Agroecology is a Climate Solution!

Sharing farmers' expertise from Africa, Asia and Latin America
Presented by the PAN International Agroecology Working Group

L'agroécologie est une solution climatique !

L'expertise des agriculteurs en Afrique, en Asie et en Amérique latine à découvrir.
Présenté par le groupe de travail sur l'agroécologie de PAN International

¡La agroecología es una solución climática!

Compartiendo la experiencia de agricultores de África, Asia y América Latina.
Presentado por el Grupo de Trabajo de Agroecología de PAN International.

PAN
pesticide action network international

2025

Agroecology is a Climate Solution!

Sharing farmers' expertise from Africa, Asia and Latin America

Scientific evidence indicates that chemical-intensive agriculture exacerbates climate change, contributing to greenhouse gas emissions, while also making our agricultural systems more vulnerable to the stresses brought on by climate change.

Agroecology offers a powerful climate solution.

This productive, ecologically resilient, economically robust and sustainable approach to farming integrates cutting edge science with local and Indigenous knowledge, innovation and practice, and emphasizes farming in harmony with natural cycles and processes.

Grounded in the principles of food sovereignty, collectivity and justice, agroecology provides both a vision and a foundation for the needed transformation of our food systems, and offers a multitude of pathways that farmers can adapt to their own circumstances.

The case studies presented here have been developed by members of ***Pesticide Action Network's*** *International Agroecology Workgroup*, in advance of the UN Framework Convention on Climate Change gathering in Brazil.

The series provides policymakers, partners and the public with concrete evidence of the ability of agroecology to lead the way towards successful climate-resilient farming solutions, while reducing the carbon footprint and greenhouse gas emissions associated with chemical-intensive agriculture.

These case studies showcase the experiences, knowledge and expertise of farmers from **Argentina, Benin, Burkina Faso, Costa Rica, Ethiopia, India and Kenya.**

Agroecology Case Studies

- **Agroecological best practices through farmer field schools in Benin**
- **Mapping agroecological practices in Burkina Faso**
- **Agroecological pest management in Lake Ziway, Ethiopia**
- **Climate resilience through agroecology: Fifteen years of community-led sustainable agricultural practice in Kenya**
- **Scale up agroecology for sustainable and resilient food systems in Kenya**
- **Agroecological farming practices in Kerala, India: Women leading the way**
- **Semi-urban organic farming practices of Participatory Guarantee System farmers in Kerala, India**
- **Agroecology in Argentina: Promoting climate-resilience, protecting health and restoring biodiversity**
- **Agroecological alternatives for crop management without use of highly hazardous pesticides in Costa Rica**

Recommendations

Across the diversity of case studies, common themes emerged. Farmers shared their hopes and aspirations for ways in which their successes could be seen, understood and taken up by others. With a supportive and enabling policy environment, many of the structural challenges they and other farmers face can be more readily overcome, paving the way for national transformation of food systems and global progress in tackling the pressing issues that the world faces today.

Key arenas for action include:

- ***Policy*:** Boost public investments in agroecology; provide incentives and programs to support farmers' transition from chemical-intensive to ecological farming; develop integrated cross-sectoral national action plans with financing for an agroecological transition.
- ***Financing & Markets:*** Simplify green and organic certification processes and encourage the establishment of Participatory Guarantee Systems; expand access to financing for farmers in transition.
- ***Research, Extension & Education:*** Support farmer participatory research to generate locally relevant knowledge; reorient extension services to promote agroecological approaches; support establishment of farmer-to-farmer communication and knowledge exchange systems.
- ***Health & Environmental Protection:*** Protect public and ecosystem health with legal and regulatory frameworks that phase out the use of highly hazardous pesticides; introduce initiatives to promote ecological pest management and restoration of degraded areas.
- ***Circular economy:*** Promote systems of circular production by leveraging agricultural and organic waste and plant-based inputs to generate energy, organic fertilizer and natural pest control products, and by integrating animals for a more diverse and dynamic system.
- ***Ethics:*** Promote a holistic view of ecology, where humans are caretakers, not exploiters, of natural resources and where production is not measured solely by economic returns, but by the ability to regenerate soils, nourish communities, and coexist with the environment now and for generations to come.

Farmers emphasize that communities and Indigenous knowledge must be at the center of these policies, programs and initiatives. In the words of one farmer, Marcela Calderón:

"We are sowing the future, sowing autonomy, sowing life."

Additional resource: Marquez, E. 2025. Pesticides and Climate Change: From a Vicious to a Vivacious Cycle. panna.org

¡La agroecología es una solución climática!

Compartiendo la experiencia de agricultores de África, Asia y América Latina

Las pruebas científicas indican que la agricultura sobre dependiente en productos químicos agrava el cambio climático, ya que contribuye a las emisiones de gases de efecto invernadero, mientras hace que nuestros sistemas agrícolas sean más vulnerables a las tensiones provocadas por el cambio climático.

La agroecología ofrece una poderosa solución climática.

Este enfoque productivo, ecológicamente resiliente, económicamente sólido y sostenible de la agricultura integra la ciencia de vanguardia con los conocimientos, la innovación y las prácticas locales e indígenas, y hace hincapié en la agricultura en armonía con los ciclos y procesos naturales. Basada en los principios de soberanía alimentaria, colectividad y justicia, la agroecología proporciona tanto una visión como una base para la transformación necesaria de nuestros sistemas alimentarios, y ofrece una multitud de vías que los agricultores pueden adaptar a sus propias circunstancias.

Los estudios de caso que se presentan aquí han sido elaborados por miembros del Grupo de Trabajo Internacional de Agroecología de la Red de Acción contra los Plaguicidas, antes de la reunión de la Convención Marco de las Naciones Unidas sobre el Cambio Climático en Brasil.

La serie proporciona a los responsables políticos, a los aliados y al público en general pruebas concretas de la capacidad de la agroecología para liderar el camino hacia soluciones agrícolas exitosas y resilientes al clima, mientras reduce la huella de carbono y las emisiones de gases de efecto invernadero asociadas con la agricultura sobre dependiente en productos químicos.

Estos estudios de caso muestran las experiencias, los conocimientos y la pericia de agricultores de **Argentina, Benín, Burkina Faso, Costa Rica, Etiopía, India y Kenia.**

Estudios de caso sobre agroecología

Recomendaciones

A través de la diversidad de estudios de caso, surgieron temas comunes. Los agricultores compartieron sus esperanzas y aspiraciones sobre las formas en que sus éxitos podrían ser vistos, comprendidos y adoptados por otros. Con un entorno normativo propicio y favorable, muchos de los retos estructurales a los que se enfrentan ellos y otros agricultores pueden superarse más fácilmente, allanando el camino para la transformación nacional de los sistemas alimentarios y el progreso mundial en la lucha contra los problemas urgentes a los que se enfrenta el mundo en la actualidad.

Áreas clave de acción:

- ***Políticas**:* Impulsar las inversiones públicas en agroecología; ofrecer incentivos y programas para apoyar la transición de los agricultores de la agricultura sobre dependiente en productos químicos a la agricultura ecológica; desarrollar planes de acción nacionales intersectoriales integrados con financiación para una transición agroecológica.
- ***Financiamiento y mercados***: Simplificar los procesos de certificación ecológica y orgánica; fomentar el establecimiento de sistemas de garantía participativa; ampliar el acceso al financiamiento para los agricultoxares en transición.
- ***Investigación, extensión y educación***: Apoyar la investigación participativa de los agricultores para generar conocimientos relevantes a nivel local; reorientar los servicios de extensión para promover enfoques agroecológicos; apoyar el establecimiento de sistemas de comunicación e intercambio de conocimientos entre agricultores.
- ***Salud y protección del medio ambiente***: proteger la salud pública y la de los ecosistemas con marcos legales y normativos que eliminen gradualmente el uso de plaguicidas altamente peligrosos; introducir iniciativas para promover la gestión ecológica de plagas y la restauración de áreas degradadas.
- ***Economía circular:*** Promover sistemas de producción circular aprovechando los residuos agrícolas y orgánicos y los insumos de origen vegetal para generar energía, fertilizantes orgánicos y productos naturales para el control de plagas, e integrando animales para lograr un sistema más diverso y dinámico.
- ***Ética***: promover una visión holística de la ecología, en la que los seres humanos sean cuidadores, y no explotadores, de los recursos naturales, y en la que la producción no se mida únicamente por los beneficios económicos, sino por la capacidad de regenerar los suelos, nutrir a las comunidades y coexistir con el medio ambiente ahora y para las generaciones venideras.

Los agricultores enfatizan que las comunidades y los conocimientos indígenas deben estar en el centro de estas políticas, programas e iniciativas. En palabras de una agricultora, Marcela Calderón:

«Estamos sembrando el futuro, sembrando autonomía, sembrando vida».

Recurso adicional: Marquez, E. 2025. Pesticides and Climate Change: From a Vicious to a Vivacious Cycle. panna.org

L'agroécologie est une solution climatique !

L'expertise des agriculteurs d'Afrique, d'Asie et d'Amérique latine

Les preuves scientifiques indiquent que l'agriculture intensive, fondée sur l'utilisation de produits chimiques, exacerbe le changement climatique, notamment en contribuant aux émissions de gaz à effet de serre, tout en rendant nos systèmes agricoles plus sensibles aux pressions climatiques.

L'agroécologie offre une solution efficace pour lutter contre le changement climatique.

Cette approche agricole qualifiée de productive , d'écologiquement résiliente, d'économiquement robuste et de durable intègre les dernières avancées scientifiques aux connaissances, innovations et pratiques locales et autochtones, et met l'accent sur une agriculture en harmonie avec les cycles et les processus naturels.

Fondée sur les principes de souveraineté alimentaire, de collectivité et de justice, l'agroécologie offre à la fois une vision et une base pour la transformation nécessaire de nos systèmes alimentaires, et propose une multitude de voies que les agriculteurs peuvent adapter à leur propre situation.

Les études de cas présentées ici ont été élaborées par les membres du Groupe de travail sur l'agroécologie du Pesticide Action Network, en prévision de la réunion de la Convention-cadre des Nations unies sur les changements climatiques au Brésil.

Cette série fournit aux décideurs politiques, aux partenaires et au public des preuves concrètes de la capacité de l'agroécologie à ouvrir la voie à des solutions agricoles résilientes au changement climatique, tout en réduisant l'empreinte climatique et les émissions de gaz à effet de serre associées à l'agriculture intensive.

Ces études de cas présentent les expériences, les connaissances ainsi que l'expertise d'agriculteurs **d'Argentine, du Bénin, du Burkina Faso, du Costa Rica, d'Éthiopie, d'Inde et du Kenya.**

Études de cas agroécologiques

Recommandations

Des thèmes communs se dégagent de la diversité des études de cas. Les agriculteurs ont fait part de leurs espoirs et de leurs aspirations quant à la manière dont leurs succès pourraient être vus, compris et repris par d'autres. Grâce à un environnement politique favorable et propice, bon nombre des défis structurels auxquels eux-mêmes et d'autres agriculteurs sont confrontés peuvent être plus facilement surmontés, ouvrant la voie à une transformation nationale des systèmes alimentaires et à des progrès mondiaux dans la lutte contre les problèmes urgents auxquels le monde est confronté aujourd'hui.

Les principaux domaines d'action sont les suivants :

- ***Politique :*** stimuler les investissements publics dans l'agroécologie ; mettre en place des incitations et des programmes pour aider les agriculteurs à transitionner d'une agriculture intensive à une agriculture écologique ; élaborer des plans d'action nationaux intersectoriels intégrés prévoyant le financement d'une transition vers l'agroécologie.
- ***Financement et marchés :*** simplifier les processus de certification écologique et biologique et encourager la mise en place de systèmes de garantie participatifs ; élargir l'accès au financement pour les agriculteurs en transition.
- ***Recherche, vulgarisation et éducation :*** soutenir la recherche participative des agriculteurs afin de générer des connaissances pertinentes au niveau local ; réorienter les services d'enseignement afin de promouvoir les approches agroécologiques ; soutenir la mise en place de systèmes de communication et d'échange de connaissances entre agriculteurs.
- ***Santé et protection de l'environnement :*** protéger la santé publique et celle des écosystèmes grâce à des cadres juridiques et réglementaires qui éliminent progressivement l'utilisation de pesticides hautement dangereux ; introduire des initiatives visant à promouvoir la lutte écologique contre les parasites et la restauration des zones dégradées.
- ***Économie circulaire :*** encourager les systèmes de production circulaire en utilisant les biosdéchets agricoles et les intrants végétaux pour la production d'énergie, d'engrais organiques et de produits antiparasitaires naturels, tout en intégrant les animaux pour un système plus diversifié et dynamique.
- ***Éthique :*** promouvoir une vision holistique de l'écologie, dans laquelle les humains sont les gardiens, et non les exploiteurs, des ressources naturelles, et où la production n'est pas mesurée uniquement en termes de rendement économique, mais aussi en termes de capacité de régénération les sols, à nourrir les communautés et à coexister avec l'environnement, aujourd'hui et pour les générations futures.

Les agriculteurs soulignent que les communautés et les connaissances autochtones doivent être au centre de ces politiques, programmes et initiatives. Comme le dit une agricultrice, Marcela Calderón,

« Nous semons l'avenir, nous semons l'autonomie, nous semons la vie. »

Ressource supplémentaire : Marquez, E. 2025. Pesticides and Climate Change: from a Vicious to a Vivacious Circle. panna.org

Réseau d'action contre les pesticides - PAN selon son acronyme anglais - est une coalition mondiale regroupant plus de 600 organisations non gouvernementales, institutions et particuliers dans 90 pays, qui œuvrent pour remplacer les pesticides dangereux par des alternatives écologiques et socialement justes. Fondé en 1982, PAN s'efforce de mettre fin à la dépendance aux pesticides hautement dangereux et de garantir la santé, la résilience et la justice dans l'alimentation et l'agriculture. PAN prône l'agroécologie comme une solution efficace pour lutter contre les effets négatifs de l'agriculture intensive et les crises planétaires et sociétales convergentes que sont le changement climatique, la perte de biodiversité, la pollution et la dégradation de la santé publique. PAN inscrit son action dans une approche fondée sur les droits qui donne la priorité à l'agroécologie, à la souveraineté alimentaire et à la justice climatique.

pan-international.org

Scannez le code QR et explorez les études de cas

PAN
pesticide action network international

AGROECOLOGICAL BEST PRACTICES THROUGH FARMER FIELD SCHOOLS IN BENIN

Agroecological best practices through farmer field schools in Benin

Summary

In Benin, agroecology has gradually gained ground over the last decade, thanks to joint initiatives led by producers, NGOs (non-governmental organizations), national and international research centers, and public and private authorities. The support of these organizations has enabled the growing adoption of sustainable, high-quality agricultural practices, such as biological control, integrated pest management, and the promotion of indigenous knowledge. The case study analyzed the agroecological best practices introduced and implemented through the practical agriculture schools (EPA) created as part of various development projects and programs in Benin. These agroecological practices have brought numerous benefits, including climate change mitigation and adaptation, increased household income and food security, women's empowerment and gender equality, health and biodiversity benefits, social cohesion, and community strengthening. In order to enable widespread adoption of agroecology across Benin, policymakers are encouraged to develop and implement appropriate institutional, policy, financial, and technical policies and initiatives.

Lead organization: GAPROFFA Action Group for the Promotion and Protection of Flora and Fauna

Partners involved: National Institute for Agricultural Research of Benin (INRAB), International Institute of Tropical Agriculture (IITA), universities, agricultural colleges in Benin, ENABLE TAAT Project (Technology for African Agricultural Transformation), PRIMA (Regional Program for the Integration of Agricultural Markets), ENABEL (Rikolto).

Context

Agroecology in Benin has been growing steadily over the past decade, driven by joint initiatives involving producers, NGOs (non-governmental organizations), national and international research centers, and both public and private institutions. Organizations such as OBEPAB (Beninese Organization for the Promotion of Organic Agriculture), FAEB (Agroecological Federation of Benin) and several farmers' cooperatives have played a key role in the growing adoption of high-quality, sustainable agricultural practices such as biological control, integrated pest management, and the promotion of endogenous knowledge. The case study is supported by INRAB (National Institute for Agricultural Research of Benin), IITA (International Institute of Tropical Agriculture), universities, and agricultural colleges. It analyzes the agroecological best practices introduced and implemented through the farmer field schools (FFS) set up by development projects and programs such as ENABLE-TAAT (Technologies for African Agricultural Transformation), in youth entrepreneurship, Rikolto in the Rice program, and PRIMA (Regional Program for the Integration of Agricultural Markets) on vegetable, legume, and food crop production. These initiatives have been supported and funded by the African Development Bank (AfDB), the Belgian cooperative (ENABEL), and the International Fund for Agricultural Development (IFAD) in Benin.

With an economy largely based on agriculture, Benin faces significant challenges related to food security, sustainable management of its natural resources, and the growing effects of climate change. Soil degradation, variable rainfall patterns, and dependence on highly hazardous pesticides (HHPs) continue to threaten the health of producers, biodiversity, and the quality of ecosystems. In this context, the transition to agroecological practices appears to be a sustainable solution capable of improving the resilience of agricultural systems, reducing the use of harmful chemicals, and strengthening the country's food sovereignty.

Methods

The methodological approach used is collaborative data collection, directly involving producers, Champs Écoles Paysans (CEP) facilitators, and partner project managers in the observation, experimentation, and evaluation of agroecological practices (the participatory approach) on demonstration plots, technical training, and peer exchanges. Focus groups were also held to gather the perceptions of producers, including men, women, and young people. Quantitative data was collected using the scoring method with pebbles. A literature review was also conducted to collect secondary data on agroecology in Benin.

Specifically, information was collected through semi-structured interviews, group discussions, and field observations conducted at CEP sites.

Training young people in agroecological practices

Participants interviewed included beneficiary producers, technical managers, and coordinators of the programs mentioned (ENABLE-TAAT, Rikolto, PRIMA).

A total of seven (7) farmer field schools (FFS) were visited, covering the following crops: maize, cassava, rice, market gardening, fish farming, and perennial crops.

Agroecological practices

The summary of the literature review conducted at the research centers revealed agroecological practices such as: the use of botanical extracts (neem extract, neem cake-based fertilizers), intercropping with lemongrass, mushrooms,

Rice producers Farmer Field School

and Vernonia amygdalina as biopesticides and biofertilizers. Several private sector actors have been identified as being actively involved in the adoption and dissemination of these agroecological alternatives: Eléphant Vert, CIM-BIO, Biophyto, and FUPRO-Benin (Federation of Producers' Unions of Benin).

After investigation, the results of this study showed that crop diversification, crop combinations and rotations, integrated pest management, composting/bokashi, agroforestry, and soil conservation techniques are agroecological alternatives used by producers in the fields. In addition to these methods, mulching and vermicomposting (tea) were used by producers to maintain soil moisture and facilitate crop germination.

Vermicomposting (Tea)

Organic cucumbers

When planting annual crops (corn, cassava, rice), farmers adopt agroecological practices such as reduced tillage, compost made from animal manure, decomposed organic manure for soil restoration, the use of local farm seeds saved after harvest, and agroecosystem analysis to help farmers decide whether or not to treat their crops. For perennial crops, they adopt agroecological practices such as intercropping with legumes and tubers and the application of effective microorganisms. All these methods are accompanied by technical data sheets in which their principles and descriptions are detailed and made available to the facilitators of the Champs Ecoles Paysans (CEP) and also to producers in the local language.

In terms of the adoption of best agroecological practices in the CEPs visited, more than 2,500 producers are practicing agroecological alternatives in market gardening in southern Benin. Additionally, over 3,000 producers are practicing agroecological alternatives in rice farming in central Benin, and more than 1,200 producers are practicing agroecological alternatives in corn, cassava, and perennial crops in northern Benin.

Benefits of agroecology

Agroecology, beyond a simple change in farming practices, generates multidimensional positive impacts for producers and their communities.

- **Climate change mitigation:** In terms of climate change mitigation, agroecological practices such as the use of compost and organic fertilizers reduce the use of chemical fertilizers by 20 to 30%, thereby contributing to lower greenhouse gas emissions.
- **Carbon sequestration:** The introduction of hedgerows and agroforestry systems promotes carbon sequestration estimated at 1.5–2 t CO_2/ha/year, thereby strengthening the role of farms as carbon sinks and also contributing to soil restoration.
- **Climate adaptation:** Producers who have adopted mulching and cover crop techniques (mucuna, stylosanthes) have seen a significant improvement in the resilience of their production systems.
- **Food security:** On average, rice farmers have seen a 25% increase in yields during periods of drought, which also translates into improved household food security, with nearly two additional months of food availability per year.
- **Biodiversity:** The introduction of legumes and hedgerows on plots has increased plant diversity by more than 40% on young farmers' farms. A 30% increase in the presence of pollinators, particularly bees and other beneficial insects, has been observed in agroecological plots, which enhances the productivity and stability of agricultural ecosystems.
- **Economic benefits:** Economically, producers benefit from a significant reduction in chemical input costs, estimated at between 20% and 35%. By selling crops grown using agroecological practices on local markets, they generate 15% to 20% more profit than with conventional practices.
- **Health benefits:** The use of biopesticides and the reduction in the use of chemical inputs have led to a 40% decrease in reported cases of poisoning in production areas, reducing the opportunity costs associated with hospitalization, monitoring, and healthcare expenses. At the same time, household dietary diversity has increased with the integration of a variety of crops (moringa, leafy vegetables), leading to a 25% improvement in the following dietary diversity index, particularly in female-headed households.
- **Gender equality:** Female participation is significant. In CEPs, women represent 45-50%

of beneficiaries, strengthening their role in decision-making, but also in the management of agricultural income. This increased involvement translates into greater decision-making power within households. Women involved in community organic gardens even earn up to 30% additional income, which contributes to their economic empowerment, enabling them to contribute to education, food, health, and community integration.

Focus group of women rice farmers

Benefits for the community:

- In the project implementation areas, membership in cooperatives has increased by 30%, reflecting a stronger collective dynamic.
- Community initiatives such as tontines, seed exchanges, and community work promote solidarity and strengthen social cohesion.
- In terms of local knowledge and skills, around 80% of farmers trained in the Écoles Paysans fields report a better understanding of rational soil management and integrated pest and disease control.
- This acquired knowledge does not remain individual: on average, each trained farmer transfers their knowledge to two or three others, thus creating a horizontal dissemination of agroecological innovations.

Challenges and solutions

Despite its observed positive effects on agriculture, the environment, and health, the implementation of agroecology in Benin faces several major challenges, many of which could be overcome with appropriate policy measures. These constraints include:

- Insufficient adequate and experienced labor in organic farming
- Poor access to irrigation systems
- Low adoption rate of agroecological practices, especially among young people, because agroecological practices are considered time-consuming insufficient organic inputs such as organic manure, compost, and crop residues land pressure and small cultivable areas, which make it difficult to implement integrated systems such as agroforestry or combined livestock farming
- High cost of products derived from biopesticide and agroecological alternatives for consumers, without taking into account the health benefits
- Lack of information and marketing around products derived from biopesticide and agroecological alternatives
- Lack of financing, credit, and subsidies for green agriculture
- Low level of commitment from governmental institutions and private investors to promote agroecology in Benin

However, producers and stakeholders in the field have suggested possible solutions, namely:

- Mechanization to reduce the drudgery of work
- Creation of community composting centers to increase the availability of organic inputs
- Securing land tenure and developing local labels, organic markets, and facilitating the granting of organic certification
- Capacity building for stakeholders through awareness raising, training, and advocacy for behavioral change towards agroecological practices for future generations
- Facilitation of access to financing to consolidate the adoption of agroecology in Benin

Lessons learned

A key lesson learned from this study is that short-term development projects (3 years, renewable once) can be important means of stimulating learning and adoption of agroecological practices. However, to ensure wider adoption across Benin, the government will need to institutionalize farmer training programs to promote agroecology, establish a legal framework (law and decree) in favor of agroecology, and commit to phasing out highly hazardous pesticides and promoting alternatives to chemical pesticides.

Recommendations

In light of the results of this study and the lessons learned in the field, several recommendations emerge to strengthen the adoption and sustainability of agroecological practices in Benin.

