods commensurate with the time required for the process and the establishment of agroecosystems;
- Provide tax incentives or reductions for production units whose practices do not have a negative impact on food production, health, life, and the environment;
- Public policies that support farmers in the transition (more credit, lower taxes, lower withholding taxes or export taxes);
- Achieve participatory agroecological certification systems (SPG) with the participation of producers, state institutions, civil society organizations, and consumers; and
- Encourage the creation of local networks and markets that bring consumers closer to producers so that healthy and nutritious food is accessible.

Collaborative initiatives

- Achieve a holistic vision and the common good by promoting participatory training and rural extension programs that include traditional knowledge and agroecological approaches. If one producer can change, so can another!
- Recognize the added value of agroecological foods through agroecological certifications that are economically accessible and allow for the participation of various actors;
- Raise awareness of the hidden costs and benefits of both models (in terms of water, organic matter, mineral loss, soil microbiology, and biodiversity) to enable appropriate and relevant decision-making;
- Showcase the agroecological model and disseminate existing examples, generating networks and intercommunication;
- Overcome ignorance and prejudice surrounding agroecology by raising awareness of the negative consequences of the agro-industrial production model for socio-environmental health; and
- Recover and value diverse cultural practices and rebuild a social and cultural fabric for the transmission of knowledge among farmers.

Advice from Marcela, Marcos, and Patricia Calderón to other producers:

"Our dream is that more and more farmers will cultivate naturally, and that awareness of agricultural culture will spread from those who have a pot on their apartment balcony, to those with a garden at home, to those with a park at their country house, to those with a vacant lot. You don't need to own land to change your awareness of the way of life. But we also find strengths: networks of producers, conscious consumers, bonds that transcend the commercial. We are sowing the future, sowing autonomy, sowing life. One of the changes that begins with this agroecological model is that you work for yourself, whereas in the other model you are a slave to many, to a well-established and closed system (banks, the tax agency, grain collectors, agronomists selling inputs, machinery sales, etc.). As we have discovered, overcoming each difficulty reaffirms us on the path: we are sowing the future."

Marcela Calderón at an agroecological fair

Pesticide Action Network International (PAN) is a network of over 600 participating nongovernmental organizations, institutions and individuals in over 90 countries working to replace the use of hazardous pesticides with ecologically sound and socially just alternatives.
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Red de Acción sobre Plaguicidas y sus Alternativas de América Latina (RAP-AL)
Founded in June 1983, RAP-AL, (the Latin American office of PAN) is a network of organizations, institutions, universities, associations, and individuals who oppose the massive and indiscriminate use of pesticides, especially highly hazardous ones, and genetically modified crops, putting forward proposals based on agroecology to reduce and eliminate their use in order to improve socio-environmental health and achieve food sovereignty.

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Agroecological and climate-resilient walnut production in La Rioja, Argentina

Abstract

This case study shows the process of transition and consolidation in agroecology in a family-type production unit located in Famatina, La Rioja province, which has 1.5 hectares where walnut trees are intercropped with oats as a way to generate biodiversity and increase the organic matter content of the soil. The case study demonstrates that it is possible to produce agroecologically by increasing the overall nutrition of the soil, thereby improving its chemical, biological, and physical characteristics. Pablo Montilla began working on his farm by combining knowledge from the scientific field (university courses, attending and teaching workshops, and courses) with knowledge gained from practical experience, as he comes from a family that is involved in agricultural production, albeit in a conventional way.

Context

The area is characterized by belonging to the arid and semi-arid territories of Argentina, where there is a wide temperature range, rainfall concentrated in the summer, dry winds, and low atmospheric humidity. These variables determine the presence of sandy soils, devoid of organic matter and sometimes saline. Overgrazing, deforestation, and the expansion of agricultural activities with their associated technological packages have led to the loss of biodiversity, wind erosion, environmental pollution, and soil salinization. The territory where walnut trees are grown is characterized by the existence of peasant and business producers of vines, walnut trees, olive trees, and vegetables produced conventionally, with the use of pesticides and fertilizers, although the number of agroecological producers has also increased. Mining activity, which has developed over the last 140 years, is prominent in the area. The emergence of diseases and water pollution led to community mobilization, resulting in restrictions being imposed on the activity. The decrease in the frequency and intensity of rainfall, together with the lower contribution of water from snowmelt, has led to disputes between various actors over water for human consumption and plant irrigation. Although the communities within the territory have a worldview of respect for natural resources and the inclusion of human beings in nature, this has been changing as a result of capitalist development in the area.