- *On a technical and operational level,* it is necessary to continue and intensify capacity building for producers. This involves increasing practical training in Farmer Field Schools (FFS), disseminating improved local seeds and accessible organic inputs, and promoting local innovations adapted to the socio-cultural realities of communities. The promotion of technical data sheets translated into local languages must also be systematized in order to facilitate the dissemination of agroecological practices.
- *At the economic and financing level,* targeted financial support mechanisms must be put in place. Selective subsidies for organic inputs and tax exemptions on these inputs and agroecological products could encourage the transition to agroecology. Access to credit and green microfinance must be facilitated, particularly for small-scale producers, young people, and women, so that they can invest in work equipment, inputs, and irrigation infrastructure.
- *At the institutional and political level,* the creation of marketing channels for organic products, supported by local organic certification labels (PGS-Participatory Guarantee System), would help to promote agroecological products and increase producers' incomes. Facilitating the integration of agroecology into national agricultural policies is essential. The Ministry of Agriculture and its partners must define clear strategies, aligned with food security and sustainable development objectives, to guide the agroecological transition. Strengthening applied research programs on agroecological practices and creating spaces for multi-stakeholder dialogue (producers, NGOs, cooperatives, research institutes, local authorities) will promote inclusive and participatory governance. The link is direct, because reducing the use of HHPs requires **credible local alternatives and coordination between actors.** Applied research can identify and disseminate these alternatives, while multi-stakeholder dialogue can be used to define concerted and sustainable strategies. This naturally extends the discussion on the risks associated with HHPs by proposing a systemic and collaborative solution that is in line with the spirit of agroecology.
- *At the regulatory level,* it is also necessary to establish a regulatory and legal framework (law and decree) that limits the misuse of chemical pesticides, phases out and ultimately bans highly hazardous pesticides (HHPs), in accordance with United Nations agreements.
- *At the environmental level,* recommendations focus on the conservation and sustainable management of natural resources. Crop rotation, agroforestry, intercropping, and the use of cover crops should be encouraged to preserve biodiversity and improve soil fertility. Sustainable water management measures, such as rainwater harvesting and localized irrigation, should be promoted to strengthen resilience to droughts. At the same time, it is crucial to raise awareness among producers about climate change issues in order to strengthen their capacity to adapt and anticipate extreme weather events.

The implementation of these recommendations is an essential step towards sustainably embedding agroecology in Benin's production systems, while improving the resilience of rural communities.

Overall, this case study provided an overview of the agroecological practices implemented in the CEPs established by projects, programs, and initiatives

in Benin. It also demonstrated the need for the Beninese government to commit to integrating agroecology into its development action programs. The table below presents the agroecological principles, their description, their rationale, and their impacts on several aspects.

Table: Agroecological principles, description, principles, and impacts

Agroecological methods	Description/ Objective	Principles of agroecology	Impact on climate change mitigation	Impact on climate adaptation	Impact on biodiversity	Economic impact	Impact on socio-environmental healthenvironmental health	Gender and equity
Crop rotation	Alternating different crops on the same plot to reduce disease and improve soil fertility	Diversification, synergy, soil health	Reduced use of chemical fertilizers (20–30%), lower GHG emissions	Improved resilience, higher yields (+25% during droughts)	Increased plant diversity (+40%), increase in pollinators (+30%)	Reduction in input costs (20–35%), net margin +15–20%	Decrease in cases of poisoning (-40%), diversified diet (+25%)	Female participation 45–50%, increased decision-making power within households
Crop association/ intercropping	Growing several species on the same plot to optimize resource use and limit pests	Diversification, synergy, reduction in inputs	Less chemical fertilizers, improved soil fertility	Increased resilience through the use of cover crops (mucuna, stylosanthes)	Plant diversity and increased presence of beneficial insects (+30%)	Added value on local markets, higher net margin (+15–20%)	Reduced use of chemical pesticides, improved food security	Additional income for women (+30%) in community gardens
Agroforestry	Integration of trees and shrubs into agricultural systems to improve fertility and biodiversity	Diversification, Synergy, Resource conservation	Carbon sequestration (1.5–2 t CO_2/ ha/year), carbon sink	Improved resilience and soil restoration	Increased plant diversity (+40%), habitats for pollinators	Reduced inputs, increased net margins	Enriched food (moringa, leafy vegetables), food diversity (+25%)	Increased community participation (+30% cooperative membership), strengthened solidarity
Vermicomposting/ organic fertilization	Use of organic matter to fertilize the soil	Reduced inputs, soil health, nutrient recycling	Reduced use of chemical fertilizers (20–30%), lower GHG emissions	Improved fertility and resilience of production systems	Increased plant and microbial diversity in soils	Reduced chemical input costs (20–35%)	Fewer chemical poisonings, improved producer health	Empowerment of women through additional income from value creation
Mulching/ground cover	Protects soil from erosion and maintains moisture	Conserves resources, improves soil health, reduces inputs	Conserves moisture, limits the use of chemical inputs	Increases yields (+25% during droughts)	Maintaining vegetation cover, increasing diversity	Reduced production costs, higher net margins	Improved food security (2 additional months of food availability)	Women involved in plot management and household food security
Biopesticides / integrated pest management	Pest control using biological methods and minimization of chemical pesticides	Reduced inputs, Synergy, Crop health	Fewer emissions linked to chemical inputs	Better crop protection against pests and diseases	Preservation of pollinators and natural auxiliaries	Reduction in costs linked to chemical inputs	Fewer cases of poisoning (-40%), better health for producers	Women more involved in production decisions and income management
Water management (recovery, drip irrigation)	Optimization of water use and climate adaptation	Resource conservation, energy efficiency, climate resilience	Optimization of water use, reduction of environmental footprint	Strengthening resilience to drought (+25% rice yields)	Indirect support for diversified crops and wildlife	Reduced water management costs, improved profitability	Increased food security through reliable water availability	Women beneficiaries in CEPs (45–50%) and strengthened role in water management
Cover crops/ legumes	Improved fertility and reduced erosion	Diversification, soil health, reduced inputs	Reduction in the use of chemical fertilizers through biological nitrogen fixation	Improved resilience of production systems and soil restoration	Increased plant diversity (+40%), habitats for pollinators	Reduced input costs, improved profitability	Improved food quality (moringa, leafy vegetables)	Significant involvement of women (+30% additional income, 45–50% CEP beneficiaries)

Key resources

The resources presented here are essential references for understanding the dynamics and challenges of agroecological transition in Benin and sub-Saharan Africa. They highlight the need for a favorable policy framework, applied research, and participatory approaches to strengthen the sustainability of agricultural systems. The work of the FAO and AFSA offers a comprehensive and strategic vision, while that of the APRM and INRAB provides guidance and results specific to the Beninese context. Finally, the reports of PAN International and PAN Africa highlight the risks associated with the use of highly hazardous pesticides (HHPs) and the relevance of agroecological alternatives to protect health, the environment, and food sovereignty.

- *PAN International. 2023. List of Highly Hazardous Pesticides (HHPs). Pesticide Action Network International, Hamburg. https://pan-international.org (Liste mondiale de référence identifiant les pesticides hautement dangereux et proposant des alternatives agroécologiques durables.)*
- *Ministère de l'Agriculture, de l'Élevage et de la Pêche (MAEP). 2019. Stratégie nationale de développement de l'agriculture durable et plan d'action agroécologique 2019–2025. MAEP, Cotonou, Bénin. (Document de politique nationale définissant les axes stratégiques de promotion de l'agroécologie au Bénin.)*
- *Institut National des Recherches Agricoles du Bénin (INRAB). 2024. Rapport annuel sur les innovations agricoles durables. INRAB, Cotonou, Bénin. (Rapport de recherche appliquée présentant les résultats sur les innovations agroécologiques et la gestion intégrée des ravageurs.)*
- *Alliance for Food Sovereignty in Africa (AFSA). 2022. Agroecology for Resilient Food Systems in Africa. AFSA, Kampala. https://afsafrica.org (Recueil d'études de cas africaines démontrant les impacts positifs de l'agroécologie sur la résilience, la sécurité alimentaire et la durabilité des systèmes agricoles.)*
- *Pesticide Action Network Africa (PAN Africa). 2022. État des pesticides hautement dangereux en Afrique de l'Ouest. PAN Africa, Dakar, Sénégal. (Analyse régionale des effets des HHP sur la santé humaine et l'environnement, présentant des alternatives agroécologiques adaptées au contexte ouest-africain.).*

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.

Web: pan-international.org

Facebook: PesticideActionNetworkInternational

BlueSky: pesticideaction.bsky.social

Since 2006, **GAPROFFA** (Action Group for the Promotion and Protection of Flora and Fauna) has been working to promote the sound management of chemicals and chemical waste in Benin. It works closely with the Ministry of Living Environment and Sustainable Development and several international networks (PAN-Africa, IPEN), contributing to the development of laws, the implementation of environmental conventions (Stockholm, Minamata), and raising awareness among stakeholders about chemical risks.

Dr. Adetonah Sounkoura, President, with the assistance of
Ms. Suzanne Houéfondé Ekouya

Location: Cotonou, Republic of Benin

Email: gaproffa@yahoo.fr, s.adetonah@yahoo.fr

Tel: +229 95058694

Facebook: @GAPROFFA

Agroecological best practices through farmer field schools in Benin

This case study was produced by GAPROFFA in collaboration with PAN International. It is one in a series of PAN case studies showcasing the benefits and contributions of agroecology to climate resilience, food security, health and biodiversity protection. The series is produced by members of the PAN International Agroecology Workgroup. The full series is available in a number of languages via the QR code.

Funding to develop this case study was provided by Global Greengrants Fund

PAN
pesticide action network international

MAPPING AGROECOLOGICAL PRACTICES IN BURKINA FASO

Mapping agroecological practices in Burkina Faso

Summary

Burkina Faso, like many Sahelian countries, faces major challenges related to the degradation of natural resources, food insecurity, rural poverty, and the growing effects of climate change. In this context, conventional agriculture, which is heavily dependent on chemical inputs, is showing its limitations in terms of ecological sustainability and the resilience of family farms.

In response to this situation, agroecology is emerging as a credible, inclusive, and sustainable alternative, combining endogenous knowledge, ecological innovations, and social equity. Since the 1990s, several initiatives have emerged in Burkina Faso, driven by farmers' organizations, NGOs, research institutions, and public policies.

This mapping focuses on major agroecological practices developed and disseminated in Burkina Faso. It is based on field visits, notably to the Guè bocage farm, market gardeners in the city of Ouagadougou (Tampouy and Tanghin areas), and the Koupéla vegetable producers' cooperative, as well as on existing national documentation, agroecology strategies and action plans, pilot projects, and scientific publications. The aim is to provide a comprehensive technical, scientific, and socio-economic analysis to guide decision-makers, technical and financial partners, and community actors in scaling up these practices.

Lead organization: Association Jeunesse pour l'Environnement et le Développement Durable (AJEDD)
Partners involved: Terre Verte, producer group, K company
Donors: Global Greengrants Fund)

A. SAHELIAN BOCAGE (WÉGOUBRI)

Context and summary of approaches

Sahelian bocage ("wégoubri") is an agroforestry practice structured around a continuous network of hedgerows, small dykes, ponds, and fences, aimed at restoring degraded landscapes in the Sahel. It is defined as a rural landscape of meadows and/or fields surrounded by hedgerows and woods. The bocage is a balanced environment created by humans, combining trees, crops, and livestock, where humans and nature live in harmony.

In the Sahel, the primary purpose of bocage is to retain rainwater where it falls through the use of small dykes, ponds, and hedgerows, in order to mitigate the erosive action of monsoon waters and maintain the biodiversity of an extremely fragile environment. It is implemented in Burkina Faso by the NGO Terre Verte, which has around 30 years of experience. Born out of pilot projects (farms in Guiè, Filly, Barga, etc.), bocage addresses the problems of erosion, runoff, soil degradation, overgrazing, and loss of biodiversity by reconfiguring "commons" and individual plots. It encompasses technical (dikes, hedges, bullis), institutional (customary co-ownership), and socio-economic (labor-intensive work, local jobs) dimensions (Nassirou Y.; Wegoubri 2024). Today, this technique is used in Bassitenga province (Oubri region), Yatenga province (Yaadga region), Zandoma province (Yaadga region), and Sandbondtenga province (Kuilsé region) by the NGO Terre Verte through inter-village associations.

Outside the developed areas, producers outside the perimeter are attempting to partially replicate the technology in these localities, proving that it can increase yields

Adoption and uptake

Activities observed in the pilot areas: site studies, surveying, creation of nurseries (sowing, layering, grafting), construction of earthen embankments, installation of mixed hedges (wire mesh + shrubs), digging of bullis (ponds), fencing, training of apprentices, creation of land management committees. Implementation follows a participatory approach with remuneration of local labor and skills transfer.

Quantitative examples: With the bocage, approximately 1,581 ha have been developed with more than 541 beneficiary families. Indicative development cost: $600–800/ha.

Sorghum yields observed in hedgerow areas: 2.7–3.2 t/ha (compared to traditional yields of 500 kg to 1 t/ha on undeveloped land).

Agroecological practices (specific techniques)

- Design of hedgerow areas (plots + common areas)
- Mixed hedgerows (local species: Cassia, Combretum, Parkia, Sclerocarya, etc.)
- Small dams, embankments, water retention basins (boulis) and diversion channels
- Direct sowing of shrubs in trenches; local nurseries for endemic species
- Integrated crop rotation (zaï / grazed fallow land / leguminous crops)
- Integration of livestock farming and agriculture (controlled grazing, manure for compost)

Benefits observed

Climate mitigation

Hedgerows promote carbon sequestration by increasing tree biomass and soil carbon stocks (gradual gain in the medium term). Hedges and trees store carbon and reduce pressure on distant forests to be cut down (indirect effect). Quantification: variable depending on density/species; pilot estimates suggest significant gains per hectare over 5–10 years.

Climate adaptation

Hedges + small dikes + bullis improve water regulation; restore microclimates; protect crops and fodder from drought; increase yield resilience; and reduce food vulnerability. Hedgerows facilitate productive crop rotations that are resilient to erratic rainfall.

Economic Benefits

Initial costs: €600–800/ha (development). These costs are covered by the NGO Terre Verte through donations and grants. Observed benefit: +€150–300/ha/year (yield enhancement). Potential for diversification (fruit production, timber, fodder, néré, etc.) provides additional income and amortizes investments over several years. Increased agricultural yields (pilot observations: 2×–3×); diversification of income sources (wood energy, fruit, fodder, non-timber forest products); creation of local jobs and strengthening of the socio-economic fabric.

Biodiversity

Recreation of ecotones; return of extinct species; increase in flora and fauna diversity (pollinators, soil microfauna); hedges provide corridors and refuges.

Gender and gender equity

Hedgerow perimeters involve men, women, and young people; hedges provide resources (fodder, fruit) that are beneficial for women's activities (processing, marketing). Pilot programs report active inclusion of women (training, nurseries), but access to land and credit for women needs to be strengthened.

Socio-environmental Health

Reduction in slash-and-burn practices; Improved local air quality (less wood burning); Diversified diet (fruit, seeds); Improved water hygiene (bullis); Reduced exposure to chemical pesticides, contributing to improved health; Rapid restoration of soil fertility and structure; Reduced runoff and erosion; improved rainwater infiltration.

Lessons learned

The bocage allows beneficiary producers to organize themselves into cooperatives for better management of their land. Awareness-raising and training sessions are held for beneficiaries to support them in the rational management of their land. Terre Verte, through inter-village associations that promote Sahelian bocage, organizes annual competitions to reward the best production and the best areas.

Challenges

The challenges encountered may include the following: High initial costs of development; land insecurity; lack of sustainable financing; fragile security context in certain areas.

Recommendations

Invite the government to support the scaling up of hedgerows with appropriate financing mechanisms (targeted subsidies); the legal formalization of hedgerow co-ownership; the strengthening of local nurseries; the integration of hedgerows into Municipal Development Plans; and ongoing training. Report the results of hedgerow development on the MRV (Measuring, Reporting and Verification) platform.

Testimonial

"After hedgerow development, species reappeared, sorghum yields are high, and we sell the grass."

Mixed hedges on two plots separated by a path.

Fallow fields.

Fields of white sorghum.

Fields of red sorghum with zaï.

B. ZAÏ AND HALF-MOONS

Context and summary of approaches

Zaï and half-moons are traditional improved practices designed to capture water and concentrate organic amendments around the plant, enabling the restoration of severely degraded soils in conditions of low rainfall (e.g., 400–500 mm/year). Zaï was historically developed in Yatenga; it consists of dug-out pits filled with compost/manure. It is used throughout Burkina Faso.

Half-moons (curved half-moon shapes dug into the ground) allow runoff to be collected over larger areas.

Today, these practices are used throughout Burkina Faso, particularly in the Yaadga, Soum, and Liptako regions, as well as in the Kuilsé, Nando, and Oubri regions.

Adoption and uptake

The project to promote zaï and half-moons included: training farmers; organizing collective work sites (labor-intensive work); providing compost or supporting composting stations; distributing resistant seeds; providing logistical support (tools); and demonstrations on plots of land. These water and soil conservation practices were disseminated through pilot farms and farmer networks.

Growing adoption: Adoption of these practices by farmers has increased thanks to yield demonstrations and capitalization through nurseries and composting. Half-moon + manure yields can reach 1.2 to 1.6 t/ha of sorghum, compared to grain yields of 112% and straw yields of 49% for zaï compared to unimproved fields.

Agroecological practices

- **Zaï:** digging holes (~30 cm diameter, 15–20 cm deep), filling with compost/manure, sowing seeds around the edge.
- **Half moon**: digging a half-moon shaped basin to capture runoff, planting shrubs/seedlings.
- **Additional practices**: mulching, intercropping (cereals + legumes), organic fertilization, controlled grazing fallow.

Field prepared with Zaï, amended with compost

Benefits observed

Climate mitigation

Improvement of soil organic matter increase in organic carbon stock; reduction of pressure on forests (less deforestation). Local quantification is made possible through soil monitoring (SOC).

Climate adaptation

Zaï/half-moons increase resilience to irregular rainfall; enable more reliable harvests; reduce the risk of crop failure, thereby improving food security.

Economic benefits

Increased yields (in pilot projects, zaï has shown significant gains); reduced purchases of chemical inputs if compost is used correctly; costs: low labor costs, investment in compost; positive profitability often from the first or second year; low technological cost due to use of manual labor; high farmer ownership.

Biodiversity

Restoration of soil microfauna; improved biological structure; possibility of introducing trees and hedges that attract pollinators and beneficial wildlife; contribution to organic soil restoration and organic matter replenishment.

Gender and gender equity

Women are involved in the production and spreading of compost in the holes dug.

Socio-environmental health

Reduction in the use of chemical inputs; improved food quality; reduced risks associated with pesticide toxicity; promotes rapid emergence and establishment even with low rainfall; improved yield from the first year.

Lessons learned

Access to compost is a bottleneck; combining livestock farming and agriculture provides a supply of manure.

Challenges

Continuous availability of organic amendments, need for light mechanization for large-scale digging, requires abundant labor.

Recommendations

Creation of community composting sites, material support for digging, image box - a visual resource for implementation and extension of techniques in local languages for local communities. Need to guarantee women's access to plots of land and compost.

Testimonial

"The zaï allowed me to sow earlier and still get a harvest even when the rains were poor."

Corn produced using Zaï

Half-moons cut into a field

Corn growth using the half-moon technique

C. BIOPESTICIDES (LOCAL PRODUCTION AND USE: APPICHI, KOGLE-ZANGA, ME, LIQUID FERTILIZER)

Context and summary of approaches

Locally developed biopesticides and bio-inputs (preparations based on chili peppers, garlic, ginger, neem, ash, effective microorganisms (EM)) meet the need to reduce the use of synthetic pesticides, control costs, and improve health safety.

In addition, by reducing dependence on chemical inputs made from fossil fuels, these biopesticides also mitigate climate change and strengthen climate adaptation. Burkina Faso has a wealth of documented local experience (improved traditional recipes and manufacturing protocols).

Biopesticides are produced locally by certain NGOs and associations to support their agroecological practices. This is the case for the Béog nééré agroecology association, AJEDD, the Association for Research and Training in Agroecology, and the NGO Manetese. Alongside these structures, there are other actors in the production and marketing chain. This is the case for Faso Intrant Agricole and the Koob Tuuma company in Ouagadougou.

Biopesticides are widely used in market gardening and in the outskirts of Ouagadougou where market gardening is practiced, they are used in increased quantities mixed with chemical pesticides.

Adoption and uptake

Activities: training workshops on manufacturing (Appichi, Kogle-zanga), demonstrations on plots of land, distribution of technical data sheets, establishment of local production units, basic quality control (fermentation time, dilution), pest diagnosis. Growing adoption in market gardening and nurseries.

Agroecological practices (recipes and protocols)

- **APPICHI:** ginger, red chili pepper, garlic, alcohol, fermentation (15-day process) - dilute before spraying (0.5 L/15 L water or according to recipe).
- **Kogle-zanga:** dried chili pepper, garlic, onion, local soap, neem oil — 3 mixed solutions - preventive application once a week (50–80 mL/15 L depending on crop).
- **Effective microorganisms (EM):** preparation based on forest soil, sugar, milk, bran; fermentation 21 days - foliar use (dilutions 1 L/16 L water).
- **Liquid fertilizer:** mixture of various organic materials fermented for 14 days - dilution 1 L/20 L water; use in nurseries/gardens.

These biopesticides are used against insects such as whiteflies, aphids, scale insects, and caterpillars.

Safety note: follow dilution instructions, fermentation period, and protective equipment guidelines; training in the toxicology of ingredients (chili pepper, alcohol).

Benefits observed

Climate mitigation

Reduction in emissions linked to the production/import of chemical inputs (transport, manufacturing) and the use of mineral inputs; indirect carbon storage through improved soil health with organic fertilizers.

Climate adaptation

Better crop protection; reduced losses due to pests; increased food security and economic resilience for households.

Economic benefits

Low production costs (local ingredients) reduced input expenses; local commercial potential (sales to groups, market gardeners). Reduced dependence on expensive and dangerous chemical pesticides; low production costs (local ingredients). Local empowerment (local production, job creation).

Biodiversity

Less unintended impact on beneficial insects and microfauna; conservation of pollinators; long-term soil improvement.

Gender and gender equity

Production/small manufacturing units promote the economic integration of women (small businesses, tontines); targeted training recommended to empower women producers.

Socio-environmental health

Less exposure to toxic pesticides for farmers and consumers; better food safety; public health benefits. Biodegradable products; low pesticide residues in food.

Lessons learned

Local biopesticides effective in prevention; quality and standardization essential. It is essential to maintain quality and standardization; ongoing training is essential.

Challenges

Quality variability (concentrations); storage/stability requirements; market acceptance of biopesticides; lack of a national regulatory framework for biopesticides.

Recommendations

Standardization of protocols; laboratory support for toxicity and efficacy analyses; local certifications/labels; integration into the National Agroecology Strategy (SNAE) as an authorized input; study business models (collective production units, micro-enterprises).

Testimonial

"Kogle-zanga has enabled us to reduce damage from whiteflies; I am selling more and have reduced my pesticide expenses."

Empty jar of biopesticide. Credit AJEDD

AJEDD team talking with a producer using APPICHI. Credit AJEDD

APPICHI biopesticide. Credit AJEDD

COMPARATIVE SUMMARY & OVERALL CONTRIBUTIONS

Climate adaptation (resilience)

Together, these practices help reduce the climate vulnerability of agricultural systems and stabilize incomes and food security.

- **Hedgerows**: water retention, crop protection, microclimates, fodder security.
- **Zaï/half-moon:** early emergence, more reliable harvests, soil restoration.
- **Biopesticides**: crop protection against pests, reduction in losses.

Climate mitigation (emissions reduction)

- **Hedgerows & hedges**: carbon sequestration (biomass/soil).
- **Biopesticides & organic fertilizers**: reduction in mineral input use (carbon footprint of production and transport).
- **Green charcoal & waste recovery:** reduction in deforestation and emissions linked to traditional wood energy production.

Socio-economic and governance impacts

- Creation of green jobs (nurseries, biopesticide units, processing).
- Co-ownership models (hedgerows) and local governance strengthening social cohesion.
- Recurring need for access to financing, legal formalization, integration into local policies/ planning.

Operational recommendations

Burkina Faso has already taken an important step forward with the adoption of the National Agroecology Strategy (SNAE), which reflects the government's commitment to promoting sustainable, inclusive, and resilient agriculture. To fully realize this vision, national and local decision-makers must also:

- Invest in research, extension, and education in agroecology, enabling producers to adopt sustainable practices more widely across the country;
- Strengthen existing measures through coherent policies, appropriate legal and financial mechanisms, and targeted support programs.

These actions will strengthen food sovereignty, restore ecosystems, and consolidate the economic and environmental resilience of rural communities.

Our specific operational recommendations to support the expansion of Sahelian bocage, zaïs and demi-lunes for water and soil conservation, and the production and use of biopesticides include the following:

1. **Finance nurseries & bocage development** through dedicated funds + microcredit.
2. **Institutionalize** hedgerow perimeters (legal status), integrate into PCD.
3. **Create community composting centers** to supply zaïs/half-moons.
4. **Report these practical cases on the MRV** platform to capitalize on data (ha, yield, jobs).
5. **Train and certify local** actors (biopesticide production, hedge maintenance, MRV monitoring).
6. **Standardize & validate** biopesticide recipes in the laboratory (safety/efficacy).

Annex: Summary table of methods (excerpt)

Practice	Main steps	Inputs	Indicative cost	Expected yield/effect
Hedgerows (perimeter)	Site study - nursery - embankments hedges + fences monitoring	Local seedlings, wire mesh, labor	600–800 EUR/ha (funded by Terre Verte through donations and grants)	Sorghum yields increase 2–3× in 3–4 years
Zaï	Dig holes - add compost - sow seeds	Compost, hand tools	High labor requirements	Harvest even with low rainfall
Half-moon	Trench - planting trees/seedlings	Tools, seedlings	Variable	Runoff retention, plant regeneration
APPICHI / Kogle	Mix local ingredients - fermentation - dilution spraying	Chili pepper, garlic, alcohol, neem, soap	Very low (local ingredients)	Pest reduction, pesticide substitution

Key resources:

- Yarbanga N., 2024. Wégoubri
- Baudin F. 2017. Wégoubri. Un bocage au Sahel. Entretiens avec Henri Girard. Editions Culture-Environnement-Médias. https://www.cemfrance.eu/produit/wegoubri-un-bocage-au-sahel-2
- Terre Verte. 2021. 2020 Annual Report of the Filly Pilot Farm. https://eauterreverdure.org/publications/documents

This case study was produced by AJEDD in collaboration with PAN International. It is one in a series of PAN studies from around the world showcasing the benefits and contributions of agroecology to climate resilience, food security, health and biodiversity protection. The series is produced by members of the PAN International Agroecology Workgroup. The full series is available in a number of languages via the QR code.

Funding to develop this case study was provided by Global Greengrants Fund.

Pesticide Action Network International (PAN International) 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.

Web: pan-international.org
Facebook: PesticideActionNetworkInternational
BlueSky: @pesticideaction.bsky.social

Association Jeunesse pour l'Environnement et le Développement Durable (AJEDD)

Founded in 2017, the Association Jeunesse pour l'Environnement et le Développement Durable (AJEDD-Youth Association for the Environment and Sustainable Development) is a civil society organization based in Burkina Faso committed to protecting the environment, promoting sustainable agriculture, and mobilizing young people for inclusive development that respects ecosystems.

Location: Ouagadougou, Burkina Faso
Email: ajedd.fburkina@gmail.com
Tel: +226 76680425
Facebook: @AJEDD.Burkina

Agroecological pest management in Lake Ziway, Ethiopia

PESTICIDE ACTION NETWORK UK

PAN
pesticide action network international

Agroecological pest management in Lake Ziway, Ethiopia

Summary

In 2018, PAN Ethiopia and PAN UK initiated an IPM research and farmer training project in Lake Ziway area, Oromia, Ethiopia. The aim of the project was to reduce pesticide use and consequent health and environmental impacts by promoting agroecological methods for pest management among vegetable farmers through Farmer Field Schools (FFS) and farmer-participatory learning plots. Since 2018, over 700 farmers have been trained via season-long FFS, plus a further 500 farmers have been trained via peer mentoring. From a survey of 78 trained farmers in 2021, many farmers had significantly reduced their use of HHPs, with only 5.5% reporting acute health incidents compared to 20% recorded at the baseline. Initial uptake assessments showed that 92% of trained farmers adopted at least one agroecological method.

Background

- Lake Ziway area is an important location for vegetable production in Ethiopia's Central Rift Valley.
- Overuse of agrochemicals in the area threatens human health and the environment.
- A baseline survey of 75 smallholder onion farmers and 15 casual farm workers from five villages near Batu Town, revealed that 64% of the pesticides used by farmers are Highly Hazardous Pesticides (HHPs).
- The frequency of pesticide applications ranged from 12 to 22 applications per season, with no field monitoring for pests or diseases, nor consideration of integrated pest management (IPM) or agroecological principles.
- Alarmingly, 20% of smallholders and 73% of farm workers reported pesticide poisoning incidents within the previous year.

Lead organisations: Pesticide Action Nexus Ethiopia (PAN Ethiopia), Pesticide Action Network UK (PAN UK)
Partners involved: District Agriculture Office
Donors: Traid, JJ Charitable Trust, the Dutch Sustainable Trade Initiative (IDH)
Location: Lake Ziway, Central Rift Valley of Ethiopia, Ethiopia

General information:

Total and productive surface area of the property: Mean farm size= 1ha

Legal link with the land: Land owners

Access to water for irrigation (rivers, lakes, other): Lake-fed irrigation using pumps

Number of workers (including family members): Range = 5-10 (varies by household)

Link with national and district public policies:

- National Nutrition Sensitive Agri-food systems strategy (2024-2030)
- National Food Safety and Quality Strategy for Primary Agricultural Produce (2024-2030).

Type of biome / natural vegetation systems: Semi-arid mixed cropping system

Climate of the area (temperatures, rainfall, etc.): Annual temperature ranges between 15-29°C and annual rainfall varies between 400-1000mm

Pesticides of concern: DDT, profenofos, endosulfan, chlorpyrifos and malathion

Key indicators: Pesticide reduction, farm productivity, net income, acute pesticide poisoning.

Agroecological approaches introduced (see Annex)

- Since 2018, over 700 farmers have been trained via season-long FFS, averaging 11 weekly sessions, plus a further 500 farmers have been trained via peer mentoring.
- Specific efforts were made to invite women with their husbands which, along with a gender awareness workshop with government staff, helped to recruit 33% women to FFS training.

Adoption and uptake

- From a survey of 78 trained farmers (14% women) in 2021, many farmers had significantly reduced their use of HHPs. For insect pests, farmers reported applying an average of 5 insecticide sprays per season (range: 2-12 times), compared with their recalled average of 9 applications before training (range: 4-18 times).
- Of these surveyed farmers, 85% reported they still apply food spray and sow habitat strips of alfalfa or maize, while 60% of farmers reported they avoid HHP insecticides harmful to natural enemies and 60% leave natural vegetation/ weeds in around fields for natural enemies.
- 31% of farmers reported that they had stopped use of specific HHPs (including DDT, profenofos, endosulfan, chlorpyrifos and malathion).
- Initial uptake assessments showed that 92% of trained farmers adopted at least one agroecological method.

Extension agents receiving training in agroecological pest management methods in an onion field, Ziway. Credit PAN UK.

Benefits observed

Climate mitigation

- 76% reduction in synthetic pesticide spray frequency (average over three seasons of FFS field trials versus non-FFS farmers). Thereby reducing greenhouse gas emissions involved in their production and distribution.
- 50% reduction in synthetic fertilizer use.

Climate adaptation

- Increase in crop rotation and crop diversification leading to increased climate resilience.
- Incorporation of compost and vermicompost into the soil increases organic matter and helps to conserve soil moisture and can reduce drought stress in plants.

Economic Benefits

- 8% reduction in production costs (average over three seasons of FFS field trials versus non-FFS farmers).
- Slight yield increase (average over three seasons of FFS field trials versus non-FFS farmers).
- 9% increase in net income (average over three seasons of FFS field trials versus non-FFS farmers).

Biodiversity

- Significant increase in beneficial insects (natural enemies of pest insects) due to application of the food spray method, an increase in vegetation diversity and a decrease in pesticide load.

Gender and gender equity

- 33% FFS participants were women.
- Agroecologically-produced vegetables are being sold to local hotels and restaurants by a women farmer group which is currently being supported to establish a Participatory Guarantee System.

Community organization

- 4 women farmer groups were established by the project and are collectively producing and selling bio-inputs and vegetables.

Health

- 5.5% surveyed farmers reported acute pesticide poisoning over the previous 12 monhts compared to 20% recorded at the baseline.

Lessons learned

- Ethiopian agri-supply stores provide almost no biorational alternatives to HHPs. In Ziway, one commercial neem-based product is available (Nimbecidine). National availability of biopesticide and biorational products registered for vegetables is extremely limited.
- Overall, field trial results and feedback from participating farmers and government extension agents demonstrated and provided confidence that agroecological pest management practices for onion cultivation in Ethiopia can match or exceed conventional farming yields, while achieving better health and environmental outcomes.

Vermicomposting trials in Ziway. Credit PAN Ethiopia.

Recommendations for policymakers and government agencies

- The testing and dissemination of agroecological methods is needed, particularly to find alternatives for fungicides.
- Validating and testing different combinations of agroecological methods with farmers and government extension agents helps both groups to understand their efficacy and economic feasibility under different conditions.
- Mainstreaming agroecological approaches in vocational training is critical for scaling up changes in practices. PAN Ethiopia has made a good start with recent inclusion of organic practices in Ethiopia's Technical Vocational and Education Training (TVET) curriculum. This could be complemented with vegetable-specific ecological pest management modules at university level.
- Priority registration of biopesticides and biorational products would be a very positive step to support the Ethiopian horticulture sector to reduce reliance on HHPs, with benefits for farmer and worker health and consumer safety.
- Despite good demand and premium prices, the logistics for farmer groups to reach these markets is challenging. More policy support and practical help for farmers, including marketing, is needed. Public and private resources for farmer training and logistical support must be directed towards agroecological methods that protect farmers' health and the natural resources on which they depend.

SUCCESS STORIES OF AGROECOLOGY FARMERS

Ms Rukya Dedu's Story

Ms Rukya Dedu, a smallholder farmer from Abine Germama village, is one of the founding members and chair of the Abine Germama vegetable producers' women self-help group. She initially joined FFS training in 2018 in an effort to reduce the use of pesticides and synthetic fertilizers. Now she is supporting her family with the income generated from producing and selling vegetable seedlings and agroecological inputs to other farmers and by selling vegetables to restaurants and hotels with the other self-help group members.

During the FFS trainings, homemade recipes for pests and disease management and vermicomposting for soil health management were the topics that caught Rukya's attention. She started producing extracts from garlic, ginger, chilli and onion to use for pest management purposes, and set up a vermicomposting unit in her backyard. She has now cut the use of pesticides and synthetic fertilizers and replaced them with agroecological methods.

In 2023, Rukya produced surplus vermicompost and vermiwash and started selling it to other farmers in her village. Rukya typically produces 40 litres of vermiwash per month and sells a 5-liter container for 100 Ethiopian Birr (USD 3.5), providing an additional source of income for her and her family.

Ms. Rukya Dedu applying homemade vermiwash and vermicompost to her diversified market garden in Abine Germama village

Annex: Agroecological pest management methods introduced to onion farmers in Ziway via the FFS learning plots

Method	Further information	Agroecology principles
Habitat borders	Alfalfa or maize planted around the crop borders to increase habitat diversity and to maintain natural enemies.	Synergy, biodiversity, economic diversification
Food spray	Brewery yeast-based food spray applied on crop foliage approx. 2-6 times per season to attract natural enemies into sprayed vegetable fields.	Input reduction, diversification, biodiversity, synergy
Decision support	Simple counting method for monitoring levels of pests and natural enemies (take action when pest levels rise above 1 predator to every 2 pests). Actions include: a further food spray (either alone or mixed with neem); neem only spray; insecticide as last resort.	Input reduction, biodiversity, participation
Wider spacing of plants	Mainly a disease management method and to enable farmers and workers to move more easily through the crop for better monitoring and better targeting of any applications.	
Application of neem seed extract	Added with a food spray or as a stand-alone application if pest numbers are outstripping natural enemy control (i.e., when predator to prey ratio considerably < 1:2). Neem seedlings were provided to farmers to grow in their field borders as a medium-term solution to overcome dependence on neem seed from other regions.	Input reduction
Avoiding HHP insecticides harmful to natural enemies	Many insecticides are broad spectrum and kill natural enemies or interfere with their performance. Only using insecticides as a last resort and selecting those such as spinosad, which are somewhat less harmful to natural enemies helps protect the natural enemies attracted by the food spray method.	Input reduction, soil health
Applying vermicompost at transplanting and/or as a side dressing in mid-season	Helps grow a healthier, more robust crop better able to withstand pest attack and reduces volume of synthetic fertiliser needed. Helps conserve soil moisture and can reduce drought stress in plant.	Recycling, input reduction, soil health, economic diversification
Roguing (hand pulling) of individual wilt or virus affected plants	Removes infective material from the field and reduces risk of disease spread.	Input reduction
Sanitary pruning of badly diseased and older and yellowing tomato leaves	Reduces level of disease spores able to spread to clean tissue. Opens up lower crop canopy for better air circulation and reduces humid microclimate which favours disease.	Input reduction
Application of baking powder solution (sodium bicarbonate)	Makes the foliage surface less favourable for disease spore germination.	Input reduction
Thorough clean-up of all crop waste after harvest and removal from field	Reduces survival of pests which pupate or shelter as adults in crop waste. Crop waste can be composted, buried or fed to livestock or vermicompost units.	Input reduction, recycling
Farmer field schools	Season-long farmer-participatory training involving learning plots for hands-on group learning and decision making.	Knowledge co-creation, participation

Key resources

- PAN UK (2016). Using the Food Spray Method to enhance biological control in cotton: a trainers' guide. https://www.pan-uk.org/food-spray
- PAN UK (2024). Phasing out highly hazardous pesticides in vegetable farming (Ethiopia). https://www.pan-uk.org/vegetable-farmers-in-ethiopia
- Watts, M. Williamson, S. (2015) Replacing Chemicals with Biology : Phasing Out Highly Hazardous Pesticides with Agroecology. PAN Asia and the Pacific : Penang. https://www.panna.org/wp-content/uploads/2022/12/Phasing-Out-HHPs-with-Agroecology.pdf

This case study was produced by Pesticide Action Network (PAN UK) in collaboration with Pesticide Action Nexus Ethiopia and PAN International. It is one in a series of PAN case studies from around the world showcasing the benefits and contributions of agroecology to climate resilience, food security, health and biodiversity protection. The series is produced by members of the PAN International Agroecology Workgroup. The full series is available in a number of languages via the QR code.

Funding to develop this case study was provided by Traid, IDH (the Sustainable Trade Initiative) and The JJ Charitable Trust.

Pesticide Action Network International (PAN International) 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.

Web: pan-international.org
Facebook: PesticideActionNetworkInternational
BlueSky: @pesticideaction.bsky.social

Pesticide Action Nexus Ethiopia is a non-profit organization that focuses on promoting sustainable farming, reducing pesticide risks, and protecting both the environment and human health by promoting agroecological alternatives in Ethiopia. It works closely with smallholder farmers, farmer cooperatives, and communities to support agroecological practices like organic cotton farming, ecological vegetable production, and pollinator conservation.

Atalo Belay
Email: feelatalo@gmail.com
Tel: +251-116-186774
Web: panethiopia.org

Pesticide Action Network UK (PAN UK) is the only UK charity focused solely on tackling the problems caused by pesticides and promoting safe and sustainable alternatives in agriculture, urban areas, homes and gardens at home and overseas.

Alex Stuart
Email: alex@pan-uk.org, admin@pan-uk.org
Tel: +44 1273 964230
Web: pan-uk.org
Facebook & Instagram: @PesticideActionNetworkUK

PAN
pesticide action network international

CEJAD
Centre for Environment
Justice and Development

SCALE UP AGROECOLOGY FOR SUSTAINABLE AND RESILIENT FOOD SYSTEMS IN KENYA

Scale Up Agroecology for Sustainable and Resilient Food Systems in Kenya

Executive Summary

Kenya's agricultural sector faces unprecedented threats, including unsustainable agricultural practices, soil degradation, adverse effects of climate change and declining productivity due to extensive use of toxic agrochemicals.

These threats call for the need to transform the country's food system in a manner that is eco-friendly, resilient, and just by shifting to agroecological production practices as opposed to conventional practices rooted in synthetic fertilisers and pesticides, and hybrid seeds.

Meeting the country's food security and nutrition needs requires integration of ecological principles into farming to restore soil health, enhance biodiversity protection, and strengthen resilience to climate variability. Despite its numerous benefits, adoption of agroecology in Kenya remains limited due to several factors including limited access to organic inputs, inadequate technical support, low awareness among policy and decision makers, subsidy bias towards industrial agriculture, and market and policy barriers.

For the country to achieve its food security and nutrition needs while also addressing the triple planetary crisis of pollution, climate change and biodiversity loss, there is an urgent need to integrate agroecology across all sectoral plans, policies and strategies at national and county level, bolster public investment in agroecology, enhance research, extension, and knowledge sharing on agroecology and establish structured markets and certification systems for agroecological produce to enhance farmers' income.

This policy brief is intended for decision makers at the national and county government levels, particularly the ministries of agriculture, environment and planning and economic development, and other relevant agencies and departments.

Background

The agricultural sector is the backbone of Kenya's economy, accounting for about 22.5% to the Gross Domestic Product (GDP) in 2024, and a key source of employment and livelihood, particularly for the rural population (KNBS, 2025). While the sector recorded a mixed performance in 2024, the burden of malnutrition persists as a critical concern. The proportion of the population with severe food insecurity increased from 15% in 2016 to 28% in 2023, one in five children are stunted while one in four women are anaemic.

The need to feed Kenya's growing population has led to increased expansion of agricultural activities into natural habitats, creating a significant threat to biodiversity. Food security has also been negatively impacted over the years by the increased incidences of extreme weather events such as droughts, heavy rains, and floods, which are attributed to the adverse effects of climate change (IPCC, 2023). With these challenges, there is a widespread recognition that the current food systems are failing to meet human needs and are exacerbating climate change and biodiversity loss.

Why agroecology?

Transforming Kenya's food system requires shifting how food is produced, distributed, and consumed to make it sustainable, resilient, equitable, and healthy. Agroecology offers a proven pathway by harnessing natural processes, optimizing farm resources, reducing harmful impacts, and promoting social equity.

Agroecology integrates local and scientific knowledge, fostering interactions among plants, animals, people, and the environment. It emphasizes co-creation of knowledge that blends science with traditional and local knowledge of food system actors. It is widely recognized as a transdisciplinary science, a set of practices, and a social movement (Figure 1).

A transdisciplinary science	A set of practices	Social movement
The integrative study of the ecology of the entire food system, encompassing ecological, economic and social dimensions	Aimed at improving agroecosystems by harnessing natural processes, creating beneficial biological interactions and synergies among their components	That strengthens the economic viability of rural areas based on short marketing chains and safe food production, it supports diverse forms of smallholder food production, food sovereignty, local knowledge, social justice, local identity and culture, and indigenous rights for seeds and breeds

Figure 1: Dimensions of agroecology

Source: Adapted from High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, 2019

The agroecological transition pathway is informed by 13 agroecological principles which are consolidated around the 3 interrelated organizational pillars of a sustainable food system. (Figure 2).

The principles relate closely to the Food and Agriculture Organization of United Nations' 10 elements of agroecology.

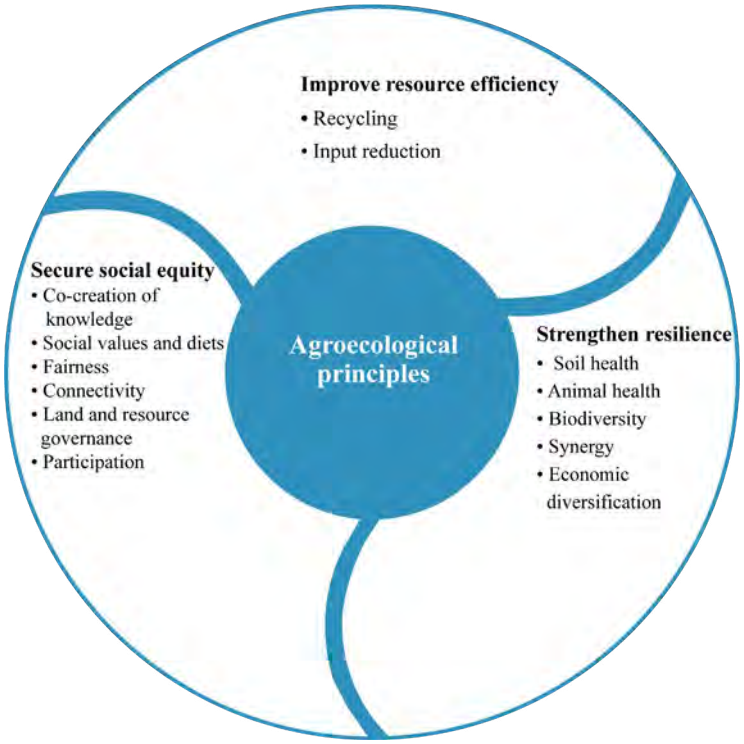


Figure 2: Principles of Agroecology

Source: Adapted from High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, 2019

Benefits of Agroecology

Figure 3: Possible outcomes for agri-food systems transformation

Source: Adapted from High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, 2019

Figure 3 above highlights some of the key benefits that Kenya can realise by integrating the above agroecological principles in her food system.

Current state of agroecology in Kenya

- Kenya has made significant progress in promoting agroecological practices, particularly through development of agroecology policies and initiatives. Murang'a County was the first county in Kenya to develop a policy on agroecology (see Table 2).
- According to Kenya Organic Agriculture Network (KOAN), there are approximately 173,000 hectares of land in the country currently under organic cultivation. In addition, Kenya has at least 64,000 organic producers, 100 organic processors, and about 6 certified organic farmer markets mainly spearheaded by NGOs. Additionally, there are about 11 organic traders and 7 organic input suppliers.
- Some progress has been made in developing certification schemes for organic farming. There are local certification bodies currently operating in the country, among them, Encert and AfriCert (KOAN, 2024). These are mostly spearheaded by NGOs and the private sector.
- In recent years, efforts have also been made by some universities and colleges, such as Egerton University, to integrate agroecology into their academic curriculum from certificate to post-graduate programs.
- In some parts of the country, there are training and outreach programs for agroecology, led by the private sector and civil society actors (AFSA, 2020).
- Some of the common agroecological practices currently practiced in Kenya include integrated pest management (IPM), agroforestry, composting and organic manure use, soil and water conservation, livestock production, food forest, seed saving and agro-processing.

Kenya's commitments to agroecology

The 2010 Constitution of Kenya acknowledges sustainable development as a valuable principle to good governance and guarantees every citizen the right to healthy and adequate food, and a clean and a healthy environment. The country's long term development blueprint - Vision 2030 - further emphasizes the need to produce food sustainably. In keeping with the provisions of the Constitution, several policy frameworks have been developed at national and county level to position the country towards a sustainable path to agricultural production. Table 1 provides a summary of national policy frameworks that provide for agroecology in Kenya.

Table 1: Policy framework on agroecology at the national and county level

Sector	Framework	Relevance
Agriculture	Agricultural policy 2021	• Provides for promotion of agroecology among other nature-based solutions to achieve sustainable and resilient food systems.
	National Agroecology Strategy for Food System Transformation Strategy (NAS-FST), 2024-2033	• This is Kenya's central commitment to agroecology that aims to sustainably transform the country's food system to ensure food security and nutrition, climate resilient livelihoods and social inclusion for all.
Environment	National Environment Policy 2013	• Provides for promotion and support for eco and organic farming to maintain soil fertility.
	National Biodiversity Strategy and Action Plan (2019-2030)	• Calls for provision of subsidies that support agroecological initiatives and elimination of subsidies on environmentally harmful agrochemicals. • Provides support to smallholder farmers to implement agroecological practices and techniques through rural development programs. • Provides for promotion of agroecological practices as a mechanism for soil and water conservation. • Calls for promotion of agroecology as a strategy for achieving climate smart agriculture (CSA) at the county level.

At the county level, there is growing commitment from the county governments to promote agroecology. However, more counties are yet to commit to promoting agroecology as part of agricultural transformation. The table 2 highlights some of the counties that have developed or are developing the policy frameworks for agroecology.

Table 2: Policy frameworks on agroecology at the county level

Sector	Framework	Relevance
Agriculture	Murang'a County Agroecology Policy 2022-2032	• This is the key framework that aims to support productivity and sustainability of the agroecological food production system in Murang'a County in line with the National agroecology Strategy for Food System Transformation Strategy. • Among others, it commits to create and fund a county agroecology department or board, integrate agroecology in mainstream agriculture in all productive sectors and mainstream agroecology in extension services.