Planting walnut trees interspersed with oats

Production unit: La Media Luna farm ("half moon" in English)
Producer: Pablo Montilla
Location: Famatina, La Rioja, Argentina

Characteristics of the production unit: The property covers 1.5 hectares. Pablo is the owner of the land. The walnut trees, which are grown in rotation with oats, are irrigated by furrows with water obtained, along with other producers, from a local river.

Membership in organizations: Pablo participates in the local irrigation consortium and the Famatina Agricultural Producers Association (APAF, by its acronym in Spanish).

Links to public policies: Pablo currently has no links, but in previous years he had links with the National Institute of Agricultural Technology (INTA, by its acronym in Spanish) and the walnut production cluster in the province. These links have enabled him to access inputs, knowledge about production strategies and practices, as well as to learn about marketing methods and to connect with other producers.

Technologies used: Pablo does not own a tractor or plows; soil management tasks are carried out by a contractor. He does own hand tools (shovels, hoes) and a brush cutter (fuel-powered wild plant cutter) for cutting grass.

All photo credits: Javier Souza Casadinho

Agroecological practices

Source of walnut trees and rootstocks: When Pablo started the business twelve years ago, the walnut trees were already on the property, and he added new walnut trees purchased from local stores. He buys what are called rootstocks, and grafts branches or buds from commercial varieties onto them. He has also been grafting parts of the walnut tree (scions) onto obsolete or old walnut trees.

Soil and nutrient management: Pablo fertilizes his property with purchased goat and chicken manure, although he did not do so last year due to the cost of these fertilizers. Working the soil carefully and with the right tools reduces soil disturbance, maintains its structure, incorporates crop residues, and improves soil biology. He has grown green manure crops to incorporate organic matter and thus improve soil characteristics. In addition, nitrogen is incorporated due to the symbiosis of leguminous plants with bacteria of the genus *Rhizobium*.

Insect and disease management: Prevention is the main tool. There is great biological diversity since the farm was designed to blend into the natural environment (forest). The farm is immersed in the forest where native trees provide protection from the wind and shelter for beneficial insects. There are also special places called "islands" within the farm where pennyroyal plants grow naturally. This diversity provides shelter, food, and mating sites for insects that prey on or parasitize harmful insects. The main insect that attacks the plants is *Carpocapsa* sp, which is managed using biological inputs and resistant varieties. Foliar fertilizers also improve plant nutrition and health, increasing their resistance to insects and diseases.

Marketing: Pablo sells his products in other provinces to retail businesses as agroecological walnuts in 10, 20, and 25-kilogram bags. He occasionally sells to local consumers in 1-kilogram bags. On some occasions, he receives an additional bonus from consumers and intermediate marketers for selling agroecological products. He does not have participatory guarantee system certification or any other type of certification.

The table at the end provides additional details on agroecological practices for nutrient, pest, and disease management.

Top photo: Planting walnut trees in harmony with the natural environment

Bottom photo: Agroecological walnut trees

Benefits

- Increased temporary and spatial diversity provides resilience to climate change.
- Increased diversity and soil fertilization improve its physical, chemical, and biological characteristics.
- Not using pesticides and fertilizers significantly improves the socio-environmental health and well-being of all living beings.
- Production costs are reduced by not using chemical inputs.
- Healthier food is produced as it does not contain traces of pesticides.
- Social cohesion and mutual learning are increasing, as more producers have visited the farm in recent years. Pablo has also been invited to give talks at other educational institutions and producer associations.

Challenges

- **Climate change:** Rising temperatures and humidity have led to the emergence of fungal diseases and prevent trees from vernalizing (accumulating cold hours), which hinders proper flowering and fruiting, while reduced rainfall inhibits plant growth and increased humidity may be promoting the emergence of fungal diseases. The decrease in rainfall reduces winter snowfall and, therefore, the water available in rivers during the summer.
- **Production costs:** Although the production unit covers all production costs, it does not fully compensate for family labor, the increased cost of purchased fertilizers, or the costs of transporting dried fruits to market (associated with increased fuel costs).
- **Scale of production:** Achieving an adequate scale of production requires replacing "old" or "obsolete" plants with new ones, which are expensive. To avoid these costs, producers plant fewer new plants and therefore have lower production than could be achievable. The cost of grafting new "shoots" or "productive branches" is also high, both in terms of labor and inputs (new shoots).
- **Water:** Access to water supply is problematic due to a lack of organization among producers, which means that irrigation channels are not maintained in good condition. Water scarcity is exacerbated by increased demand from large producers of olives, pistachios, walnuts, and grapes.

A sign welcomes visitors to La Media Luna, an agroecological farm

Actions to address climate change and other challenges

- Designing the production unit as a living organism with multiple relationships, and carrying out the design and implementation of walnut trees in accordance with the natural environment, in harmony with the plants that grow (herbaceous, arboreal, and shrubby) in the forest.
- Including more biological diversity to support the resilience of agroecosystems to environmental pressures related to climate change.
- Keeping the soil covered with walnut leaf litter, wild plants that grow spontaneously, and green manure crops such as vetch and oats. This generates organic matter in the soil, which promotes water infiltration, retention, and maintenance of soil moisture, which is beneficial during droughts and heavy rains.
- Organizing among producers can address some of the identified production and marketing costs; additional policy changes are also necessary (see Recommendations).

Lessons Learned

La Media Luna's production unit allows us to share a range of knowledge and lessons learned.

- **Integrating the production unit into the natural environment**, the forest, consisting of species such as Tala, Algarrobo, Jarilla, and Retamo. We learn about the need to increase diversity in order to generate processes of interaction between species, for example, the provision of wild plants for food, shelter, and mating sites for beneficial insects. Tree plants act as living fences, reducing wind speed and absorbing carbon dioxide (one of the gases responsible for climate change).
- **Mitigating climate change:** Using less tillage on the soil and doing so with tools (chisel plow) that disturb the soil less than conventional tillage means using less fossil fuels and emitting less carbon dioxide.
- **Critically adapting to climate change:** Applying animal manure and planting green manure increases the amount of organic matter in the soil, improving its characteristics such as infiltration and storage of rainwater and irrigation. Keeping the soil covered prevents water evaporation from the soil.
- **No synthetic pesticides are used:** Insects can be managed by generating natural and cultivated biodiversity, which minimizes outbreaks of harmful species and provides comprehensive soil nutrition. The latter promotes the growth of healthy plants that are naturally more resistant to insects. With these practices, synthetic pesticides are neither required nor used.
- **Working in a production unit that is treated as a living organism** with multiple relationships, with healthy soils and biodiversity of plants, insects, and birds, brings satisfaction to the members of the production unit, promoting their health and well-being.
- **The ability to make timely changes,** for example, in the selection of nut varieties resistant to insect attack, increases the adaptability and success of the production unit.

Recommendations

Producers

Promote coordination among producers based on solidarity and community organizing. By organizing, the collective can strengthen the organization among producers in order to achieve different objectives.

- Purchase fertilizers in larger volumes, reducing costs.
- Influence public policies related to walnut production.
- Improve and increase local and regional marketing channels.

Institutional and regulatory support

- Establish credit policies, through state and private banks, to promote the incorporation of agroecological strategies and practices.

Collaborative initiatives

- Enable the emergence, appreciation, and sharing of local knowledge through meetings between producers and official agencies and non-governmental organizations that carry out agricultural extension work.
- Promote more training and knowledge exchange opportunities through state institutions and those created by producers.
- Promote the participation of young people from rural families and agricultural training institutions.
- Create opportunities for consumers and producers to meet in order to promote the production and consumption of healthy foods through "short" or local marketing channels.