Agriculture	Vihiga County Agroecology Policy, 2025	• This policy seeks to promote the adoption of Agroecology practices to enhance agrobiodiversity conservation for a more sustainable food system. • Key commitments in this policy include supporting production and consumption of safe and diverse diets, promotion of indigenous agricultural knowledge and practices, supporting and promoting marketing of agroecology products and strengthening of research and extension services on agroecology.
	West Pokot County Agroecology Policy, 2025	• This policy aims to integrate biodiversity conservation and sustainable ecosystem use into agriculture, enhancing incomes, food, and nutrition security by mainstreaming agroecology into policies and programs. • Key commitments include integrating agroecological practices into county policies, building knowledge and skills, promoting sustainable agro-enterprises and markets for agroecological products, and strengthening indigenous seed and food sovereignty.
	Makueni Agroecology Policy, 2025 (Draft)	• This policy aims to guide Makueni County's agroecological transition, fostering a sustainable food system that ensures food security, better nutrition, climate-resilient livelihoods, and inclusive growth.

At the international level, agroecology has been recognized by many governments, including Kenya, as an effective approach for transforming global food systems towards a more productive, sustainable and inclusive path. The UN Food Systems Summit (2021) and the Global Stocktake under the United Nations Framework Convention on Climate Change (UFCCC) are some of the frameworks that have recognized agroecology. Table 3 highlights some of the regional and global policy frameworks to which Kenya has committed that expressly call for the promotion of agroecology.

Table 3: Regional and global policies on agroecology

Sector	Framework	Relevance
Agriculture	Comprehensive Africa Agriculture Development Programme (CAADP) Strategy and Action Plan: 2026-2035[1]	• Seeks to promote and support the adoption of conservation agriculture and the promotion of agroecological practices as a strategy for achieving sustainable food production on the Continent.
Environment	Global Stocktake (UNFCC)[2]	• Outcome of the first Global Stocktake encourages implementation of integrated, multi-sectoral solutions, such as land-use management, sustainable agriculture, resilient food systems, nature-based solutions and ecosystem-based approaches to mitigate climate change impacts and losses.
	Kunming-Montreal Biodiversity Action Plan[3]	• Recognizes application of agroecology as one of the approaches for achieving target 10 on Enhance Biodiversity and Sustainability in Agriculture, Aquaculture, Fisheries, and Forestry.

1 https://au.int/en/documents/20241230/caadp-strategy-and-action-plan-2026-2035
2 https://unfccc.int/documents/636608
3 https://www.cbd.int/gbf/targets

		• Encourages the use of integrated pest management to reduce the risks of pesticides and highly hazardous pesticides (HHPs) to protect biodiversity from pollution (Target 7).
	Global Framework on Chemicals- For a Planet Free of Harm from Chemicals and Waste[4]	• Commits to phase out HHPs in agriculture promote transition to and make available safer alternatives by 2035. • Calls on governments to implement policies and programmes to increase support to safer and more sustainable agricultural practices, including agroecology, integrated pest management and non-chemical alternatives by 2030.

Gaps and Barriers

While Kenya has made strides in promoting agroecology, it is yet to be given greater attention due to various actors, including farmers, pesticide regulators and decision makers. The following gaps and barriers have slowed down the development and adoption of agroecology in Kenya.

- **Limited access to organic inputs:** Lack of reliable supply chains for existing organic inputs have limited their access and wider adoption among farmers, especially those in remote areas.
- **Inadequate technical support:** While agroecology is gaining momentum in some areas, many farmers still lack the technical skills and institutional support to implement it effectively. County governments have yet to integrate agroecology in their agricultural extension services, leaving a significant gap in agroecology-focused trainings and resources.
- **Low awareness among policy and decision makers:** Some policymakers, county technocrats, and extension officers lack clarity about what "agroecology" means, its benefits, trade-offs.
- **Market barriers:** Without access to premium markets, farmers are less incentivized to adopt agroecological practices, as they cannot capitalize on the higher prices that organic produce can command. The lack of certification systems and market infrastructure for organic products limits their ability to reach consumers who are willing to pay more for sustainably produced goods.
- **Policy barriers:** Although Kenya has adopted a national agroecology strategy, its implementation has been slow and fragmented. A few counties have made commendable efforts to domesticate the strategy, but most have yet to do so. Progress has also been hindered by weak coordination among government agencies, limited collaboration between national and county governments, and poor alignment among stakeholders implementing various agroecology initiatives.
- **Subsidy bias toward conventional / high-input agriculture:** There are limited financial incentive schemes specifically targeting agroecological transitions (subsidies, credit, insurance) compared to those for conventional input-intensive agriculture. Existing government subsidies often support mineral fertilisers, hybrid seeds and high-input yield increases rather than organic inputs or diversified systems. This biases agricultural

4 https://www.chemicalsframework.org/page/strategic-objectives-and-targets

Recommendations

If implemented, the following recommendations will enhance adoption of agroecology in Kenya:

- The Ministry of Agriculture must strengthen policy and legal frameworks by integrating agroecology across all sectoral plans, policies and strategies, and encourage county governments to domesticate the National Agroecology Strategy at their regulatory level and integrating agroecology across all sectoral plans, policies and strategies.
- National and county governments must boost public investment in agroecology by establishing dedicated budget lines, offering incentives and subsidies for agroecological inputs, and expanding access to financing to support farmers' transition to sustainable practices.
- The Ministry of Agriculture must enhance research, extension, and knowledge sharing on agroecology by investing in participatory research, reorienting extension services to promote agroecological principles, establishing county-level demonstration farms, and strengthening data collection and documentation on agroecological practices.
- The Ministry of Agriculture must safeguard farmers' seed rights by promoting and strengthening community seed banks and systems to ensure access to indigenous and climate-resilient varieties.
- The Ministry of Agriculture, in collaboration with county governments, must establish structured markets and certification systems for agroecological produce to enhance farmers' incomes. It should also support farmer cooperatives to strengthen their bargaining power and promote value addition for indigenous crops and agroecological products.
- The Ministries of Agriculture at both national and county levels must integrate agroecology into climate, environment, health, and nutrition agendas, while promoting cross-sectoral financing across agriculture, health, environment, and education sectors to support agroecological initiatives.

References

1. *Food and Agriculture Organization of the United Nations (FAO) Agroecology Knowledge Hub* https://www.fao.org/agroecology/overview/overview10elements/en/
2. *National Agroecology Strategy for Food System Transformation Strategy (NAS-FST), 2024-2033* https://kilimo.go.ke/wp-content/uploads/2024/11/National-Agroecology-Strategy-for-Food-System-Transformation-2024-2033.pdf
3. *Kenya Organic Agriculture Network (KOAN) website* https://www.koan.co.ke/
4. *Kenya National Bureau of Statistics (KNBS), 2025. National Agriculture Production Report* https://www.knbs.or.ke/wp-content/uploads/2025/10/National-Agriculture-Production-Report-2025.pdf
5. *Murang'a County Agroecology Policy 2022-2032* https://faolex.fao.org/docs/pdf/ken234012.pdf
6. *Vihiga County Agroecology Policy, 2025* https://vihiga.go.ke/agroecology-policy-2025/
7. *West Pokot County Agroecology Policy, 2025* https://www.westpokot.go.ke/wp-content/uploads/2025/07/West-Pokot-County-Agro-Ecology-Policy-2025.pdf
8. *Makueni Agroecology Policy, 2025 (Draft)* https://makueni.go.ke/sandbox/site/files/2025/05/Draft-Makueni-Agroecology-Policy-2025.pdf
9. *Alliance for Food Sovereignty in Africa (AFSA). Policy Brief: Strengthening Agroecological Practices to Enhance Soil Health and Food Security in Kenya* https://afsafrica.org/wp-content/uploads/2025/05/kenya-policy-brief_kaudain.pdf
10. *AFSA, 2020. Kenyan National Climate Change Policies: Gaps and Opportunities for Mainstreaming Agroecology in Kenya.* https://afsafrica.org/wp-content/uploads/2021/10/kenya_report-on-ccp-final-1-24-9-2020-.pdf

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.

Web: pan-international.org

Bluesky: paninternational.bsky.social

Facebook: PesticideActionNetworkInternational

Linkedin: Pesticide Action Network International

Centre for Environment Justice and Development (CEJAD)

CEJAD is a registered public interest non-governmental organisation in Kenya that works to promote sound management of chemicals and waste to protect the environment and human health, especially vulnerable populations.
Location: Nairobi, Kenya
Email: info@cejadkenya.org
Phone +254 0720 465 500
Web: www.cejadkenya.org

Facebook: @cejadke
Instagram: @cejad_kenya
X: @CEJADKenya
LinkedIn: Centre for Environmental Justice and Development

Scale Up Agroecology for Sustainable and Resilient Food Systems in Kenya

This case study was produced by **CEJAD** in collaboration with PAN International. It is one in a series of PAN case studies showcasing the benefits and contributions of agroecology to climate resilience, food security, health and biodiversity protection. The series is produced by members of the PAN International Agroecology Workgroup. The full series is available in a number of languages via the QR code.

Funding to develop this case study was provided by Global Greengrants Fund

See the full series in a number of languages via the QR code

CLIMATE RESILIENCE THROUGH AGROECOLOGY

Fifteen Years of Community-Led Sustainable Agricultural Practice in Kenya

Climate Resilience through Agroecology:

Fifteen Years of Community–Led Sustainable Agricultural Practice in Kenya

Background

When Grow Biointensive Agriculture Centre of Kenya (G-BiACK) first started documenting agricultural practices in central Kenya back in 2009, the landscape looked very different from what we see today. Walking through the farms in Kiambu, Muranga, and Machakos counties, you'd encounter farmers heavily dependent on synthetic inputs, bags of chemical fertilizers stacked outside homesteads, empty pesticide containers scattered around, and soils that looked increasingly depleted despite the constant chemical additions.

The dependency was almost heartbreaking to witness. Farmers knew something wasn't right. They talked about how their grandparents grew abundant crops without all these expensive inputs, how the rains seemed less predictable, how their children were getting sick more often. But they felt trapped. The extension officers told them to use more chemicals. The input dealers were always ready with new products. It was a cycle that kept getting more expensive and less effective.

That's when G-BiACK stepped in with what many farmers initially dismissed as "going backwards." The idea of double-digging beds by hand, making compost from kitchen scraps, saving seeds; it sounded like too much work for uncertain returns. What happened over the next 15 years changed the entire agricultural landscape of these three counties. This case study documents that transformation from the ground level, based on countless conversations with farmers, field visits, and witnessing the gradual but profound changes that occurred when communities embraced agroecological principles.

Impact at a Glance

- **30,000+ Farmers reached**
- **52% Adoption rate**
- **60% Synthetic input reduction**
- **30% Income increase**

Layout, Planning, and Technologies in Agroecological Units

Deep Land Preparation and Bed Design

The foundation of everything is the double-dug bed system. This method means digging down to about two spade depths, roughly 24 inches and loosening the soil to create a deep, healthy bed.

We've watched farmers transition from conventional tillage to this method, and the initial skepticism is always the same, "Why dig so deep when a tractor can do it faster?" But after one season, they see the difference. The soil structure changes completely. Water infiltration improves dramatically. Root penetration goes deeper.

On sloped areas, farmers now use raised beds for better drainage, while in drier zones, they've adopted sunken beds and zai pits for water retention. It's not a one-size-fits-all approach; each farm adapts the techniques to their specific microclimate and soil conditions.

Deep Land Preparation and Bed Design

Integrated Soil Fertility Management

The composting systems have become quite sophisticated over the years. What started as simple compost piles has evolved into systematic approaches using crop residues, kitchen waste, and animal manure. Many farmers now produce several types of organic inputs:

- Vermicompost for high-value crops
- Cold Compost
- Liquid manures like super magro
- Bokashi fermentation
- Biochar from agricultural waste

Integrated Soil Fertility Mangement

Seed Systems and Crop Diversity

Perhaps the most revolutionary change has been the return to locally adapted varieties. G-BiACK helped establish 15 community seed learning centers, and the impact has been remarkable. Farmers are now growing crops their parents had almost forgotten; indigenous vegetables like African nightshade (managu), spider herb (sagaa), and various amaranth varieties. Women have emerged as the primary custodians of these seed banks, and their knowledge of seed selection and storage has become invaluable community assets.

Seeds exchange and exhibition with farmers

Impact Assessment

Climate Resilience & Adaptation

Our projects have significantly strengthened both climate mitigation and adaptation in the farming communities we work with. Farmers capture carbon from the air when they grow crops like maize. The plants absorb carbon dioxide during growth and store it in their leaves, stems, and roots. Instead of burning or discarding the maize stalks after harvest, farmers return them to the soil by making compost and they also have improved management of soil organic matter (SOM), where increases of about 15% have been recorded. These figures come from annual soil sampling at consistent depths of 0–30 cm, with laboratory analysis using the Loss on Ignition (LOI) method. Because soil organic matter is roughly 58% carbon, the 15% rise in SOM translates to an estimated 8.7% increase in soil carbon. More than 10,000 trees have also been planted, contributing to eco-system

restoration, soil stabilization, and long-term carbon storage. At the same time, reduction of about 60% has been observed in the quantities of synthetic fertilizers being used, thereby reducing nitrous oxide emissions as well as the demand of inputs based on fossil fuel. Cover crops and perennials give additional benefits to soil fertility and carbon retention.

Biodiversity Conservation & Enhancement

Community seed banks well managed have preserved and promoted indigenous and open-pollinated seed varieties for conservation of biodiversity. Seed exchange events have helped transfer farmer-to-farmer knowledge and genetic resources, while documentation of seed characteristics and origin stories has helped sustain cultural heritage as well as genetic diversity.

Health & Nutrition Outcomes

There are substantial health benefits with an increased reduction of exposure to synthetic pesticides and fertilizers, that are harmful to nature. This also provides safer working conditions for farmers and a reduction in chemical-related illnesses, both acute symptoms and chronic conditions. Less incidence of respiratory problems and skin diseases has been reported, with environmental health benefiting from cleaner water sources due to less chemical runoff.

Farmers standing beside a compost pile

The participating households are enjoying nutritionally enriched diets owing to the increased dietary diversity as they produce an array of crops including indigenous vegetables, legumes, fruits, and cereals. Organic produce has higher nutrient density for better immunity and health. Thus, malnutrition cases have decreased, especially among children and vulnerable groups, while increased household food sovereignty guarantees the availability of freshly harvested foods throughout the year.

Farmers With their Harvest

Gender Equality & Social Empowerment

A lot of progress has been made in women's empowerment. The number of women occupying leadership roles across farming cooperatives, community committees, and market networks has increased by 40%. Women are occupying strategic decision-making positions and can now influence agricultural planning and resource allocation. Seed custodianship has grown into a strong women-led movement, with many operating community seed banks and spearheading indigenous seed conservation efforts. More training, finance, and marketing opportunities have equipped women to take greater control of household incomes. This has led to increased investment into health, education, and nutrition.

Findings

G-BiACK's evaluation is thorough and draws on 15 years of participatory monitoring and evaluation, incorporating quantitative indicators on the one hand and qualitative inspection on the other, thus providing a very well-rounded view of outcomes and impacts. It incorporates annual farmer surveys and focus group discussions that consider the challenges of various farming contexts, as well as innovations developed at the community level as solutions. Soil fertility assessment and biodiversity monitoring are considered across different categories of indicators.

Physical indicators include soil color, structure, moisture content, and the presence of micro- and macro-organisms that point to active soil life. Soil organic matter (SOM) is also tracked as a key marker, since a large share of it is carbon, making it a useful way to estimate soil carbon levels while also reflecting overall soil quality. Under biodiversity assessment, we focus on soil biota and functional diversity, with observations drawn from processes like decomposition and nitrogen fixation that demonstrate how soil ecosystems are recovering and supporting productivity. Economic analyses, including changes in household income, cost–benefit balances, and market participation, complement these measures by providing insight into livelihood improvements.

Collection of climate resilience indicators and adaptation outcomes give us insight into farmers' adaptation to emerging weather patterns, resource shortage, and climate-related risks.

Adoption and Reach:

- 52% Adoption Rate among participating farmers
- 30,000 + Farmers Reached across three counties

Environmental Transformation:

- Synthetic input reduction: 60%
- Trees planted: 10,000
- Soil organic matter increase: +15%
- Demonstration farms: 30

Social Transformation:

- 40% increase in women's leadership
- 45 Seed events and fairs organized

Social impact measurement will gauge gender and youth participation vis-a-vis equity and inter-generational transfer of knowledge placed as the core of program outcomes.

Social Transformation

Methodology

- **Demonstration Farms:** There are 30 demonstration farms serving as live laboratories, where farmers can see and learn first-hand practice methods of agroecosystem farming.
- **Farmer-to-Farmer**: Initiating mutual learning through cross visits, farmer networks, and farm field days through which farmers build trust and hasten adoption.
- **Community Centers:** 15 seed learning centers serve as hubs for knowledge sharing, seed banking, and community organization.

Core Agroecological Practices Implemented

Method	Further information	Agroecology principles
Deep land preparation	Covering soils with dried leaves, straw and green manure leaves	Synergy, biodiversity, soil health
Composting	Composting by use of crop residues, kitchen waste, and animal manure to improve moisture retention, increase the level of organic matter, and increase minerals and microbial activities in the soil.	Recycling, soil health, efficiency, input reduction
Seed Saving	Community-managed seed banks with women as custodians. Regular seed exchange, seed forums Preserved drought-tolerant varieties.	Diversity, efficiency, circular and solidarity
Agroforestry	Planting of trees like lucerne and calliandra for fodder, and moringa and neem as herbs.	Synergy, Biodiversity
Livestock Integration	Crop and small livestock integration (African integrated farming system)	Crop and small livestock integration (African integrated farming system)

Challenges & Lessons Learned

Key Challenges

- **Policy Environment**: Seed policies that restrict farmer-managed seed systems and limit the integration of agroecology in national agricultural policies.
- **Market Challenges**: Limited markets for agroecological products and high costs of organic certification processes.
- **Resource Constraints:** Inadequate government extension support and limited funding for scaling agroecological practices.
- **Cultural Resistance:** Initial skepticism from communities accustomed to conventional Farming methods and instant results from synthetic inputs.

Lessons Learned

- **Patience & Persistence:** Agroecological transformation requires time. Building soil health and farmer confidence is a gradual process that yields long-term benefits.
- **Community-Centered Approach**: Success comes from working with existing community structures and empowering local leadership rather than imposing external solutions.
- **Farmer-Farmer Trainings Demos:** Visible success stories and peer learning are more powerful than theoretical training in driving adoption.

Critical Success Factors

- **Partnership:** Strong collaborations with local and international organizations
- **Evidence-Based:** Continuous monitoring and documentation of impacts
- **Capacity Building:** Investment in local expertise and leadership development
- **Adaptive Management:** Flexibility to adapt approaches based on local contexts

Recommendations for Policy and Practice

Based on fifteen years of observation and documentation, several key recommendations emerge for policymakers and development practitioners.

- **Policy Integration:** Agroecology needs to be explicitly integrated into national agriculture, environment, and climate policies. This isn't just about adding a section on organic farming – it requires rethinking how agricultural development is planned and funded. Seed policies must be reformed to recognize and support farmer-managed seed systems. Community seed banks should receive the same support as major seed companies, including quality assurance and marketing support.
- **Extension System:** Reform Agricultural training institutions need curriculum reform to include agroecological principles and practices. The current focus on conventional agriculture leaves extension officers unprepared to support farmers interested in sustainable alternatives. The farmer-to-farmer learning model should be formally recognized and supported. Lead farmers who have successfully adopted agroecological practices should be integrated into official extension systems.
- **Market Development:** Simplified organic certification processes for small-scale farmers would help access premium markets. Participatory guarantee systems, where communities certify each other's practices, have shown promise in other countries. Public procurement policies should prioritize agroecological products for schools, hospitals, and other government institutions. This would provide stable markets while supporting public health objectives.
- **Research and Documentation:** More systematic documentation of agroecological practices and outcomes is needed. Farmer participatory research approaches should be supported to generate locally relevant knowledge. Long-term studies comparing agroecological and conventional systems across different ecological zones would provide stronger evidence for policy decisions.

Community Voices

Patrick Muthemi, Kitabasiye Community

"The 2017 drought almost broke me. All my neighbors who were still using chemical fertilizers lost everything. But my farm, which had been building soil organic matter for five years through composting and cover cropping, actually produced a harvest. Not a big one, but enough to feed my family and have something to sell. That's when the whole community really took notice. Now I host field days where farmers come to see our water harvesting structures and learn about drought-resistant varieties. My son, who was working in Nairobi, came back to help expand our agroecological practices."

"For many years, we bought seeds every planting season, and that was costly and stressful, especially when they were not available. We learned during the training on how to preserve the indigenous seeds. These days, we plant from our own seed banks and share seeds with other farmers of the community. These jars of seeds actually mean security for our families because today we do not worry about what to plant. They carry our culture and tradition within them, preserving the heritage so future generations will be able to grow the very same healthy and resilient crops. This work has given us pride and dignity for knowing that it is preserving life itself."

Grace Musyoki (left) and Agnes Kileti (right) from Mwanga Community

Mama Ruth from Kanini Kaseo Community

"Before I had entered the program, farming was always uncertain for me. The soil was tired, my yields were low, and sometimes I could not produce food for my family. I have learned through training on sustainable farming methods to care for the soil, plant to conserve moisture, and diversify my crops. What a change! The farm is now healthy, and I am able to feed my family throughout the year and even sell what remains. It's no longer hard to work on the field; rather, it is a source of enjoyment and pride. This transformation has inculcated with me the belief that farming can be a decent living for anyone with the right knowledge and practices."

Future Prospects and Scaling Opportunities

The momentum for agroecological transformation is building across Kenya and the broader East African region. G-BiACK has already supported the establishment of satellite centers in Uganda, Tanzania, Malawi, Rwanda, Ghana, Nigeria, and Sierra Leone. This regional expansion demonstrates the adaptability of agroecological principles across different contexts.

Future scaling efforts should focus on:

- Establishing more community seed learning centers and demonstration farms
- Digitizing training content to reach farmers in remote areas
- Strengthening partnerships with schools to engage younger generations
- Advocating for supportive policy environments at the national and county levels
- Developing sustainable financing mechanisms for agroecological transitions

The 52% adoption rate among farmers exposed to G-BiACK programs suggests that agroecological practices are viable and attractive when properly introduced and supported. With appropriate policy support and continued technical assistance, this transformation could be replicated across much of sub-Saharan Africa.

Conclusion

Fifteen years of documentation have shown that agroecological transformation is not only possible but profitable and sustainable. The farmers in Kiambu, Muranga, and Machakos counties have demonstrated that agriculture can be productive, environmentally regenerative, and socially just simultaneously.

The journey hasn't been easy, and challenges remain. But the evidence is clear: when farmers have access to appropriate knowledge, supportive communities, and basic resources, they can create farming systems that work for people and planet. The question now is whether policymakers and development institutions will provide the support needed to scale these successes.

As climate change intensifies and conventional agriculture faces increasing sustainability challenges, the experiences documented here offer hope and practical pathways forward. The farmers of central Kenya have shown the way – now it's time for policies and institutions to catch up.

Pesticide Action Network International (PAN International) 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.

Web: pan-international.org

Bluesky: paninternational.bsky.social

Facebook: PesticideActionNetworkInternational

Linkedin: Pesticide Action Network International

The Grow Biointensive Agriculture Centre of Kenya (G-BiACK)

Empowering Communities, Transforming Lives

G-BiACK is a training and demonstration center that promotes Agroecological agriculture, food sovereignty and environmental conservation through the GROW BIOINTENSIVE method.

Website: g-biack.org

Facebook & TikTok: @gbiack

LinkedIn: G-BiACK

Instagram: gbiackofficial_

X : x.com/GBiACK_

YouTube: G-BiACK TV

Climate Resilience through Agroecology

This case study was produced by **G-BiACK** in collaboration with PAN International. It is one in a series of PAN case studies showcasing the benefits and contributions of agroecology to climate resilience, food security, health and biodiversity protection. The series is produced by members of the PAN International Agroecology Workgroup. The full series is available in a number of languages via the QR code.

Funding to develop this case study was provided by Global Greengrants Fund.

See the full series in a number of languages via the QR code

PAN
pesticide action network international

Thanal

CASE STUDY -1

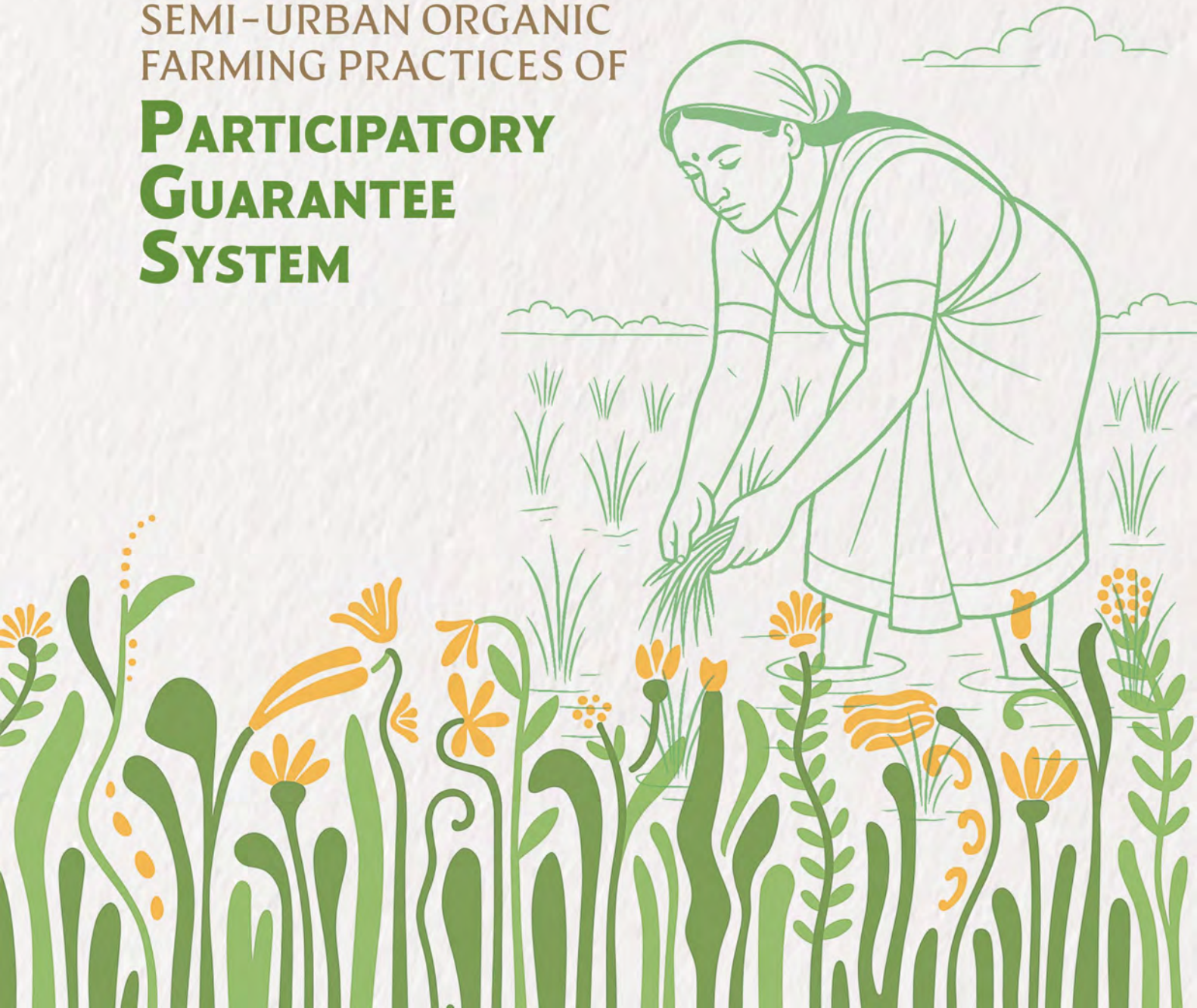
AGROECOLOGY FARMING PRACTICES IN KERALA, INDIA

WOMEN LEADING THE WAY

CASE STUDY -2

SEMI-URBAN ORGANIC FARMING PRACTICES OF

PARTICIPATORY GUARANTEE SYSTEM



CASE STUDY#1

Agroecology farming practices in Kerala, India
Women leading the way

Summary

Thanal with the support of Pesticide Action Network Asia Pacific (PANAP) has been supporting and training 26 women farmer groups (399 farmers) in Agroecology transition since 2022. From small-scale home gardening to community farming, raising a society, improving their livelihoods and making themselves self-sufficient in safe chemical-free food, these women are transforming their communities. Through capacity building programmes, hands-on-trainings, knowledge exchange programmes and continuous field management support, these 399 women farmers have stepped into agroecology, building their confidence, enhancing their livelihoods, and advancing food sovereignty.

Lead organization: **Thanal Trust**
Partners involved: **PANAP, Meenangadi panchayat (local self government)**
Donors: **PANAP**
Location: **Kerala**

General information

Farm size: **Mean farm size = 10 cents (405 m²)**

Legal link with the land: **Land owners**

Access to water for irrigation: **Pond, well, river**

Biome: **High range areas, upland and lowland mixed cropping system**

Climate: **Variable**

Pesticides of concern: **glyphosate, imidacloprid, 2,4-D, Saaf (carbendazim + mancozeb)**

Key indicators: **Biodiversity conservation, input reduction, increased productivity, pesticide and chemical fertilizer reduction, community farming**

Background

The project was conducted in Wayanad district of Kerala, India. Wayanad is an ecologically sensitive area and is highly vulnerable to climate change. The people there are small-scale farmers who practice conventional as well as organic farming. Through the new interventions, they started adopting agroecological practices, sharing their profits, gaining better access to fair price markets, and utilizing knowledge exchange platforms where they shared their field problems and successes. Biodiversity monitoring and agroecosystem analysis were also implemented in the fields of selected farmers.

Project activities, adoption and uptake

- The project provided training in agroecological farming practices to 399 women farmers over the period from January 2022 to December 2024. Of these farmers, almost 50% of them actively adopted some of the agroecological measures they learned through regular training.
- WhatsApp groups were created for farmers groups, through which 24 hour technical guidance on crop pest and disease management was provided. This social media platform provided farmers with a space for sharing their harvest stories which served as a motivation for the whole team.
- Among the 26 women farmer groups, 3 groups started group farming and were recognized by the Agriculture Department of Kerala and local

government bodies. As a result, the women farmers groups received opportunities to be a part of different government schemes.

Agroecological practices adopted in Wayanad, Kerala

Annual crops:

Conservation tillage practices were implemented, aiming at reducing soil erosion, improving soil structure and water infiltration. The crop residues were incorporated back into the planting pits. For basal manuring, powdered sea shells are added for neutralising soil pH. In addition, kitchen/leaf compost or Trichoderma-enriched decomposed cow dung is used as basal manures one week before planting and as mulch. At the time of planting, one teaspoon of VAM (vesicular arbuscular mycorrhizae) is added. After the 7th day of planting, Jeevamrutham/amrithapani/panchagavya is applied and on the 10th day, natural pest repellents are applied as a prophylactic measure. This is repeated until the crop reaches the flowering stage. At the flowering stage, diluted egg amino acid is sprayed for enhanced flower and fruit set.

Perennial crops:

For perennial crops, the tillage practices are the same as that of annual crops. Basal manure along with crushed sea shells, compost, enriched cow dung, and bone meal is also added. The manure application is repeated after 4-6 months based on crop growth progress.

Use of wild plants:

For making pest repellents, wild leaves with strong odours and those with latex are used.

A detailed table of agroecological farming methods introduced to farmers in Kerala is included at the end (see Annex).

Benefits observed

Climate mitigation

- Farmers reduced the use of fossil fuel energy sources and started using solar energy sources for farming operations, e.g. solar water pumps for irrigation.
- The manivayal regenerative agriculture project, when shifted to organic farming, contributed to an annual emissions reduction of 1.2 tonnes of CO -equivalent.

Climate adaptation

- Adjusting the planting timing: Farmers adjusted the sowing dates, which has been very effective in avoiding drought and flood periods; they also introduced short-duration crops. For example, previously farmers used to plant cool-season crops in November and harvest them by late February or early March. But summer now arrives earlier (February), so the planting is done in early October, allowing harvesting to be completed by the end of January, reducing the yield loss.
- Sucking pest infestation was widely seen in vegetable crops due to climate conditions favourable to these pests, such as increased humidity and high temperatures. So the sowing time was changed which helped to avoid pest outbreaks that have worsened with the warming climate.
- Use of cow dung manure formulations improved soil structure, earthworm count and soil properties important in controlling soil erosion.
- Windbreaks planted around the farming areas prevented crop lodging in heavy winds: Curry leaf plant (culinary), Glyricidia (manure and pest repellent), Calotropis (pest repellent) are the common windbreaks with multiple uses that are planted on farms.
- Increased climate resilience was achieved through use of native varieties of paddy, such

as Vellappokkan, an indigenous paddy variety that can withstand lodging in water-logged areas.

- Mulching, green manuring and crop rotation improved the water holding capacity and nutrient use efficiency, thereby reducing water stress in crops.

Economic Benefits

- The transition from costly chemical inputs to organic formulations made from locally available materials has significantly improved farmers' profit margins, especially among smallholders managing less than 0.1 ha (10 cents) of land.
- Farmers adopting regenerative agroecological practices reported notable yield improvements and higher farm productivity, contributing to enhanced income and food security. For example, in Manivayal, farmers reported paddy yields increased by 33%, following the shift to agroecology.
- Integrated and diversified farming systems reduced the risks associated with single-crop dependence, while providing multiple income streams from activities such as equipment leasing, organic input production, and farm produce sales. These diversified livelihood options have strengthened economic resilience and created more stable and sustainable rural incomes.

Biodiversity

- Training in biodiversity monitoring and agroecosystem analysis helped farmers to distinguish pests from beneficial insects such as predators and parasites, enabling the farmers to adopt wise pest management measures. This in turn reduced the irrational application of chemical pesticides that harm such beneficial organisms.
- Regular monitoring helped farmers to adopt timely management measures for pests and diseases, before reaching the Economic Threshold Level (ETL) for the crop.
- Fields in their third year of transition to agroecology showed an improved pest-to-defender ratio of 1:1, reflecting a ≈50% increase in beneficial insects such as ladybird beetles, spiders, red ants, praying mantises, and wasps, while pests outnumbered defenders by 2:1 in conventional fields.
- Agroecological fields recorded two to three times higher wild plant diversity than conventional farms, supported by richer soil organic carbon and minimal tillage practices.
- Agroforestry and integrated organic systems showed ~40–60% higher diversity of pollinators, birds, and predatory insects compared to monocropped fields. Frogs were present in 33% of organic farms but absent in conventional ones, while lichens and mosses thrived in agroecological fields, indicating healthier air, water, and soil ecosystems.

Gender and gender equity

- Gender equity and women's leadership was advanced, as 90% of participants were women, many of whom subsequently established women farmer groups.
- Representation from the Indigenous community: among 26 farmer groups, 2 groups were from the indigenous community, "Kurichya"

Mary Mathai, member of a women farmers group in Wayanad, conducts biodiversity monitoring in her field, with the guidance of Thanal field inspector, Aswathy. (Photo credits: Thanal)

Community organization

- Women farmer groups were formed which

brought them together, pooled their resources and started doing community farming. This created self-confidence and motivation and brought them out of social stigma.

- A community farming initiative was established in Manivayal village, where 10 men and 6 women from the indigenous community revived 8 acres which had been left fallow for more than 4 years due to water shortage. The community has been able to use solar energy efficiently, using a solar water pump to pump water from the nearby stream for vegetable farming purposes during summer and returning the water back to the stream.

Challenges

- Absence of subsidised organic inputs and resources, increasing the cost of cultivation;
- Lack of adequate economic support such as microcredits for small scale farmers;
- Decline in livestock farming, making it difficult to source organic manure, a major component in agroecological farming.
- Preference of farmers towards hybrid varieties, leading to loss of indigenous seeds.

Recommendations for policymakers and government agencies

- Promote the distribution of indigenous seed varieties through government schemes (instead of commercial hybrid seed), to enhance farmers' seed sovereignty and to strengthen agroecology;
- Initiate and implement government schemes that support farmers who wish to shift from conventional agriculture to agroecology during a transition period.
- Provide capacity building programmes for self-help groups (SHGs) in operating bioresource centres in every panchayat, to expand easy access to natural agricultural inputs. This can be done by agricultural extension departments.

SUCCESS STORIES OF AGROECOLOGY FARMERS, WAYANAD

Thankamani's Story

Woman farmer leads agroecology transformation in Wayanad

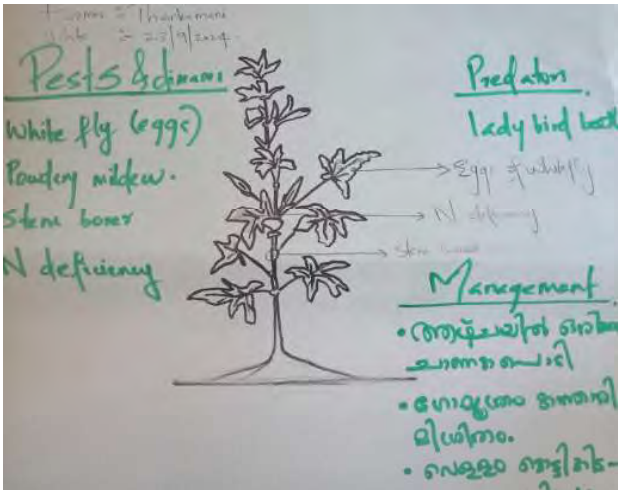
Mrs. Thankamani Suresh is a smallholder farmer who lives in Kolagappara village of Wayanad district, whose dedication to agroecology farming has earned her the Kisan Jyothi Award 2025, awarded by Meenangadi Gramapanchayat. She joined with Thanal in 2022 as part of the Women in Agroecology project (a three year project conducted in collaboration with Thanal and Pesticide Action Network Asia Pacific, aimed at mobilizing women farmers into agroecology, empowering them with a sustainable livelihood, and promoting community farming). During this time, Thankamani started learning about agroecological farming practices in an effort to reduce the use of pesticides and synthetic fertilizers. During the farmer training, homemade recipes for pests and disease management and biofertilizers for soil health management were the topics that caught her attention. She is supporting her family with the income generated from the sale of vegetables, tubers and other food crops.

Farming is the mainstay of Thankamani and her family. Over the past three years, Thankamani has revived barren lands, ensuring food security while conserving wetlands and groundwater. She grows indigenous paddy varieties like Ayiram Kana, Govind Bhog, Gandhasala and Jeerakasala, maintaining biodiversity and climate resilience. She also cultivates chinese potato, yams, root crops, coffee, pepper, millets, pulses, green manure crops and vegetables, reviving neglected farmlands into productive ecosystems through integrated farming with poultry, dairy and apiculture. Thankamani uses Jeevamrutham, Amrithapani and Pachagavya — effective cow dung formulations used as soil health enhancers that help in improving soil microbial activity. For pest management, she uses five-leaf extract, pheromone traps, thulsi-jaggery traps, fish amino acid and egg amino acid — natural inputs that reduce chemical dependency. During summers, the fallow sandy wetlands are sown with pulses and

the green manure crop, daincha, improving soil fertility by enhancing nitrogen fixation. This in turn reduces the use of urea for the second crop.

Leading an Agroecology Women Farmers Group in Kolagappara, supported by Thanal, Thankamani empowers other women to switch to sustainable agriculture through her farm visits and training. In 2024, with her leadership, an agroecology women farmers group was started in Kolagappara and took initiative in practicing agroecology at the household level. Now Thankamani is working closely with Thanal and is selected as one of the master farmers of our new project, "Mannorukkam- Enhancing Soil Health and Agroecology".

Thankamani on her diversified farm [Cassava,Red Amaranth and chinese potato) *(Photo credits: Thanal)*



Members of the women farmers group conduct agroecosystem analysis in Thankamani's field, analysing the ratio of pests to natural enemies, which then informs their pest management decisions. (Photo credits: Thanal)

Manivayal

Restoring land through diversified farming

The local panchayat president inaugurates their harvest festival.

In February 2024, a pilot project was launched in Manivayal village, bringing together 16 indigenous community farmers (ten men and six women) on eight acres of land to establish an agroecology farming model. The Manivayal regenerative agriculture project transformed the previously barren land, which had been left fallow for more than four years, into a productive agroecology farm, by addressing water scarcity through a solar water pump. Efficiently using the solar energy, they pumped water from the nearby stream, utilised for farming purposes and then returned it back to the stream.

Earlier, the community had been cultivating paddy in this plot and after the rice cultivation, the field was left fallow during summer (March-June). During the 2024 summer, mixed intercropping of 13 different vegetables, two flower crops and three millet crops was done. Agroecological training empowered farmers with new manure preparation techniques for soil health improvement, leading to chemical-free cultivation, ₹26,185 (297.37 USD) in earnings, and financial growth through reinvested profits. They harvested 437 kg of vegetables and more than 50 kg of marigold and sunflower which were sold locally.

Supported by Thanal in collaboration with Meenangadi Panchayat, the project also contributed to an annual emissions reduction of 1.2 tonnes of CO_2- equivalent. Building on the success of the solar water pump and regenerative agriculture initiatives, a superpower tiller was provided to enhance agricultural productivity and support the

economic empowerment of Indigenous farmers, as part of the UST Tribal Empowerment Program. The tiller, which began operations on July 13, 2024, worked for 78 hours across 24 fields, fostering a self-sustaining economic model as farmers leased it out for additional income. To ensure its efficient use, a skilled operator and helper were appointed, earning Rs 200 per hour and Rs 50 per hour, respectively. Each farmer paid Rs 700 (7.95 USD) per hour for tiller services, generating a total income of Rs 71,235 (809.28 USD). This initiative not only improved farm productivity but also strengthened the economic stability of the tribal community, reinforcing the role of sustainable agriculture in livelihood development and community empowerment. After the harvest of vegetables, paddy was cultivated and the rice yield increased from 1.2 tonnes in 2023 to 1.6 tonnes in 2024, marking a significant 33% increase in production.

Annex: Agroecological farming methods introduced to farmers in Kerala via agroecology trainings

Method	Further information	Agroecology principles
Mulching	Covering soils with dried leaves, straw and green manure leaves.	Synergy, biodiversity, soil health
Cover cropping	Cover cropping prevents weed growth and conserves soil moisture. Live roots harbor microbes that act as shields, preventing pest and disease attack.	Biodiversity, soil health
Jeevamrutham	An organic tonic prepared using fresh cow dung, cow urine, Jaggery, pulse powder, and top soil. This enhances soil microbial activity and thereby helps the soil bind nutrients for easy plant uptake. Soil is drenched once in 15 days. (500 ml/ plant)	Input reduction, biodiversity, synergy, soil biodiversity, resource utilization
Amrithapani	Organic liquid formulation of cow dung which enhances plant immunity and soil microfauna. Applied to soil once a week and during planting.	Input reduction, biodiversity, synergy, soil biodiversity, resource utilization
Fish amino acid	An organic pest repellent as well as soil tonic used for soil drenching and foliar spray. Used once in a month (3ml/L).	Resource utilization, soil health, biodiversity
Egg amino acid	An organic liquid made using egg and lemon water. Used for preventing flower drop and enhancing fruit setting.	Economic profit, resource utilisation, input reduction
Decision support	Simple counting method for monitoring levels of pests and natural enemies (action is taken when pest levels rise above 1 predator to every 2 pests). Actions include: a further spray of organic pest repellents and biofertilizers	Input reduction, biodiversity, participation
Wider spacing of plants	Mainly a disease management method and to enable farmers and workers to move more easily through the crop for better monitoring and better targeting of any applications.	
Application of Entomopathogenic fungi, nematodes and bacteria	Pseudomonas fluorescence, Trichoderma viridae, Pochonia, Beauveria bassiana, Verticillium lecanii, Paecilomyces lilacinus are the biofertilizers suggested for preventing and managing bacterial, fungal and nematode infestations in plants as well as to control beetles, caterpillars and bugs.	Plant health, food security, pesticide reduction
Application of biofertilizers	Azospirillum, Azotobacter, Rhizobium, potassium solubilizing bacterial consortium, and phosphorus solubilizing bacterial consortium are the major biofertilizers used for improving the uptake of soil nutrients for managing nutrient deficiencies in plants	Input reduction, biodiversity, synergy, soil biodiversity, resource utilization

Avoiding HHPs (insecticides and herbicides) harmful to natural enemies	Many insecticides are broad spectrum and kill natural enemies or interfere with their performance. Coffee farmers in Wayanad widely use a mix of chlorpyrifos and nimbecidine for controlling the coffee borers and imidacloprid for whiteflies and mealy bugs in vegetable crops. For weed control, glyphosate is commonly used. As an alternative to pesticides our farmers used cow urine, chilli extract and five leaf extract for caterpillars and Verticillium lecanii for sucking pests, fish amino acid for bugs and Clerodendrum infortunatum leaves for beetles.	Resource utilization, soil health, biodiversity
Applying compost/ dried cowdung/ enriched cowdung	Helps grow a healthier, more robust crop better able to withstand fungal attack and reduce volumes of synthetic fertilizer needed. Helps conserve soil moisture and can reduce drought stress in plants.	Recycling, input reduction, soil health, economic diversification
Roguing (hand pulling) of individual wilt or virus affected plants	Removes infective material from the field and reduces risk of disease spread	Input reduction
Sanitary pruning of badly diseased and older and yellowing leaves	Reduces level of disease spores able to spread to clean tissue, opens up lower crop canopy for better air circulation and reduces humid microclimate which favours disease	Input reduction
Thorough clean-up of all crop waste after harvest and removal from field	Reduces survival of pests which pupate or shelter as adults in crop waste. Crop waste can be composted, buried or fed to livestock or vermicompost units.	Input reduction

CASE STUDY#2

Semi-urban organic farming practices of Participatory Guarantee System farmers in Kerala, India

Summary

Thanal has been working as a certified regional council of Participatory Guarantee System (PGS) Organic Certification under the Kerala Department of Agriculture and Farmers Welfare since 2017. As part of the certification procedure, regular farmer trainings, peer monitoring, mobile agroclinic facilities and farmer to farmer knowledge exchange programmes are being conducted, enabling farmers to shift completely to organic farming practices, thus reducing the dependency on pesticides and chemical fertilizers.

Background

Trivandrum is the capital city of Kerala and the demand for chemical free organic food is comparatively high. There are semi-urban areas where the land area is limited for people to cultivate and the busy lifestyle forces them to depend more on outside markets. Since there is a great demand for organic produce, there are many fake products in the market that claim to be organic but actually are not. Certification was found to be a fair solution for this. But the third party certification costs are high, making it difficult for small scale farmers to afford. Participatory Guarantee System (PGS) certification works on transparency, shared vision and trust. It is a decentralised certification system, in which people from similar situations form a farmers group, inspect and peer review the crop production practices, and take decisions on organic certification. All farmers groups organise meetings and trainings every month, which improves the social bond between people in this busy urban lifestyle.

Activities, Adoption and uptake

(How well were the practices adopted, and by how many farmers, villages, districts, etc, and what are the future prospects/plans for scaling out?)

Lead organization: **Thanal Trust**
Partners involved: **Department of Agriculture and Farmers Welfare, Agriculture Extension departments**
Location: **Trivandrum, Kerala**

General information

Total and productive surface area of the property: 10 cents (405 m2)

Legal link with the land: Land owners

Access to water for irrigation (rivers, lakes, other): Well

Number of workers (including family members): Family members (2-3 people)

Membership of community and regional organisations: PGS registered farmer groups

Link with national and district public policies: Bharathiya Prakruthi Krishi Padhathi (BPKP- Government scheme for promoting natural and organic farming)

Type of biome / natural vegetation systems: Mixed farming, terrace farming, kitchen gardening

Climate of the area (temperatures, rainfall, etc.): Variable

Pesticides of concern: Imidacloprid, Carbendazim

Key indicators: Social values and diets, livelihood, fairness, participation, market access, connectivity, resource utilisation

- In Trivandrum, 18 PGS groups (85 farmers) have been trained and are practicing the below-mentioned agroecology practices.
- Some of the farmers started their own enterprises, such as running a vegetable shop, mushroom farm, etc.
- Through organic certification, farmers find it much easier to find a marketing channel that values the health and environmental benefits provided by these organic farmers.