Javier Souza Casadinho & Pablo Montilla

APPENDIX
Table: Agroecological practices for nutrient, pest, and disease management

Method	Details and benefits	Principles
Diversified cultivation of perennial plants alongside green manure crops and wild plants and aromatic plants	The design includes the cultivation of walnut trees, oats as green manure, and specific areas where medicinal and aromatic plants grow (islands and corridors). It nourishes the soil and provides shelter and food for beneficial insects.	Synergy, socio-environmental health, diversification, ecological management of insects and diseases, comprehensive soil nutrition. No use of synthetic pesticides; pollinator feeding
Living fences	Native trees such as retamo, jarilla, tala, and carob are allowed to grow to provide shelter and protection for beneficial insects and protection from the wind.	Synergy, biodiversity, reduction of inputs, protection of human health, plant health, water cycle. Integrated landscapes
Appropriate mechanical tools	Working the soil with a harrow and disc plow incorporates crop residues (plant debris) into the soil, controls weeds, and prepares the soil for planting. Using a chisel plow causes less disturbance to soil structure and the organisms (bacteria, fungi, and insects) that live in it.	Biodiversity, soil biology, ecosystem health
Use of goat and chicken manure	Application of goat manure at the base of plants to improve soil fertility. Fertilizers are purchased from local producers (goat farmers) or from intermediaries who bring them from more distant areas.	Reduction of inputs, improvement of the chemical, physical, and biological characteristics of the soil, nutrient cycle, plant health, and prevention of insects and diseases, use of local resources.
Ash and wood chips	Ash is obtained from burning branches and firewood, and wood chips are applied to the soil; they provide beneficial nutrients (phosphorus, calcium).	Reduction of inputs, soil fertility, nutrient cycle, plant health, use of local resources.
Green manure	Oats are sown to improve soil structure and fertility and are grown in association with vetch and rye. Vicia crops are sown both to incorporate organic matter and thus improve soil structure and fertility, and to incorporate nitrogen through the symbiosis of these plants with soil bacteria.	Reduction of inputs, soil fertility and biodiversity, nutrient cycle, plant health and pest and disease prevention, use of local resources. Increase in biological diversity in the soil.
Foliar fertilizer	Made from cow manure and mineral salts (Supermagro), it is applied to the leaves of plants for rapid nutrient absorption.	Reduction of external inputs, soil quality, nutrient cycle, plant health and pest and disease prevention, use of local resources.
Resistant varieties	Planting of resistant nut varieties known as "Sunday" and "David," which have a harder shell.	Reduction in pesticide use, protecting community health.
Use of bio-inputs	Application of virus-based inputs for Carpocapsa management; use of sex pheromone strips to confuse males during mating.	Reduced pesticide use, natural insect management, community health.

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The transition to agroecology in Marcela Benbassat's garden in Loma Verde Escobar, Argentina

Abstract

Marcela Benbassat grows vegetables on a farm located close to the city of Buenos Aires. Her farm is in an area where vegetable production exists alongside residential areas, which has led to conflicts over the use of pesticides. Vegetable production activities, which have been carried out for 70 years, require a high-level of pesticide use in order to increase productivity and the formal quality of the products. The high use of pesticides, which generates resistance in insects, together with the scarcity of biodiversity, reinforces dependence on these inputs. Research on vegetable quality shows high levels of chemical substances.

In response to this situation, agroecological producers have emerged in recent years, seeking to produce high-quality food based on biological diversity and comprehensive soil nutrition. These producers market their products at their own production units and at local fairs and markets. Among the motivations for agroecological production are protecting environmental health, producing healthy food, and reducing production costs. There are cases where producers and consumers have formed associations, known as Community Supported Agriculture (CSA), in order to jointly plan activities (crops to be grown, animal husbandry, product processing), sharing risks and benefits.

Marcela Benbassat hosts visiting farmers

Production unit: Large vegetable garden
Producer: Marcela Benbassat
Location: Loma Verde Escobar, Buenos Aires province

Membership in organizations: Participates in the Argentine Biodynamic Association (ABDA, by its acronym in Spanish)

Link to public policies: It was awarded a certificate of agroecological production and received fruit trees from the Ministry of Agricultural Affairs of the province of Buenos Aires. The farm (name?) also received 30 fruit trees as part of a project linked to the same ministry.

Technologies used: they do not have a tractor, but they do have a rototiller and hand tools (shovels, hoes, rakes, and mattocks).

Characteristics of the production unit

The production unit covers an area of 0.5 hectares, 21% of which is under greenhouse cover. It has been leased, rented, for 12 years. It is watered by drip irrigation with water extracted from a well by an electric pump. In addition to Marcela Benbassat, three salaried workers who are not part of the family work on the farm.

Marketing is carried out through direct sales on the premises based on orders placed electronically (Internet, WhatsApp), in what is known as an "online" store, with products picked up on the premises or delivered to the customer's home (including payment of shipping costs). Products are also sold at a delivery point located in the nearby town of Vicente López. The production unit has a store where it sells its own products and other products (bread, sweets, flour, wine, olives) from other producers located in various areas around Argentina.

All Photo credits: Javier Souza Casadinho

Agroecological practices and approaches

Crops: a) Vegetables (lettuce, chard, artichokes, squash, arugula, zucchini, etc.). b) Medicinal plants (mint, rosemary, oregano). c) Fruit trees that are not yet in production. They dig deeply every two years, then make ridges 40 meters long by 1 meter wide where they grow various species of plants. They do not have animals, but they do have four beehives.

Seed management: They produce their own seeds (except for tomatoes), also buy from a seed producer that follows biodynamic standards, and have received seeds from state programs. They buy lettuce seedlings.

Nutrient management: To improve soil fertility and nutrient absorption, the farm uses compost from the farm itself, livestock manure, and green manure, as well as other natural products.

Pest and disease management: The main approach is based on (a) prevention, diversifying natural and cultivated species in the garden design, which attracts beneficial insects and repels harmful ones, and (b) growing healthy crops through soil nutrition management, which increases plant resistance to insect pests and diseases. When necessary, various natural treatments are used (manual removal, biological inputs, chemical-free seed treatments).

Additional details on agroecological practices for nutrient, pest, and disease management are provided in the table at the end.

Additional characteristics of the agroecosystem

Physical aspects

- They have living fences where they grow privet berries and pindo palms to obtain material for compost, as well as firewood to burn during frosts and to protect crops from wind and pesticide drift from nearby farms.
- The trees also participate in the water cycle, absorbing rainwater, using it in their metabolic processes, and then transpiring it.

Economic and social aspects

- **Economic:** Although sales of products fell due to the economic crisis in Argentina, the production unit is still profitable. Expenses for plastic material to protect against the cold have increased. The production unit covers all costs and also remunerates fixed capital, making it financially viable.
- **Gender and youth:** There is gender and intergenerational equity, with employees under the age of 30.
- **Community organization:** Neighbors visit the property and learn about the practices, such as fertilizing the soil with composted poultry manure. They cooperate with other production units by exchanging products and alternating selling days. Commercial agreements are made to barter products, and the property is open to neighbors and visitors.

Vegetable sponge plants grown to shade tomatoes

Impacts of climate change and farmers' responses

- Rapid climate change and extreme weather events have posed numerous challenges to agriculture in the region. Some of these adverse effects and farmers' responses are detailed below.
- More frosts (temperatures below zero degrees Celsius) and they are more intense.
- Higher temperatures affect seed germination, increase the need for irrigation, cause plants to suffer from heat stress, and halt their growth. More ventilation is needed, and greenhouses must be opened.
- Stronger winds that can break greenhouses and raise dust, and more rain in summer.
- Excessive rainfall in summer and humidity can promote the development of fungal diseases such as Sclerotina sp. in lettuce crops.
- Some insect populations increase with rising temperatures (grasshoppers, mites).

Farmers have responded with these measures:

- Increased irrigation due to lack of rain, although this increases production costs (electricity).
- To prevent water evaporation from the soil, they plant more densely and use mulch made from vegetable leaves.
- Damage to crops caused by frost and low temperatures is controlled by burning wood to generate heat and placing plastic (anti-frost) in greenhouses.
- With regard to insect population dynamics, high temperatures increase the population of some insects, such as grasshoppers, so they work with more diversity and bio-inputs prepared from the same insects that are incinerated, spreading their ashes as dust or spraying them as liquid on the crop.
- When spider mites appear in tomato crops, they shade the plants with other plants such as loofah, apply straw to the soil, and spray the plants with a horsetail (Equisetum sp.) maceration.
- As a preventive measure, crop rotation and intercropping are used.
- Planting living hedges of trees that reduce wind speed can minimize damage to greenhouses.
- To reduce fungal diseases caused by humidity, plant a greater variety of plants, enrich the soil with organic matter, rotate crops, and increase ventilation in greenhouses.
- To prevent pest outbreaks, plant crops in rotation and association.