Agroecological practices

Annual crops and Perennial crops

- Potting mixture preparation based on the purpose, i.e. for seed germination, for vegetable pot filling, for fruit trees (explained in detail in the annex).
- Crop management of terrace and kitchen gardens, including pest repellent preparation and manure-making.

Benefits

Climate Mitigation

- Nitrogen-fixing legume crops planted as an intercrop with high-value horticultural crops provided soil cover and improved soil fertility, thereby reducing the use of chemical fertilizers and the emissions from these fertilizers.

Climate Adaptation

- Crops selected based on seasonal suitability proved more resilient in withstanding the stresses of extreme weather conditions. This in turn strengthened their resistance to pests and diseases.
- Drip irrigation and sprinkler irrigation methods helped mitigate water and heat stress, enabling effective resource utilisation.
- Usage of temporary shades like green nets for raising seedlings and photosensitive crops was found effective in maintaining humidity and temperature levels necessary for plant growth.
- A method of tying cloths around trees proved effective in protecting plants from heat stress and reduced pest outbreaks.
- Coating lime over tree trunks reduced heat stress and damage from sun scorches and other climate change-related injuries.

Biodiversity

- Planting pollinator-attractive plants as border crops increased crop yield and supported insect and plant biodiversity in the agroecosystem.
- Planting trap crops (marigold, Calotropis, maize between main crops) attracts pests towards the trap crops, thereby limiting economic damage to the main crops and avoiding harm to beneficial insects.
- Planting both border and trap crops enhanced pollination activity and provided additional food sources for natural enemies, thereby increasing overall production, supporting natural enemy activity and reducing pest populations.

Income/economics

- Thanal has a social enterprise in Trivandrum, the "Organic Bazaar,"where our PGS farmers sell their surplus produce from the kitchen garden at a premium price.
- Through the Organic Bazaar, farmers earn an additional profit, a crucial supplement to income from their regular jobs.

Health (socio-environmental health)

- Reducing dependency on the outside market for food purchases improved household food security and thus the nutrition and health status of the families.
- Spending evenings on the terrace or in the kitchen garden with family members alleviated work-related stress and enhanced mental well-being.
- Working together in home gardens reduced the screen time of children and strengthened family relations.

Gender and gender equity

- Most of our small-scale farmers are women, who gained skills and confidence by participating in the project.

Community organization

- PGS farmers work together as a group based on their locality; they also manage and issue the certifications to farmers as a group, building social cohesion and pride in their local identity.
- Monthly trainings and meetings are conducted in farmers' homes and provides an open space for them to raise their problems and share suggestions on farming practices.

Challenges

- In urban areas, it is difficult for farmers to source organic manure. Compost is the only nutrient input which they can source or produce easily by themselves.
- In order to access the market, farm products have to be aggregated, which is a major challenge in PGS. Transportation costs are high; even during the transportation we have to ensure the products are not being contaminated, which requires additional certification in PGS; transporting perishable products is difficult, etc.
- Since PGS is a peer-reviewed certification system, disputes can arise in collective decision-making processes.

Recommendations

- Public initiatives, infrastructure support and subsidies are needed to support farmers and local communities in their adoption of agroecological farming practices and in the establishment of local marketing systems that will contribute to food security, health, biodiversity conservation and reduced harm from agrochemicals. Examples include:
- Surplus produce, even though of a small quantity, must be properly stored, processed and marketed. Initiatives and infrastructure to support short value chains are needed, for example: cold rooms, pack houses, and facilities for minimal processing which can be developed via capital subsidy to farmer producer organisations.
- Governments should provide subsidies (30–50%) for rooftop farming kits (soil beds, vertical planters, drip irrigation) to support food sovereignty and help meet local food security needs without dependence on chemical inputs.
- Linkages that connect rooftop gardeners with PGS/urban farmer collectives would facilitate seed exchange and bio-input supply.

Sreelekha's Story

Surplus produce and income from PGS-certified farming

Sreelekha in her terrace garden

Smt. Sreelekha, a homemaker from Kovalam, Trivandrum, was concerned about health issues from pesticide-contaminated vegetables. With limited land, she thought of terrace farming for her household needs. Hearing about Thanal's work in agroecology and PGS certification, she approached them through a PGS farmer friend. With regular PGS training and technical support, Sreelekha started terrace farming in 2018 and became a PGS-certified organic farmer by 2020. As her production grew, she began selling the surplus produce at Thanal Organic Bazaar, a social enterprise working since 2003 in Trivandrum, supporting PGS farmers. The extra income has contributed to her family's livelihood.

Presently, Sreeleha cultivates a diverse range of crops, including varieties of chilli, brinjal (eggplant), ivy gourd, cauliflower, cabbage, amaranth, beans, bhindi (okra), and papaya. Sreelekha has achieved a self-sustaining system where she produces the majority of the vegetables needed for her household. In addition, she maintains a poultry setup comprising seven hens and two roosters. The

organic supplements include compost, coir pith, fish amino acid, farmyard manure, green manures, Jeevamrutham, and Panchagavya — all of which play a pivotal role in nourishing her crops. As the potting medium base, she uses dry leaf compost made at her home, which is lightweight and a good source of plant nutrients. For pest management, she uses biofertilizers and home remedies like neem oil, garlic emulsion, cow urine chilli extract, insect traps like thulsi traps and yellow and blue sticky traps. For controlling flower drop and fruit drop, egg amino acid spray is used.

Now Sreelekha is supplying vegetables weekly at the Organic Bazaar. With her guidance, many other farmers in the locality have also started homestead farming and have formed a PGS farmers group in which they conduct regular meetings and provide training. In addition, Thanal is facilitating its PGS farmers with regular soil testing and necessary input supply through the mobile agroclinic. Through these interactions, they are learning new agroecological practices and practical solutions for crop management while also exploring new marketing channels.

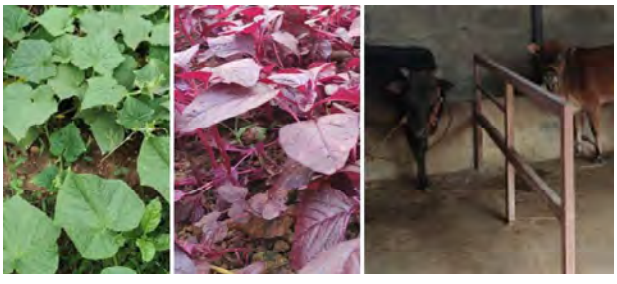
Veena's Story

A Woman's Quest for Food Security

In 2022, Mrs. Veena began integrated farming on 52 cents (0.2 ha) of her ancestral land, which had remained fallow for many years. Her first challenge was clearing the overgrown weeds, which were then incorporated back into the soil. This practice unexpectedly resulted in an excellent harvest (tomato, brinjal, chilli, amaranth, bitter gourd, yard long beans, etc.) in the first year. As a newcomer to farming, she had thought that the initial years would not be profitable, but her early productivity surprised her. However, the yield began to decline in subsequent years as the soil texture changed. She studied these changes in yield, soil color, and texture over the following years. Eventually, she realized the importance of soil mulching. She discovered that her initial success was due to the integration of organic residues, which had preserved soil texture, maintained soil temperature, improved water retention and carbon content, and thereby enhanced soil microbial activity and crop growth.

Veena adopted agroecological practices to rejuvenate her land. Meanwhile she bought indigenous cows and chickens for meeting the nutrient requirements of her crops. The major soil inputs used are compost made from leftover livestock feed, crop residues in the field, ash obtained from fuming the cattle shed in the evenings to prevent diseases in the cows, and composted poultry manure. For pest control, she uses leaf extracts of common weeds immersed in cow urine for one week; the resulting thick green liquid repels most of the vegetable pests. In addition to growing vegetables, Veena also started a small-scale value added operation for her farm produce. Milk, curd, ghee, paneer, and powdered spices are the major value-added products sold. Two permanent laborers on her farm, a husband and a wife, assist her in all the field activities. Thus Veena's farm also provides a livelihood opportunity for another family.

Veena primarily relies on word-of-mouth marketing to promote her product. She has a loyal base of regular customers who visit her to purchase her vegetables consistently. Additionally, she sells her surplus produce at nearby organic shops in Trivandrum. To ensure stable market pricing, Veena obtained PGS Organic Certification with support from Thanal Trust. However, as the demand for organic produce continues to rise, she has struggled to meet production targets. To address this, Veena adopted organic precision farming during the Rabi season with guidance from experts and consultants. This is a farming method in which precise amounts of required nutrients, water, and manures are given to plants as and when required, which ensures proper resource utilisation. She believes that precision farming is an efficient approach that helps save both time and space.



Veena's Integrated Farming approach in her 0.2 ha plot

Annex: Agroecological practices introduced to urban PGS farmers in Trivandrum via PGS Trainings

Method	Further information	Agroecology principles
Potting mixture for seed germination	• Coir pith • Coir pith+ top soil • Coir pith+ compost These are the 3 mixtures we use in Pro Tray (small containers used for raising seedlings with many compartments) as potting mixture	Recycling, land and natural resource governance
Potting mixture for vegetable garden (initial pot filling)	1 kg dried powdered cow dung for Nitrogen, organic matter, drainage; 1 kg leaf compost/dried leaves for Micro and macro nutrients; 1/2 Kg Bone meal for Calcium + Phosphorus; crushed sea shell for acidic soil reclamation for a single grow bag.	Land and natural resource governance, synergy, recycling
Decision support	Mobile agroclinics helped farmers in timely management of pests and diseases and also provided soil carbon testing.	Synergy, connectivity, fairness, participation
Jeevamrutham	An organic tonic prepared using fresh cow dung, cow urine, Jaggery, pulse powder and top soil. This enhances the soil microbial activity and thereby makes the soil bind nutrients for easy plant uptake. Soil is drenched once in 15 days. (500 ml/plant)	Input reduction, biodiversity, synergy, soil biodiversity, resource utilization
Amrithapani	Organic liquid formulation of cow dung which enhances plant immunity and soil microfauna. Applied to soil once a week and during planting	Input reduction, biodiversity, synergy, soil biodiversity, resource utilization
Egg amino acid	A formulation made up of egg and lemon water which accelerates flowering and fruit set	Synergy, resource utilisation
Fly traps	Installing yellow sticky traps for whiteflies and aphids Blue sticky traps for thrips Thulsi trap for fruit flies and bugs Banana jaggery trap for fruit flies	biodiversity
Pest repellents	Five leaf extract using different wild leaves having pest repellent properties when the pest-defender ratio exceeds 1:1 (neem, Calotropis, Vitex, Moringa spp.)	Plant health, food security, input reduction
Roguing (hand pulling) of individual wilt or virus affected plants	Removes infective material from the field and reduces risk of disease spread	Input reduction
Application of entomopathogenic fungi, nematodes and bacteria	Pseudomonas fluorescence, Trichoderma viridae, Pochonia, Beauveria bassiana, Verticillium lecanii, Paecilomyces lilacinus are biopesticides that are recommended for preventing and managing bacterial, fungal and nematode infestations in plants, as well as to control beetles, caterpillars and bugs.	Plant health, food security, pesticide reduction
Application of biofertilizers	Azospirillum, Azotobacter, Rhizobium, potassium solubilizing bacterial consortium, and phosphorus solubilizing bacterial consortium are the major biofertilizers used for improving the uptake of soil nutrients for managing nutrient deficiencies in plants.	Food security, soil health, pesticide reduction

Pesticide Action Network International (PAN International) 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.

Web: pan-international.org

Facebook: PesticideActionNetworkInternational

Thanal is a community-based environmental organization in Kerala committed to sustainable living through agroecology, waste reduction, biodiversity conservation, and climate resilience. Its initiatives empower communities and influence policies toward a just and sustainable future.

Web: thanaltrust.org

YouTube: thanal outreach

Facebook: Thanal Trust

Instagram: thanal_trust

Semi-Urban organic farming practices of Participatory Guarantee System farmers, Kerala

This case study was produced by **Thanal** in collaboration with PAN International. It is one in a series of PAN case studies showcasing the benefits and contributions of agroecology to climate resilience, food security, health and biodiversity protection. The series is produced by members of the PAN International Agroecology Workgroup. The full series is available in a number of languages via the QR code.

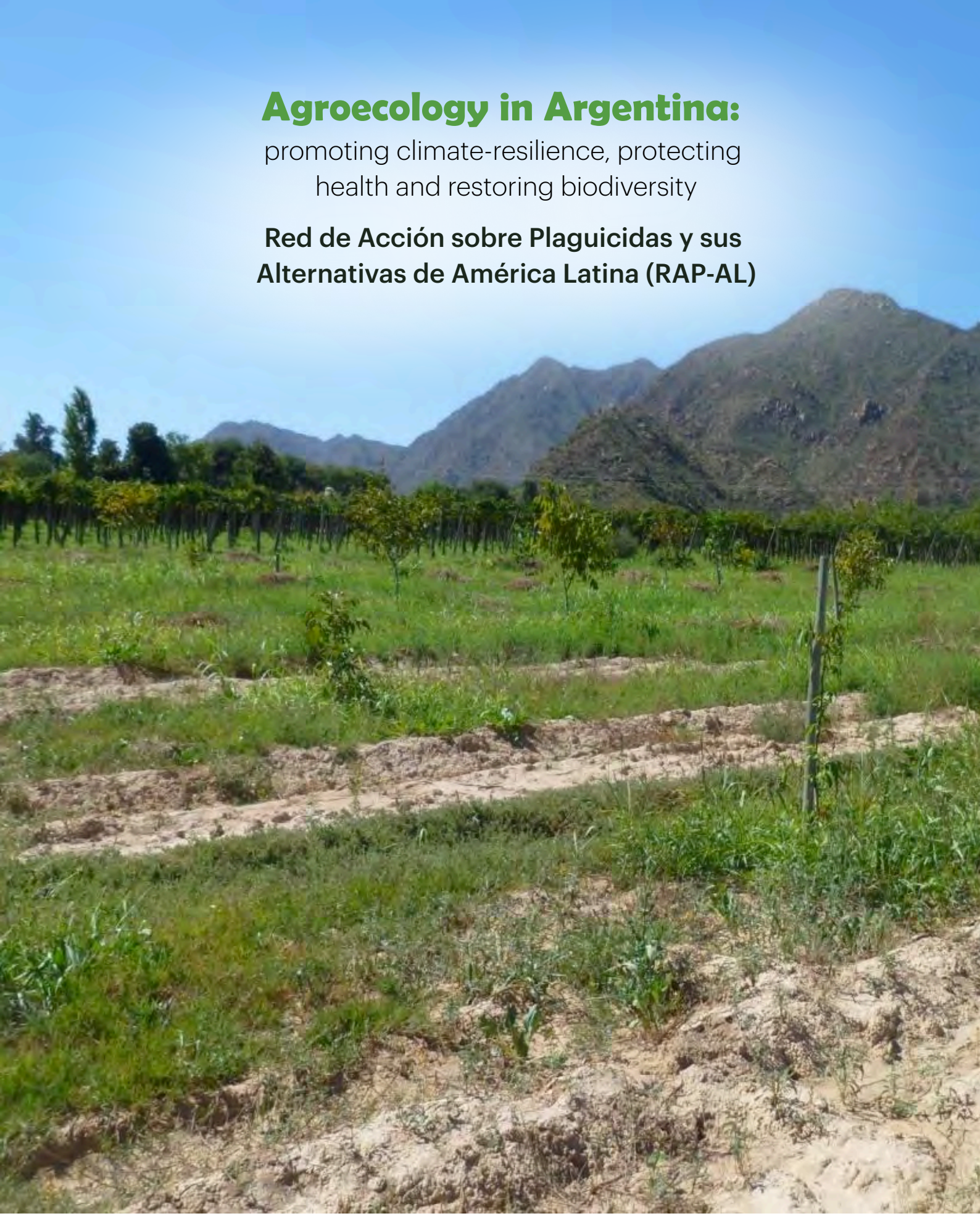
Funding to develop this case study was provided by Global Greengrants Fund

See the full series in a number of languages via the QR code

Agroecology in Argentina:

promoting climate-resilience, protecting health and restoring biodiversity

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



PAN
pesticide action network international

ALIMENTEMOS AL MUNDO SIN VENENOS
RAP-AL
RED DE ACCION EN PLAGUICIDAS Y SUS ALTERNATIVAS PARA AMERICA LATINA

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.
Web: pan-international.org
Facebook: PesticideActionNetworkInternational
BlueSky: @pesticideaction.bsky.social

Marcela Calderon, El Huerto Interior
Email: elhuertointerior7@gmail.com
Tel: 00549236 4678711
Instagram: @elhuertointerior
Facebook: El Huerto Interior

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.

Web: rap-al.org
X: @RAP_ALatina
YouTube: @redRAPChile

Javier Souza Casadinho, RAP-AL Regional Director
Center for Studies and Appropriate Technologies of Argentina
Location: Marcos Paz Provincia de Buenos Aires
Email: csouza@agro.uba.ar
Tel: 54.11.36171782

This case study was produced by **RAP-AL**, the Latin American office of PAN, in collaboration with **PAN International**. It is one in a series of PAN case studies from around the world showcasing the benefits and contributions of agroecology to climate resilience, food security, health and biodiversity protection. The series is produced by members of the PAN International Agroecology Workgroup, and is available in a number of languages via the QR code.

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.

Pablo Montilla

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.
Web: pan-international.org
Facebook: PesticideActionNetworkInternational
BlueSky: @pesticideaction.bsky.social

Pablo Montilla, La Media Luna
Email: pmontilla@agro.uba.ar
Tel: 0054 9 3825 437251

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.
Web: rap-al.org
X: @RAP_ALatina
YouTube: @redRAPChile

Javier Souza Casadinho, RAP-AL Regional Director
Center for Studies and Appropriate Technologies of Argentina
Location: Marcos Paz Provincia de Buenos Aires
Email: csouza@agro.uba.ar
Tel: 54.11.36171782

This case study was produced by **RAP-AL**, the Latin American office of PAN, in collaboration with **PAN International**. It is one in a series of PAN case studies from around the world showcasing the benefits and contributions of agroecology to climate resilience, food security, health and biodiversity protection. The series is produced by members of the PAN International Agroecology Workgroup. The full series is available in a number of languages via the QR code.

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.

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."

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.

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.

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.
Web: pan-international.org
Facebook: PesticideActionNetworkInternational
BlueSky: @pesticideaction.bsky.social

Marcela Benbassat, Huerta Grande
Email: Benbassat@agro.uba.ar
Tel: 0054 911404573
Web: huertagrandebiodinamica.com.ar

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.
Web: rap-al.org
X: @RAP_ALatina
YouTube: @redRAPChile

Javier Souza Casadinho, RAP-AL Regional Director
Center for Studies and Appropriate Technologies of Argentina
Location: Marcos Paz Provincia de Buenos Aires
Email: csouza@agro.uba.ar
Tel: 54.11.36171782

This case study was produced by **RAP-AL**, the Latin American office of PAN, in collaboration with **PAN International**. It is one in a series of PAN case studies from around the world showcasing the benefits and contributions of agroecology to climate resilience, food security, health and biodiversity protection. The series is produced by members of the PAN International Agroecology Workgroup. The full series is available in a number of languages via the QR code.

Agroecological alternatives for crop management without use of highly hazardous pesticides in Costa Rica

Regional Institute for Studies
on Toxic Substances

PAN
pesticide action network international

IRET

Agroecological Alternatives for Crop Management Without Use of Highly Hazardous Pesticides in Costa Rica

Summary

The "Los Sukias" farm, located in Bebedero, Cañas, Guanacaste, has established itself as a benchmark for large-scale organic agricultural production. With clay and sandy loam soils and access to flood irrigation from the Bebedero River, it primarily grows rice (*Oryza sativa L.*) and sugarcane (*Saccharum officinarum L.*). Since 2012, it has transitioned from a conventional model to a regenerative system, completely eliminating the use of agrochemicals and adopting certified agroecological practices under the "EcoArroz" brand. Minimum tillage, crop rotation, mulch, bioinputs, and integrated pest management are pillars of the production model, which improves soil quality and strengthens biodiversity.

The benefits of this type of production system are tangible: yields close to eight tons per hectare, reduced production costs compared to conventional agriculture, and higher prices due to its value as an organic product. This has positioned Los Sukias in differentiated markets. Beyond productivity, the model also provides environmental and social benefits: carbon capture, emissions reduction, water retention, and flora and fauna conservation, among others. The Los Sukias experience demonstrates the viability of producing food sustainably, profitably, and ethically, constituting a replicable model that positions agroecology as a climate solution, a real alternative for agricultural production in Costa Rica and a source of inspiration nationwide.

Farm owner: Andrés Vázquez Ulate

Location: The farm is located in the Bebedero district, Cañas canton, Guanacaste province, Costa Rica, at an altitude of 15 to 20 meters above sea level. It is a seasonally wet and dry area, with a rainy season from May to November and a dry season from December to April, but with access to irrigation water.

Productive area of the property: The farm currently has 216 hectares of agricultural area, of which approximately 84 hectares are cultivated with certified organic rice, 5 hectares of organic sweet potatoes, and another 127 hectares are leased to produce organic sugarcane. The remainder is forested, buffer zones, roads, and houses. The sugarcane area is currently managed by Ingenio El Viejo, as the milling process must be separate from the conventional process. El Viejo also has more than 2,400 hectares of certified organic sugarcane. Rice has been grown on leased plots for more than 25 years, 47 hectares on land leased from Aquacorporación and 37 hectares in Paso Lajas, all certified organic.

Background

The farm currently has 216 hectares of agricultural area, of which approximately 84 hectares are cultivated with certified organic rice, 5 hectares of organic sweet potatoes, and another 127 hectares are leased to produce organic sugarcane. The remainder is forested, buffer zones, roads, and houses. The sugarcane area is currently managed by Ingenio El Viejo, as the milling process must be separate from the conventional process. El Viejo also has more than 2,400 hectares of certified organic sugarcane. Rice has been grown on leased plots for more than 25 years, 47 hectares on land leased from Aquacorporación and 37 hectares in Paso Lajas, all certified organic.

1

Aerial view of Los Sukias farm.

Photo credits: Andrés Vasquez

Background (cont.)

In the Bebedero region of Cañas, Guanacaste, on the plains of the Bebedero River, the Los Sukias farm developed a conventional agricultural production model for years, primarily focused on intensive rice planting since 1983. In 1999, the farm covered 163 hectares and was dedicated to the cultivation of sugarcane, rice, and livestock. One of the main problems facing rice cultivation at that time was, among many others, the control of weedy rice. In response to this and other problems, and within the framework of a research project documented by the Costa Rica Institute of Technology (TEC, by its acronym in Spanish), an integrated management system was implemented that combined various chemical, physical, mechanical, and cultural strategies from 1999 to 2006. The results were significant: the contaminated rice seed bank was reduced, and crop yield increased from 4.6 tons per hectare in 1999 to more than 7 tons per hectare in 2006. However, over time, the farm's production vision evolved.

Around 2012, Los Sukias decided to make a significant shift toward a more sustainable and environmentally friendly model. It was then that they began replacing or significantly reducing the use of synthetic insecticides and fungicides, instead incorporating biological products, as well as inoculating fungi and bacteria or biocontrol agents. This paradigm shift was key to positioning their rice as "EcoRice." This transformation process not only involved a technical change in agricultural practices but also a conceptual evolution in farm management, incorporating principles of agroecology and integrated management that now constitute the core of its production model. The Los Sukias farm represents an example of sustainable agricultural management. The implementation of agroecological practices has led to improvements in productivity and sustainability. This approach constitutes a viable alternative for rice-producing areas in Costa Rica and provides solid evidence of the effectiveness of integrated management in pesticide-free production contexts, strengthening Los Sukias's position in agricultural innovation.

Physical & Social Characteristics of the Farm

Crops: The farm is primarily dedicated to the organic production of sugarcane and rice, integrating different techniques that allow for large-scale production while reducing environmental impact and the use of chemical inputs. Lettuce, chili, basil, sweet potatoes, and tomatoes are also grown on a small scale.
Legal relationship to the land: Owner, with right to use for food production, service providers are also subcontracted. The farm has no donors.
Number of workers: Approximately eight workers
Soil type: The majority of the farm's soil is clay soil, with access to flood irrigation; another portion is sandy loam and well-drained.
Access to irrigation water (rivers, lakes, others): The farm's water source comes largely from the Bebedero River and the irrigation canals of the National Irrigation and Drainage Service (SENARA, by its acronym in Spanish).
Biome: In Guanacaste, the original biome is the tropical dry forest, composed of predominantly vertisol soils. It features deciduous trees adapted to long periods of drought. Much of the ecosystem has been replaced by intensive agricultural systems, predominantly pastures for livestock and crops such as rice, sugarcane, melon, among others.
Climate of the area (temperatures, precipitation, etc.): The area has maximum temperatures of 32.96°C, minimum temperatures of 23.75°C, and an average of 28.35°C, located in latitude 10 39109 and longitude 085 18060; with an average annual rainfall of 1691 mm.