Outcomes and benefits

- They produce their own agroecological seeds.
- They practice innovative cultivation methods (placing loofah sponges above tomato plants to provide shade) and harvesting methods (only cutting the leaves of celery).
- They sustain soil life and keep it healthy by not using synthetic fertilizers, minimizing tillage, and incorporating organic fertilizers.
- They generate productive diversity by respecting natural and cultivated diversity, both in time and space.
- Adopting new vegetable species such as lettuce, kale, etc.
- Planting trees to promote mating sites and shelter for insect-eating birds.
- Maintain productive excellence, produce rich, healthy vegetables, and always experiment.

Lessons learned

The farmer identified several main lessons learned from her experience in managing the farm with agroecological practices:

- She highlighted the need to observe nature, its processes, the relationships between organisms and their cycles, along with the changes that arise, for example, in the face of the climate crisis.
- The need to generate change, innovate, and experiment, including practices to deal with new situations in production, marketing, and consumption, was mentioned. Examples include incorporating practices to manage insects, harvesting vegetables only when requested by consumers, and even growing new species such as kale.
- The need to obtain and conserve their own seeds was also highlighted, not only because it is more economical, but also because the seeds adapt to local conditions and can be used at the right time (when they are needed).
- The idea of maintaining productive excellence that results in healthy and nutritious food is mentioned.

Sign at farm store: "Food for Life, Food for the Soul"

Lessons learned (Cont.)

Factors that helped farmers in the transition

- First of all, it is worth highlighting the construction and exchange of knowledge and expertise with other producers and agricultural technicians. Their own convictions about the inclusion of human beings in nature and the need to respect natural cycles and life on the planet are also noteworthy. The relationship with consumers makes it possible to plan production and obtain genuine income.
- Consumer acceptance of their vegetables, together with the possibility of marketing their products and those from other producers in the same premises, not only increases their income but also allows them to welcome consumers who can visit the production unit.

Obstacles that hindered the process

- Access to land. Marcela is a tenant who pays monthly rent to use the land. In recent years, the rent has increased, and since she does not own the land, she cannot plan for mid- and long-term, for example, to include more fruit trees or other perennial crops.
- The cost of energy needed for irrigation. In recent years, the cost of electricity has risen, limiting the possibilities of irrigating when necessary.
- The lack of support from public policies. This refers to access to credit on adequate terms (interest rates and payment conditions). The lack of policies promoting the consumption of healthy foods from agroecological production units was also mentioned.
- The existence of conventional agricultural units that apply synthetic pesticides and can contaminate vegetables produced agroecologically.

How these obstacles can be overcome

According to Marcela, her farm seeks to overcome these challenges by:

- Producers helping each other during production and marketing phases
- Taking advantage of family labor and that of hired workers
- Establishing direct contact with consumers
- Being creative and always innovating
- Engaging in dialogue with conventional producers to inform them of the advantages of producing under the agroecological paradigm

Marcela's advice to other farmers interested in switching to organic farming:

"The most important thing is that everyone must come together to care for water, life, and the future of the planet. Agroecological farmers can set an example for other producers... showing the way to health, well-being, and good living."

Farmers touring Marcela's property

Recommendations

Political and institutional support

- Increase municipal support, for example by reducing taxes and fees, improving access to markets, and purchasing a portion of agroecological farmers' production to feed people in hospitals, nursing homes, and schools.
- Implement effective land access plans.

Collaborative initiatives

- Establish more local markets created jointly by the state, producers, and consumers.
- Recreate participatory certification systems to guarantee agroecological production jointly among consumers, producers, universities, and research institutes with state support, based on the respective official regulations (ordinances).
- Establish systematically and continuously organized communication and knowledge exchange systems, such as Popular Schools of Agroecology. Consumers should participate in the meetings.
- Conduct more experimental research on agroecological practices and technologies. Producers' own land should be used to carry out participatory action research activities in collaboration with research institutions and universities.
- Encourage exchanges between seed, knowledge, and products producers.