Crotalaria is a cover crop that improves soil fertility, structure, physical, chemical and biological properties, and it is a weed control crop.

Agroecological practices

The Los Sukias farm employs a regenerative production model based on soil conservation and the use of bio-inputs. Practices include minimum tillage, incorporation of crop residues, planting cover crops such as *Mucuna* sp. and *Crotalaria* sp., and water management through temporary flooding to control weeds and pests. These techniques improve soil structure, promote biodiversity, encourage microbial activity, and reduce the use of agrochemicals. In addition, rice is established by mechanical transplanting with pre-germinated seeds to achieve rapid crop closure and less competition with weeds.

The system's management is complemented by the internal production of biofertilizers (such as worm tea, bone meal, and enriched compost), biodigesters that generate liquid fertilizer and biogas, and biological and manual pest control practices. The wild species and animals present on the farm fulfill ecological functions, providing natural fertilization, insect control, and pollinator attraction. This approach makes it possible to maintain competitive yields at low costs, improve the health of the agroecosystem, and consolidate a sustainable and self-sufficient agricultural system, reducing the need for chemical inputs and strengthening the crop's resilience to biotic and abiotic factors.

Diversified cropping system

System diversification combines the use of cover crops, wild plants, living barriers, or intercropping to improve soil health by increasing organic matter input, promoting biological nitrogen fixation, and stimulating microbial activity. Furthermore, by maintaining a greater variety of plants, habitats are created for pollinators and beneficial organisms that contribute to the ecological balance of the agroecosystem. In this way, the functional diversity of the system helps to naturally regulate pest and disease populations.

The system includes rice planting between November and December (waiting for the months of greatest sunlight) by mechanical transplanting, using pre-germinated seed at a high density (150 kg/ha), which promotes rapid crop closure and reduces weed competition. Harvesting takes place between March and April, months of the dry season that allow for less crop damage. After harvest, the fields are managed with mulches such as crushed dry rice tissue. The rice plants resprout and remain in the field for three months for a second harvest. Later, in August or September, *Crotalaria* sp. (or *Mucuna* sp.) is sown in the soil at a density of 20 kg/ha of seeds as a living mulch/cover crop that fixes 120 kg/ha of nitrogen. After 3 months, the cover crop is incorporated into the soil to provide organic matter. The edges of the crop, irrigation canals, and surrounding areas are maintained with vegetation of wild plants throughout the rice growing cycle.

Adoption & Assimilation

Agroecological methods have been consistently implemented, making the farm a national benchmark for responsible production. For his contributions to the agricultural sector, Vásquez received the Medal of Agricultural Merit in 2016. In areas of Guanacaste, local media such as "Guanacaste a la Altura" have highlighted his commitment and leadership to sustainable farming, helping to spread regenerative practices in the region.

Benefits

Climate Change Mitigation

- The regenerative organic system avoids the intensive use of synthetic fertilizers and pesticides, reducing the carbon footprint associated with the production and distribution of agrochemicals and other fossil-fuel intensive methods of agricultural production.
- Living barriers, walls, and vegetated slopes, as well as permanent mulch with species such as *Mucuna* sp. and *Crotalaria* sp., contribute to soil carbon sequestration. Based on the farm's experience, a recovery of organic matter and fertility is observed, which increases the capacity to retain carbon.

Climate Adaptation

- Vegetation cover management and crop rotation improve soil structure, providing water retention capacity during dry periods or heavy rainfall.
- Trees as living fences reduce wind speeds, water runoff, and extreme temperatures.

Biodiversity

- Conservation of wild plants on edges and borders, the use of living barriers, and cover crops promote the presence of pollinators and beneficial insects (ladybugs, dragonflies, spiders, centipedes, millipedes, etc.)
- Biodiversity within the system creates refuge and food spaces for animals such as birds, toads, frogs, and visits from coyotes

Economics

Rice production costs range between US$2,350 and US$2,550/ha, and a sack of rice sells for around US$60 because it is organic. In contrast, conventional rice production costs between US$11,765 and US$13,725/ha (five times higher), and the selling price is US$28.40 (half the price of organic rice). Some production costs for organic rice farming are listed in Table 1.

Table 1. Costs indicated by the farmer in the management of organic rice.

Item	Costs in US dollar/ ha
Leachate	$ 0.20
Bamboosine and melaza	$ 1.18
Bone bio-ferment	$ 1.37
Worm tea-type bioferment	$ 2.60
Manual weed control	$ 68.63
Ash-enriched compost (production)	$ 176.47
Ash-enriched compost (production) in batches with Mucuna sp.	$ 47.06

It should be noted that ash-enriched compost has an approximate production cost of US$1.20 per 45-kilogram bag. In productive management, approximately 150 bags are applied per hectare, for a total cost of US$470.60 (considering both production and application). Comparatively, in conventional systems, the main source of nitrogen is urea, which requires 16 bags per hectare, reaching an approximate cost of US$588, which represents a 20% increase. As mentioned, in regenerative plots with Mucuna sp., only 40 bags/ha are applied. The rice produced by Andrés has been managed through local cooperative/industrial chains, and there is institutional interest from the Ministry of Economy, Industry, and Commerce (MEIC, by its acronym in Spanish) and the Ministry of Agriculture and Livestock (MAG, by its acronym in Spanish), in conjunction with the Development Banking System (SBD, by its acronym in Spanish), to promote this type of production.

Benefits (cont.)

Economics (continued)

In Costa Rica, the chemical inputs used in conventional rice production vary in price and application rates. Herbicides include 25% quinclorac, applied at a rate of 1.4 L/ha, and 50% pendimethalin, used at 3 L/ha. Insecticides include 60% diazinon at a rate of 1.6 kg/ha, while 25% cypermethrin at 0.2 L/ha. Fungicides include 50% carbendazine at 0.6 L/ha and 43.5% mancozeb at 4 L/ha, among others. In total, pesticides, synthetic chemicals and other components represent an elevated cost (US$11,765 and US$13,725, mentioned above) in conventional rice cultivation systems. According to a CONARROZ report for the 2022-2023 period, Costa Rica's rice production systems (mostly conventional) achieved average yields of approximately 4.24 tons per hectare, a figure far from the 7 to 8 tons yield achieved by Vázquez.

Socio-environmental health

- Workers, consumers, and families are not exposed to toxic molecules thanks to organic and sustainable production (reducing the risk of poisoning).
- The total elimination of synthetic pesticides prevents the contamination of irrigation canals and water sources, benefiting both aquatic fauna and surrounding communities, wetlands of Ramsar importance, and national parks.
- High production of organic rice, one of society's most consumed crops historically and globally.
- Organic agriculture represents a more sustainable model that protects the environment and prevents long-term damage associated with the use of agrochemicals.

Gender & Gender Equality

The family participates in rice and sugarcane production; the wife is responsible for general management and part of the laboratory for the production of *Trichoderma* spp. (beneficial fungus that reduces disease in plants) and other biological control agents.

Community Organization

The experience of the Los Sukias farm has served as a demonstration space for neighboring producers, students, and professionals, promoting the exchange of knowledge. They receive frequent visits from students from agricultural colleges and universities, producer groups, professional associations, and those interested in agroecology.

Achievements

Andrés Vásquez's work has been officially recognized with the 2016 National Medal of Agricultural Merit, awarded by the Ministry of Agriculture and Livestock and the Presidency of the Republic of Costa Rica. This award recognized his career, innovation, and commitment to sustainable production, especially in reducing the use of agrochemicals.

The practices implemented on the farm have generated concrete results, including yield increases and a strong positioning of the product in markets that value safety and sustainability, as reflected in its acceptance by Coope Liberia under the Sabanero brand.

Vásquez has taken an active role in international education and the transfer of agroecological knowledge, participating in conferences and training sessions in countries such as Colombia and Venezuela, sharing his experiences and promoting the adoption of sustainable agricultural practices.

Lessons learned

- Experience shows that agroecological systems are not exclusive to small gardens or experimental plots. On large farms, such as Los Sukias, it is evident that it is feasible to maintain competitive yields without the need for pesticides.
- Many producers in Costa Rica still perceive conventional agriculture as the only profitable way to produce. This cultural and commercial bias makes it difficult to adopt sustainable ecological models.
- It is possible to produce food profitably without compromising the health of the soil, water, biodiversity, and people.
- The agroecological transition requires experimentation, and not all producers are comfortable taking on the uncertainty of changing a system they have managed for years regardless of its sustainability

Recommendations

Learning & Collaboration

- Explore organic production through experimentation with demonstration plots, where each producer can observe real results under local conditions.
- Establish horizontal learning and exchange networks between farmers who already apply organic practices and those beginning their transition.

Policies

- Join forces between institutions, organizations, and farmers, creating permanent spaces for dialogue and knowledge transfer, to encourage the adoption of sustainable agricultural practices.
- Promote environmental education from school to university, strengthening social awareness about sustainable food.
- Establish an inter-ministerial approach that articulates coordination between the Ministry of Health, the Ministry of Agriculture and Livestock (MAG, by its acronym in Spanish), the Ministry of Environment and Energy (MINAE, by its acronym in Spanish), National Groundwater, Irrigation and Drainage Service (SENARA, by its acronym in Spanish) and the Ministry of Public Education (MEP, by its acronym in Spanish) of Costa Rica, with the aim of designing and implementing actions focused on climate change mitigation, resilience, and adaptation.

Environmental

- Promote ecological restoration in degraded areas with native species for ecological succession and agroforestry/silviculture.
- Promote circular production by leveraging agricultural and organic waste to generate energy and fertilizers, as well as the integration of animals for a more diverse and dynamic system.

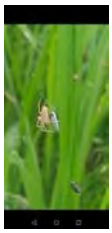
Ethics & Morality

- Promote a holistic view of ecology, where humans are caretakers, not exploiters, of natural resources.
- Promote a pro-life production model, where production is not measured solely by economic returns, but by the ability to regenerate soils, nourish communities, and coexist with the environment.

Appendix 1: Agroecological practices implemented at the Sukias farm

Practice	General information	Agroecology principles
Soil tillage method	Minimum tillage with incorporation of rice straw; wetting and passing a surface harrow (3–5 cm) to diminish erosion and improve soil health.	Soil health, nutrient recycling, soil erosion reduction.
Soil conservation	Use of *Mucuna* sp. as green manure and natural control of weeds. Soil flooding for 1–2 months to induce anoxia and eliminate pest larvae (*Phyllophaga* spp.). Presence of birds that contribute 15–30 t/ha of manure. Use of *Crotalaria* sp. to fix nitrogen and biologically restore the soil. Vegetation in canals, field edges, living barriers, etc.	Synergy, system diversification, nutrient recycling, improvement of the soil's physical, chemical, and biological properties
Types of biofertilizers	Production of 5,000 L/month of bio-ferments. Production of worm tea, bone meal bio-ferment, compost with ash, and fishmeal. Dosage: 25–30 kg/ha (worm tea), 5 L/ha (bone meal). Compost provides 25–50 kg N/ha; use reduced to 40 bags/ha in regenerative areas. Biodigester that produces 40–60 L/day of liquid fertilizer and 4–5 hours of biogas. The rice fields are inoculated with *Azolla*, a plant formed by the symbiotic interaction between a fern and the alga *Anabaena azollae,* which fixes atmospheric nitrogen.	Soil structure improvement, biodiversity conservation, soil microbiology
Origin and sowing of seeds/seedlings/plants	FLAR varieties (select seeds). Mechanical sowing with pre-germinated seed (150 kg/ha). Harvest March–April. Covering with *Crotalaria* sp. or *Mucuna* sp. (20 kg/ha) that fixes 120 kg N/ha.	Biomass recycling, reduced soil erosion, fertility, diversification
Pest and Disease Management Practices	Manual and mechanical weed control (*Echinochloa* spp., *Aeschynomene* spp.). Use of bioferments and pyroligneous acid for pest and disease management. Light traps with soapy water for lepidopteran and coleopteran pests. Shelter for beneficial insects (ladybugs, dragonflies, spiders). Natural control of *Phyllophaga* spp. by centipedes and millipedes. Birds, frogs, and toads contribute to control.	Biological pest control, increased functional biodiversity, reduced chemical inputs, and increased resilience of the production system
Use of wild plants	Living barriers with trees, palms and spontaneous vegetation (*Tridax procumbens, Euphorbia prostrata*, cucurbits) for biological control and attraction of pollinators.	Diversity, ecosystem services, habitat conservation, attraction of beneficial organisms and pollinators
Animals	The farm has its own chickens, and is also visited by various wild species, such as herons, ducks, and coyotes, which come from the surrounding natural ecosystem.	Ecological balance, animal-plant interaction, nutrient recycling

Appendix 2: Components in Las Suskias agroecological production system
Photo credit: Andrés Vázquez

Component	Contribution in an agroecological cropping system.	Photograph
Wild flowers	They promote biodiversity by attracting pollinators and natural enemies of pests, contributing to the ecological balance of the system.	
Dragon flies	They act as natural predators of insect pests, especially small insects of the order Diptera, contributing to biological control in rice crops.	
Ladybugs	They are effective biological controllers, as they feed on aphids, mites, and other phytophagous insects that consume rice crops.	
Spiders	They contribute to biological pest control by capturing a wide variety of insects (lepidoptera, coleoptera, diptera, etc.) at all stages of the crop.	 
Frogs	They regulate insect and other invertebrate populations, in addition to being an indicator of environmental quality and low chemical pollution.	
Birds	Consuming weed seeds, insects, snails and other organisms considered pests such as small rodents that consume rice grains.	
Organic rice with living fences and trees in the boundaries	They provide shade, reduce wind erosion, enhance biodiversity, and provide shelter and food for birds and beneficial insects. They also contribute to carbon sequestration and microclimate regulation.	

Component	Contribution in an agroecological cropping system.	Photograph
Organic fertilizer spraying	It improves soil structure and fertility, increases moisture retention and promotes microbial activity.	
Biodigestor	It allows the use of organic resources to generate biogas and biofertilizer, reducing costs and polluting emissions.	
Mucuna sp. controlling weeds	It acts as a cover crop, green manure, and nitrogen fixer, improving soil fertility, structure, and physical, chemical, and biological properties, as well as controlling weeds through mulching.	
Crotalaria sp. as a cover crop	Like *Mucuna* sp., it is a cover crop that improves soil fertility, structure, physical, chemical and biological properties and it is a weed control crop.	
Training: visit of the Costa Rican Association for the Study of Weeds (ACEM, by its acronym in Spanish).	The farm is open to students, teachers, and educational institutions, offering field experiences that allow them to directly observe and understand the benefits of agroecological systems, from ecological soil management to biological pest control and the conservation of associated ecosystems.	
Edges with different types of weeds	They increase plant and wildlife diversity, strengthen food webs, and enhance the system's resilience to pests or disturbances.	
Channel edges protected with living covers.	They prevent irrigation canal erosion, improve water infiltration and quality, and act as biological corridors that facilitate the movement of beneficial wildlife.	

Key Resources

Alvarado, J. 2015. Soils of Costa Rica, Vertisol order. INTA-CR.
https://www.mag.go.cr/bibliotecavirtual/av-1823.pdf

Delgado, G. 2025. CoopeLiberia R.L. is an example of diversification and business development. Panorama.
https://www.panoramadigital.co.cr/coopeliberia-r-l-es-un-ejemplo-de-diversificacion-y-desarrollo-empresarial/

Estrada, R. 2023. Agricultural companies seeking organic alternatives. Revista Milenium.
https://www.revistamilenium.com/empresas-agropecuarias-se-apoyan-en-el-ina-en-busca-de-alternativas-organicas/

Gonzalez, E. 2016. MEIC and MAG promote the cultivation of ECO Rice. El Mundo.
https://elmundo.cr/costa-rica/meic-y-mag-fomentan-el-cultivo-de-ecoarroz/

Murcia, L. 2022. Costa Rica, a regional pioneer in organic agriculture, still has many pending issues. Teletica.
https://www.teletica.com/nacional/costa-rica-pionero-regional-en-la-agricultura-organica-tiene-todavia-muchos-pendientes_307007

Rodriguez, C. 2020. Camilo Rodríguez publications Facebook page. Facebook.
https://www.facebook.com/escritorcamilorodriguez/posts/andr%C3%A9s-v%C3%A1squez-ulate-productor-de-arroznosotros-estamos-ense%C3%B1ando muchaspr%C3%A1ctic/3334872446629782/

Servicio Fitosanitario del Estado (SFE). 2025. Online consultation. Insumosys.
https://app.sfe.go.cr/SFEInsumos/aspx/Seguridad/Home.aspx

Vargas, A. 2023. Annual Statistical Report 2022-2023, Statistical Control of Rice. CONARROZ.
https://conarroz.com/userfile/file/Operaciones/Informeanualestad%C3%ADstico22-23.pdf

Vásquez, A. 2007. Implementation of an integrated management system for the control of contaminating rice (Oryza sativa) in commercial rice plantations, on the Los Sukias cattle farm, Cañas, Guanacaste. [Bachelor's thesis]. Costa Rica Institute of Technology.
https://repositoriotec.tec.ac.cr/handle/2238/2811?locale-attribute=en%20Document

Vázquez, A. 2025. Andrés Vásquez Ulate publications Facebook page. Facebook.
https://www.facebook.com/andres.vasquezulate

Vega, F. 2016. National Medal for Agricultural Merit 2016. Revista Arrocera.
https://conarroz.com/images/revista/Revista21.pdf

Villalobos, W. 2017. Senara's new project promises more water for agriculture but leaves its proper use in the hands of producers. La Voz de Guanacaste.
https://vozdeguanacaste.com/nuevo-proyecto-de-senara-promete-mas-agua-para-agricultura-pero-deja-buen-uso-en-manos-de-productores/

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.
Web: pan-international.org
Facebook: PesticideActionNetworkInternational
BlueSky: @pesticideaction.bsky.social

Andrés Vásquez Ulate, Los Sukias Farm
Tel: +506 88553493

Instituto Regional de Estudios en Sustancias Tóxicas (IRET)
IRET (Regional Institute for Studies on Toxic Substances) is an institute concerned about the impact of toxic substances on agricultural systems, the environment, and human health that conducts research and promotes agroecological alternatives for sustainable production.

Fernando Ramírez M.
Location: Heredia, Costa Rica
Email: iret@.ac.cr
Tel: +(506) 2277-3584
Web: iret.una.ac.cr
Facebook: Iret Una Costa Rica

This case study was produced by **IRET** in collaboration with **PAN International**. It is one in a series of PAN case studies from around the world showcasing the benefits and contributions of agroecology to climate resilience, food security, health and biodiversity protection. The series is produced by members of the PAN International Agroecology Workgroup. The full series is available in a number of languages via the QR code.

Funding to develop this case study was provided by Global Greengrants Fund.

Agroecología en Argentina:

promoción de la resiliencia climática, protección de la salud y restauración de la biodiversidad

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

PAN
pesticide action network international

ALIMENTEMOS AL MUNDO SIN VENENOS
RAP-AL
RED DE ACCION EN PLAGUICIDAS Y SUS ALTERNATIVAS PARA AMERICA LATINA

Un sistema agroecológico de trigo-pastizales-ganado gestionado de manera integral

la transición de la familia Calderón de la agricultura convencional a la agroecología en la provincia de Buenos Aires

Resumen

La unidad productiva "El Paraíso" se encuentra ubicada en las cercanías de Baigorrita, Partido de General Viamonte, Provincia de Buenos Aires, Argentina. Es un sistema productivo agrícola de 200 hectáreas - ganadero bajo administración de una familia - donde se cultiva trigo asociado a leguminosas, al cual luego de la cosecha se le muele y logra harina integral agroecológica, agregando valor; también se cultivan pasturas de varias especies, las que son aprovechadas por la ganadería ovina y bovina bajo un manejo holístico. No utilizan ningún agroquímico (fertilizantes ni plaguicidas) de síntesis y en 90 hectáreas el manejo es agroecológico y las 109 hectáreas restantes son arrendadas a otros productores.

Características de la unidad productiva

La familia Calderón es propietaria de la tierra y emplea a cinco trabajadores, tres de los cuales son miembros de la familia. La superficie de la unidad productiva es de 200 hectáreas: en las 90 hectáreas el manejo es agroecológico y las 109 hectáreas restantes son arrendadas a otros productores. La extracción de agua es por pozo (de las napas freáticas de agua subsuperficiales).

El sistema agrícola que se presenta en la unidad productiva integra:

- Producción de trigo para consumo humano, destino la molienda para la obtención de harina integral agroecológica.
- Producción de pasturas con diversidad de especies asociadas, que alimentan a los animales bajo el modelo de Pastoreo Holístico, promoviendo a su vez la fertilidad y biodiversidad de insectos, bacterias y hongos del suelo.
- Cría y engorde de ovinos y bovinos bajo el modelo de pastoreo regenerativo y de manera armónica con el entorno.
- Confección de rollos de pastos ya sembrados en años anteriores para generar reserva de pasto con destino a la alimentación animal.

Créditos de las fotos: Mariana Cecilia Moya

Unidad productiva: El Paraíso
Productores: familia Calderón (Marcos, Patricia, Marcela, Ana María y Ana Clara)
Ubicación: Baigorrita, Partido de General Viamonte, Buenos Aires

Pertenencia a organizaciones comunitarias y regionales

La familia Calderón participa en un grupo de agricultores llamado "Semillas de Alcaraz" que anteriormente pertenecía al Programa de Cambio Rural del Instituto Nacional de Tecnología Agropecuaria. La familia Calderón también integra la Mesa Ovina de productores de General Viamonte.

Vínculo con las políticas públicas nacionales y de Distrito

De acuerdo a la Provincia de Buenos Aires, el predio fue calificado como agroecológico. Recibieron una donación gratuita de frutales y subsidios por parte del ministerio de asuntos agrarios de la provincia de Buenos Aires. Recibieron créditos reembolsables (a tasa mas bajas y con plazos más largos que los productores convencionales) de parte del ministerio de agricultura de la nación.

Tipo de bioma y sistemas de vegetación dominantes

Los alrededores se caracterizan por la existencia de praderas templadas compuestas por suelos fértiles, con una gran transformación por la actividad agropecuaria. Gran parte de la vegetación original ha sido reemplazada por cultivos y pasturas, el sistema de vegetación dominante originalmente incluía: pastizales pampeanos, hierbas perennes y algunas anuales.

La vegetación en las zonas con pendientes bajas tiene una baja densidad de árboles nativos, debido a los procesos de deforestación que comenzaron en el siglo XIX.

Hoy se presenta un paisaje agropecuario donde predomina el cultivo de una baja cantidad de especies (la soja, maíz, trigo, girasol), ausencia de rotaciones y alta demanda de insumos sintéticos de origen externo como.

Boceto del establecimiento El Paraíso

La actividad dentro de la unidad productiva de la familia Calderón se caracteriza por la existencia de Pasturas implantadas: alfalfa, festuca, tréboles. También hay zonas de monte implantado (eucaliptos, álamos, sauces) en los márgenes de los campos o cercos. Plantas silvestres naturalizadas (como sorgo de halepo, cardos, etc.) son frecuentes en los bordes de los caminos y zonas no cultivadas. Además realizan el cultivo de especies anuales como el trigo y el maíz.

Tipo de suelo

Los suelos son los característicos de la región pampeana de la zona franco arenosa, con presencia hacia el oeste de médanos. Taxonómicamente la mayoría de sus suelos son del tipo Hapludol entico.

Clima de la zona

Presenta un clima templado, con veranos cálidos y húmedos, e inviernos frescos y secos. La precipitación anual promedio es de alrededor de 900 / 1000 mm., aunque los últimos 4 años fueron secos 600/700 mm. Los vientos predominantes son del oeste y del suroeste. La humedad relativa oscila entre el 70 y 80%, lo que contribuye a generar un clima húmedo en verano.