Ethical responsibilities

- Care for water, life, and the planet through processes that include environmental praxis, which implies reflection together with action.
- Care from the soul, understanding that one of the most important dimensions of agroecology is spirituality, which allows us to recover the notion of transcendence and our connections with all living beings.
- Be role models for other producers by creating socio-environmentally sustainable and economically viable agroecosystems.

Agroecology is health, for human beings and Mother Earth, for and in the production of healthy vegetables. Health is for all!

Left and right photos show the large diversity of plants in Marcela's garden

APPENDIX
Table: Agroecological practices for nutrient, pest, and disease management

Method	Further information	Agroecology principles
Diversified cultivation with horticultural, aromatic, and medicinal plants	The design includes a wide variety of natural and cultivated species in rotation and association. For example, combining crops that, when planted together, repel harmful insects or attract predators and parasites.	Synergy, food security, family health, economic and food diversification, reduction of inputs, biodiversity, plant health, reduction of pesticide use, protection of pollinators.
Living fences	Privet berries and pindo palms cultivated to provide material for compost, firewood, and protection for crops from frost and wind, as well as barriers against pesticide drift from nearby farms.	Synergy, biodiversity, reduction of inputs, protection of human health, plant health, water cycle.
Livestock manure composting	Composting and application of livestock manure to improve soil fertility. Sometimes manure is applied directly to the soil.	Reduction of external inputs, soil fertility and biodiversity, nutrient cycle, plant health and pest and disease prevention, use of local resources.
Green manure	Made from plant matter, such as peas, and applied to the soil to improve its structure, moisture retention, and fertility.	Reduction of external inputs, soil fertility and biodiversity, nutrient cycle, plant health and pest and disease prevention, use of local resources.
Ash and wood chips	Ash is obtained from burning branches and firewood, and wood chips are applied to the soil; they provide beneficial nutrients (phosphorus, calcium).	Reduction of inputs, soil fertility, nutrient cycle, plant health, use of local resources.
Soil mulch	The top layer of soil under the trees is mixed with water to fertilize the soil, protect the soil surface, and retain soil moisture.	Reduction of external inputs, soil quality, nutrient cycle, plant health and prevention of pests and diseases, use of local resources.
Foliar fertilizer	Made from cow manure and mineral salts (Supermagro), it is applied to the leaves of plants for rapid nutrient absorption.	Reduction of external inputs, soil quality, nutrient cycle, plant health and pest and disease prevention, use of local resources.
Use of bio-inputs based on Rhizobium bacteria and mycorrhizal fungi	Improves the absorption of soil nutrients by plants	Reduction of external inputs, plant health and prevention of insects and diseases, use of resources
Bio-inputs (natural preparations)	Plant-based alcohol preparations (garlic, rosemary, rue), nettle maceration in water applied as needed for natural pest control. Horsetail maceration (Equisetum sp) applied for mites.	Reduction in pesticide use, natural insect and disease management, biodynamic agriculture, use of local resources, and community health.

APPENDIX (Continued)
Table: Agroecological practices for nutrient, pest, and disease management

Method	Further information	Agroecology principles
Manual pest removal	Beetles and some other insects are collected by hand. They are burned and their ashes are scattered around the property to deter other insects from coming close.	Beetles and some other insects are collected by hand. They are burned and their ashes are scattered around the property to deter other insects from coming close.
Heat stress and appearance of mites	High temperatures combined with low humidity conditions are conducive to the appearance of mites in tomato crops. Shading plants with other plants, such as loofah, and applying straw to the soil reduces heat stress on plants and outbreaks of mites.	Reduced pesticide use, natural pest management, resource utilization, community health, adaptation to climate change.
Livestock manure composting	Composting and application of livestock manure to improve soil fertility. Sometimes manure is applied directly to the soil.	Reduction of external inputs, soil fertility and biodiversity, nutrient cycle, plant health and pest and disease prevention, use of local resources.
Potassium soap, neem oil	Commercial preparations repel and control insects.	Reduction in pesticide use, natural pest management, community health.
Trichoderma solution	Seeds and seedlings are immersed in a solution of Trichoderma, a beneficial fungus that combats plant diseases, promotes growth, and increases resistance to environmental stress.	Reduced pesticide use, plant health and disease prevention; resilience; community health.

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