Preocupaciones sanitarias y medioambientales relacionadas con el uso de plaguicidas

Los plaguicidas atrazina, 2,4-D, glifosato, clorpirifós, cipermetrina, son los que más se están usando. Los efectos y daños son varios como la aparición de residuos en los suelos, en las aguas, en los alimentos. Existen efectos por arrastre de las partículas de plaguicidas por el viento (deriva) e impacto en la flora, fauna e insectos polinizadores. En muchos casos existe una sobreutilización de estos plaguicidas detectándose efectos en la salud humana (cánceres, alteraciones en la respiración, nacimientos de niños con anomalías) lo cual ha determinado la reacción de la comunidad en la búsqueda de generar un marco de limitación en la aplicación de plaguicidas mediante la sanción de ordenanzas municipales.

Prácticas y enfoques agroecológicos

Al iniciar la transición a la agroecología, la familia Calderón comenzó a enriquecerse con información y conocimientos: primero de forma autodidacta, luego junto a otros productores, que ya habían empezado la transición agroecológica, fueron asesorados por técnicos e investigadores, realizando intercambios, recibiendo visitas, para saber qué estrategias implementar o aplicar para recuperar la diversidad de la vida en el suelo.

Regeneración del suelo

En el sistema agrícola, el primer subsistema es el del suelo, porque la prioridad es regenerar la microbiología, la vida en el suelo, protegiéndolo de la erosión con residuos en superficie e incorporando materia orgánica y minerales, que van a ser los generadores de los nutrientes necesarios para el subsistema de plantas y el subsistema de ganadería, que en el caso de la unidad productiva, son ovinos y bovinos. Con el proceso de quemar restos de huesos, cueros, etc., se obtiene calcio que lo aprovechan las aves.

Diversificación de cultivos y cría de animales

Respecto a las asociaciones y rotaciones de cultivos, estas posibilitan generar diversidad en el espacio y el tiempo, además tanto el maíz, el sorgo, la soja y el trigo son especies que brindan resiliencia (capacidad de respuesta frente a cambios climáticos, ecológicos y comerciales) que brindan las prácticas agroecológicas. La cría de ovinos y bovinos posibilita el abonado directo de los suelos que junto a los residuos de cosecha mejoran las características químicas, físicas y biológicas de los mismos.

Sistemas de cultivo

Para el subsistema de cultivos, las labores y la siembra las realizan con maquinaria propia, para lo cual se requiere incorporar combustibles de origen externo. En algunas situaciones, según las necesidades, se contratan intermediarios que poseen maquinaria agrícola para las labores de siembra y cosecha.

El subsistema de cultivos está integrado por las pasturas perennes y cultivos anuales. Las pasturas perennes son de las familias botánicas de gramíneas y leguminosas, las variedades fueron elegidas por su funcionalidad (Trébol Rojo, Trébol Blanco, Lotus Corniculatus, Alfalfa, Raigrás, Pasto Ovillo, Triticale, Centeno, Achicoria, Rúcula). Es de suma importancia mantener el suelo cubierto con plantas, que capturen y almacenen la Energía del Sol, el agua de la lluvia, el nitrógeno del aire a partir de la simbiosis con bacterias y Erika Lundahl carbono mediante la fotosíntesis. Todo a su vez sustenta vida en el suelo. Así, la recuperación es máxima y se activan los procesos ecosistémicos que bien manejados generan un círculo virtuoso logrando mejores producciones de carne con menores costos, regeneración del suelo sin químicos de síntesis, un balance positivo en la huella del carbono, y un mayor trabajo familiar con arraigo en los ámbitos rurales. Hoy, el total de las semillas que poseen son de origen externo. El costo de inversión inicial es alto, con una recuperación prorrateada en los quatros años aproximadamente.

Como cultivos anuales se siembran trigo y centeno asociados a las pasturas, cuando se hallan maduros se procede a la cosecha, se muele en un Molino Artesanal a piedra y se obtiene la Harina Integral Agroecológica, que es como egresa del sistema productivo. Según el año, en la medida que se pueda se deja de reserva un porcentaje para semillas. A la pastura a su debido tiempo se le deja pastorear, como alimento, a los ovinos y bovinos. En la campaña 2025/26 se van a realizar 30 hectáreas.

- *Maíz:* se incorporan semillas de una variedad típica de la zona, es decir que no es un híbrido ni se halla modificada genéticamente. Esto permite a la familia conservar la semilla y hacer una harina de maíz (polenta) más saludable. De esta manera egresa del sistema con mayor valor agregado. El rastrojo (residuos de la cosecha) es aprovechado por los ovinos y bovinos.
- *Sorgo:* se utiliza para pastoreo (alimento de los animales) y con el doble propósito de cosechar granos. El rastrojo (residuos de cosecha) y los granos obtenidos los aprovechan los ovinos, también es posible guardar la semilla para un próximo ciclo. Los residuos de cosecha, junto al estiércol de los animales, constituyen un excelente abono para los suelos.
- Soja: se utiliza en la rotación de cultivos a fin de posibilitar la fijación de nitrógeno atmosférico gracias a las bacterias simbióticas, además para incrementar los ingresos monetarios. Se comercializa como grano en una cerealera local.

Cultivo agroecológico del trigo

Sistemas ganaderos integrados

Los ovinos se manejan con un método llamado Pastoreo Racional Intensivo (efecto manada), y tienen una carga de 10 animales por hectárea, con el objetivo de obtener carne de tipo natural (animales alimentados a campo de manera natural). Las hembras se reservan para recría (obtener corderos). A los 4/5 meses de nacimiento se venden corderos sanos que con lo único que se alimentaron es con la leche de la madre y comieron pasto de manera directa en el campo. A los animales se los desparasitan tanto para los parásitos internos como externos con tierra de diatomea, y se usan otros productos sanitarios cuando es necesario (antiparasitarios inyectables).

Durante julio de 2024 se incorporó la ganadería BOVINA mediante un acuerdo de capitalización con otros productores inversionistas, integrando 37 vacas a la unidad productiva, de las cuales hoy se alimentan 35 vacas madres con sus 35 terneros que poseen aproximadamente 200 kg. Esta incorporación responde a una estrategia de acelerar los procesos de regeneración del suelo mediante el *Pastoreo Holístico*.

El sistema constituido por animales también cuenta con un subsistema animal integrado por *aves*: gallinas, pavos para autoconsumo y los gansos y gallinetas como alarmas naturales.

De ser necesario se adquieren / compran antiparasitarios inyectables o bebibles, curabichera.

Sales minerales naturales: Tierra de diatomea, cenizas, sal, azufre, conchilla (calcio), azúcar.

Insumos: pantalla solar (para dar sombra a los animales), boyero (alambrado eléctrico), varillas, e hilos.

Comercialización

La comercialización de la harina se realiza mediante la venta directa por intermediarios locales en diversos puntos del país y en ferias. Cuando el trigo está maduro se cosecha, se muele en un molino artesanal a piedra y se logra la Harina Integral Agroecológica, que es como sale del sistema. Del proceso de molienda tienen un 25 % aproximado de residuos, tanto de trigo (salvado y afrechillo), como de centeno y maíz, que es aprovechado en la alimentación complementaria de los ovinos y bovinos según las necesidades. Los animales se comercializan en el mercado local.

Ganado ovino comiendo las pasturas

Resultados

- Comprender la necesidad de integrar sistemas y actividades dentro de la unidad productiva.
- Reaparecieron en el sistema las aves y otros animales silvestres e insectos, aumentó la flora y la fauna propia del territorio.
- Se incorporan del exterior más árboles que van a formar parte de las plantaciones de frutas de verano y de invierno (para consumo propio), forestación para sombra, forestación de cortinas de viento.
- Se distribuyen las actividades productivas y de gestión de modo equitativo entre hermanos.
- Respetar a la Naturaleza, sus ciclos, sus leyes, de manera de obtener un producto verdaderamente sano y natural en su origen.
- Se contribuyó a soberanía alimentaria, arraigo en el territorio, y una relación distinta con el entorno, ser soberanos en la toma de decisiones y generar redes de cooperación entre consumidores y otros productores.
- Difundir y concientizar el Buen Vivir, y la base de su filosofía de vida es el Conocimiento, por eso abrimos las puertas del lugar para realizar capacitaciones, o visitas de distintas escuelas.
- En la unidad productiva se generó resiliencia, autonomía y viabilidad económica desde la recreación de agro ecosistemas biodiversos y con nutrición integral de los suelos.

Beneficios

Mitigación del cambio climático

- Se logra la reducción de la huella de carbono en un 80%, al no utilizar insumos externos de síntesis química (plaguicidas) ni fertilizantes nitrogenados.
- El Pastoreo Racional Intensivo permite fijar carbono en el suelo a través de raíces profundas de pasturas de diversas especies.
- Integrar los residuos de origen orgánico a la unidad productiva produciendo un proceso adecuado de humificación evitando la eliminación de gas metano
- Se produce menos eliminación de dióxido de carbono desde el suelo al reducir las labores de preparación de la cama de siembra.

Adaptación al clima

- Los árboles, las pasturas y los cultivos anuales absorben dióxido de carbono
- Se incrementó la cantidad de materia orgánica en el suelo, a partir de allí el sistema demostró ser más resiliente frente a sequías e inundaciones.
- La diversidad de cultivos y la cobertura permanente del suelo generaron mayor estabilidad productiva y menor riesgo de pérdidas totales.
- La diversificación de actividades brinda estabilidad económica frente a eventos climáticos extremos.
- La utilización de plantas con raíces extensas y profundas, en las pasturas de alimentación animal, mejoran la captación de agua.

Biodiversidad

- Sembrar pasturas de 10 a 15 especies diferentes posibilita aprovechar los diversos micro-nichos ecológicos (agua y suelo), además las mismas producen semillas para la regeneración de nuevas pasturas; también esta metodología conlleva a que aparezcan especies de plantas nativas sobre todo gramíneas (pasto miel, cloris, pasto horqueta) importantísimas por la cantidad de raíces y material vegetal aéreo que producen.
- Se incrementa la población de plantas adventicias (silvestres) que forman parte del sistema, se genera mayor población vegetal, por ende aumenta la materia orgánica aérea en el suelo, como así también la vida silvestre (Flora y Fauna).
- Se manifiestan diferentes poblaciones de especies que según sus necesidades ocupan preferentemente zonas bajas o altas del relieve, como las lomas. En los bajos existe más concentración de leguminosas como el *Lotus corniculatus*, y en las lomas la aparición de gramíneas nativas, algunas de ellas perennes.
- Al dejar el monocultivo, se observa que aparecen distintos hábitats, donde predominan especies adaptadas a ellos y se percibe el ciclo trópico que antes no se percibía, donde se materializa la diversidad funcional.
- Dado que dejaron de utilizar plaguicidas, retornaron los insectos polinizadores y la fauna silvestre al agroecosistema.
- Variabilidad genética en cultivos y animales que reduce la vulnerabilidad y las enfermedades.
- Mayor cantidad de árboles que regulan el ciclo de agua, amortiguan los vientos, atemperan los extremos de temperaturas y además aportan materia orgánica.

Observación de cultivos agroecológicos

Beneficios (cont.)

Economía

- Se pasa de requerir un 80% de insumos externos a un 10%. Lo que posibilita poseer más autonomía y soberanía alimentaria.
- Los costos de producción son más bajos porque producen sus propias semillas y no compran fertilizantes, sino que se basan en la rotación de cultivos y el abono animal. Los ingresos directos también son más bajos, ya que han reducido la superficie dedicada a la producción, pero su margen bruto es más alto que el de otros productores de la zona, ya que obtienen un precio más alto por su harina, que se produce de forma agroecológica. En general, los resultados económicos son mejores. Aún subsisten muchos costos fijos que considerar (impuestos, por ejemplo)

Salud y medio ambiente

- Al eliminar los plaguicidas de síntesis, se reducen los riesgos de enfermedades agudas y crónicas en la familia, trabajadores y consumidores.
- Disminución de la contaminación de suelos, aire y agua.
- Producción de alimentos que no contienen trazas de plaguicidas que son verdaderamente nutritivos y mejoran la calidad de vida de quienes los consumen.

Participación en la comunidad

- El sistema convencional es individualista y este sistema tiene como eje al ser humano y sus relaciones. Se crean más redes sociales.
- El sistema fomenta el trabajo en red y la cooperación.
- Apertura del campo a escuelas y agricultores y a la comunidad en general, generando espacios de educación e intercambio.
- Participación en la Mesa Ovina y en grupos de agricultores con mirada agroecológica.
- La unidad productiva se encuentra abierta a visitantes externos y diversos interesados como productores y alumnos de distintos niveles educativos que buscan generar intercambios de conocimientos, obtener datos o realizar investigaciones sobre lo que sucede en diferentes dimensiones del agroecosistema.
- La unidad productiva se constituyó en faro de referencia.

Ganado bovino alimentado de manera natural

Equidad de género

- Participación activa de mujeres en la toma de decisiones, la gestión del predio y la comercialización.
- La unidad familiar es un ejemplo de corresponsabilidad, donde las tareas se distribuyen según capacidades y no por roles de género tradicionales.

Lecciones aprendidas

- El cambiar de modelo productivo, se está a favor de la vida en todas sus manifestaciones, la perseverancia, la persistencia, la convicción que sustentan a la familia.
- Recuperar la identidad de agricultores: se vuelve a mirar el suelo y sus características, a valorar la microbiología, a respetar los ciclos de la naturaleza. Se observa cómo regresan las aves, cómo brotan especies nativas, cómo el campo vuelve a estar vivo.
- Lo más importante: Se producen alimentos que nutren a las personas de verdad, que cuidan la salud y que cuentan una historia de resiliencia y esperanza.
- Se construye soberanía alimentaria y se busca alcanzar el buen vivir.

Desafíos

- *Social:* Comprensión limitada de que la agroecología es un paradigma basado en la creación de un agroecosistema fundado en un sistema de procesos. tecnológicos centrados en el conocimiento, en lugar del uso de insumos químicos sintéticos, como es el caso del modelo agroindustrial. Esto contribuye a la soledad de los pioneros del paradigma agroecológico en la principal zona productora de fertilizantes y plaguicidas de Argentina.
- *Intercambio de conocimientos:* Falta de asesoramiento agroecológico continuo; intercambio limitado de conocimientos entre los agricultores. Los consumidores también carecen de conocimientos sobre alimentos saludables, las diferencias entre los alimentos producidos orgánicamente y la agroecología, y el impacto en la salud.
- *Económico:* Baja productividad y rentabilidad al inicio de la transición; altos costos fijos; financiamiento bancario limitado para la agricultura agroecológica.
- *Comercialización:* Apoyo insuficiente para la comercialización de productos agroecológicos, el valor agregado y la captación de clientes.
- *Falta de apoyo de las políticas públicas:* presión fiscal del Estado que no toma en cuenta las dificultades particulares que genera el proceso de transición.
- *Agroeconómico:* baja fertilidad del suelo.

Muchos de los desafíos identificados pueden abordarse mediante las recomendaciones que se indican a continuación.

Imagen cortesía de El Huerto Interior.

Recomendaciones

Productores

- Comience en un área pequeña de la unidad de producción y aumente la superficie a medida que adquiera experiencia.
- Salga de su zona de confort, pierda el miedo al cambio, a lo nuevo, a lo desconocido. Pierda el miedo a la percepción (negativa) de «ser» un productor «marginal» (loco, raro, hippie, antisistema). Acepte la posibilidad de nuevas experiencias positivas que acompañan al cambio.

Políticas y apoyos institucionales

- Desarrollar infraestructuras y servicios en las zonas rurales para garantizar el arraigo y la calidad de vida de las familias campesinas.
- Generar políticas estatales que prioricen la agroecología como modelo de producción sostenible y resiliente.
- Facilitar líneas de crédito específicas para la transición, con plazos de gracia acordes con el tiempo que requiere el proceso y el establecimiento de los agroecosistemas.
- Incentivos o reducciones fiscales para aquellas unidades de producción cuyas prácticas no tengan un impacto negativo en la producción de alimentos, la salud, la vida y el medio ambiente.
- Políticas públicas que apoyen a los agricultores en la transición (más crédito, menos impuestos, menos retenciones fiscales (impuestos a la exportación)).
- Lograr sistemas de certificación agroecológica participativos (SPG) con la participación de productores, instituciones estatales, organizaciones de la sociedad civil y consumidores.
- Fomentar la creación de redes y mercados locales que acerquen a los consumidores a los productores para que el consumo de alimentos saludables y nutritivos sea accesible.

Iniciativas de colaboración

- Lograr una visión holística y el bien común mediante la promoción de programas de capacitación participativa y extensión rural que incluyan conocimientos tradicionales y enfoques agroecológicos. Si un productor puede cambiar, otro también puede hacerlo.
- Reconocer el valor agregado de los alimentos agroecológicos mediante certificaciones agroecológicas que sean económicamente accesibles y permitan la participación de diversos actores.
- Sensibilizar sobre los costos y beneficios ocultos de ambos modelos (en términos de agua, materia orgánica, pérdida de minerales, microbiología del suelo y biodiversidad) para permitir una toma de decisiones adecuada y relevante.
- Mostrar el modelo agroecológico y difundir los ejemplos existentes, generando redes e intercomunicación.
- Superar la ignorancia y los prejuicios que rodean a la agroecología mediante la sensibilización sobre las consecuencias negativas del modelo de producción agroindustrial para la salud socioambiental.
- Recuperar y valorar las prácticas culturales diversas; reconstruir un tejido social y cultural (para la transmisión de conocimientos) entre los agricultores.

Consejos de Marcela, Marcos y Patricia Calderón hacia otros productores:

"Nuestro sueño es que cada vez seamos más agricultores los que cultivemos de manera natural; y que la Conciencia de la Cultura del Agro se difunda desde el que tiene la maceta en el balcón de un departamento, pasando por el jardín de una casa, por el parque de una casa quinta hasta por un terreno baldío. No se necesita tener campo para cambiar la Conciencia de la forma de vida. Pero también encontramos fortalezas: redes de productores, consumidores conscientes, vínculos que trascienden lo comercial. Estamos sembrando futuro, sembrando autonomía, sembrando vida. Uno de los cambios que se inicia con este modelo agroecológico es que uno trabaja para uno, en el otro modelo es esclavo de varios, de un sistema bien armado y cerrado (bancos, la agencia que cobra impuestos, las acopiadoras, las agronomías con ventas de insumos, ventas de maquinarias, etc.). Como hemos descubierto, superar cada dificultad nos reafirma en el camino: estamos sembrando el futuro".

Marcela Calderón en una feria agroecológica

La Red de Acción Internacional contra los Pesticidas (PAN, por sus siglas en inglés) es una coalición mundial de más de 600 organizaciones no gubernamentales e instituciones participantes en 90 países, que trabaja para sustituir los plaguicidas peligrosos por alternativas ecológicas y socialmente justas.
Web: pan-international.org
Facebook: PesticideActionNetworkInternational
BlueSky: @pesticideaction.bsky.social

Marcela Calderon, El Huerto Interior
Correo: elhuertointerior7@gmail.com
Tel: 00549236 4678711
Instagram: @elhuertointerior
Facebook: El Huerto Interior

Red de Acción sobre Plaguicidas y sus Alternativas de América Latina (RAP-AL)
Fundada en junio de 1983, RAP-AL es una red de organizaciones, instituciones, universidades, asociaciones e individuos que se oponen al uso masivo e indiscriminado de plaguicidas, especialmente los altamente peligrosos, y a los cultivos transgenicos planteando propuestas basadas en la agroecología para reducir y eliminar su uso a fin de mejorara la salud socioambiental y lograr la soberanía alimentaria.
Web: rap-al.org
X: @RAP_ALatina
YouTube: @redRAPChile

Javier Souza Casadinho, Director Regional de RAP-AL
Centro de Estudios y Tecnologías Apropiadas de la Argentina
Ubicación: Marcos Paz Provincia de Buenos Aires
Correo: csouza@agro.uba.ar
Tel: 54.11.36171782

Este estudio de caso ha sido elaborado por **RAP-AL**, la oficina de **PAN** en América Latina, en colaboración con PAN International. Forma parte de una serie de estudios de PAN de todo el mundo que muestran los beneficios y las contribuciones de la agroecología a la resiliencia climática, la seguridad alimentaria, la salud y la protección de la biodiversidad. La serie ha sido elaborada por miembros del Grupo de Trabajo de Agroecología de PAN International. La serie completa está disponible en varios idiomas a través del código QR.

Producción agroecológica y resistente al clima de nueces en La Rioja, Argentina

Plantación de nogales intercalados con avena

Resumen

El estudio de este caso muestra el proceso de transicion y consolidacion en la agroecología en una unidad productiva de tipo familiar, ubicada en la Famatina, provincia de La Rioja, que posee 1,5 hectáreas donde se cultivan nogales intercalados con cultivo de avena como un modo de generar biodiversidad e incrementar el contenido de materia orgánica de los suelos. El estudio de caso permite demostrar que es posible producir de manera agroecológica incrementando la nutrición integral de los suelos con lo cual mejoran las características químicas, biológicas y físicas de los mismos. Pablo Montilla comenzó a trabajar en su chacra conjugando saberes provenientes del ámbito científico (cursos en la universidad, asistencia y dictado de talleres y cursos) y los originados en la misma práctica dado que proviene de una familia que realiza tareas de producción agraria aunque de un modo convencional.

Contexto

La zona se caracteriza por pertenecer a los territorios áridos y semiáridos de Argentina donde se destaca la elevada amplitud térmica, precipitaciones concentradas en el verano, vientos secos y baja humedad atmosférica. Estas variables determinan la presencia de suelos arenosos, desprovistos de materia orgánica y en ocasiones salinos. El sobrepastoreo, el desmonte y la expansión de las actividades agrícolas con sus paquetes tecnológicos asociados, han llevado a la pérdida de biodiversidad, la erosión eólica, la contaminación ambiental y la salinización de los suelos. El territorio donde se realiza el cultivo de nogales se caracteriza por la existencia de productores campesinos y empresariales de vides, nogales, olivos y hortalizas producidos de manera convencional, con utilización de plaguicidas y fertilizantes, aunque también se ha incrementado la cantidad de productores agroecológicos. Se destaca en la zona la actividad minera, la cual se ha desarrollado en los últimos 140 años, la aparición de enfermedades junto a la contaminación del agua provocó la movilización de la comunidad por lo cual se han impuesto restricciones a la actividad. La merma en la frecuencia e intensidad de las lluvias junto al menor aporte de agua proveniente del deshielo (nieve) han determinado disputas entre diversos actores por el agua para consumo humano y el riego de las plantas. Si bien dentro del territorio las comunidades poseen una cosmovisión de respeto por los bienes naturales e inclusión de los seres humanos en la naturaleza la misma ha ido cambiando en función del desarrollo capitalista en la zona.

Unidad productiva: La Media Luna
Productor: Pablo Montilla
Ubicación: Famatina, La Rioja, Argentina

Características de la unidad productiva: Se trata de un predio de 1,5 hectáreas. Pablo es propietario de las tierras. Las plantas de Nogal, que se cultivan de modo intercalado con plantas de avena, se riegan por surco con agua que obtienen, junto con otros productores, de un río local.

Pertenencia a organizaciones: Pablo participa del consorcio de riego local y de la Asociación de productores agropecuarios de Famatina (APAF).

Vínculo con las políticas públicas: Pablo no posee vínculos en la actualidad, en años anteriores tuvo vínculos con el Instituto Nacional de Tecnología Agropecuaria (INTA) y con la cadenas (clusters) de producción nogalera de la Provincia. Estos vínculos le han posibilitado acceder a insumos, a conocimientos sobre estrategias y prácticas productivas así como a conocer modos de comercialización y conectarse con otros productores.

Tecnologías utilizadas: Pablo no posee ni tractor, ni arados, las labores de manejo del suelo las realiza un contratista, Sí posee herramientas de mano (palas, azadas), una motoguadaña (cortadora de plantas silvestres con uso de combustible) para cortar el pasto.

Todos los créditos fotográficos: Javier Souza Casadinho

Prácticas agroecológicas

Fuente de nogales y portainjertos: Cuando se inició la actividad, hace doce años, las plantas de nogal ya estaban en el predio. Él añadió nuevos nogales que compra en comercios locales. Adquiere lo que se denomina pié de injerto y les injerta ramas o yemas de las variedades comerciales. También ha ido injertando partes de la planta de nogal (púas) sobre plantas de nogal obsoletas o viejas.

Gestión del suelo y los nutrientes: Abona su predio con estiércol de cabra y de gallina comprado, aunque en el último año no lo hizo por el costo de estos abonos. Trabajar el suelo con cuidado y con las herramientas adecuadas reduce la alteración del suelo, mantiene su estructura, incorpora los residuos de los cultivos y mejora la biología del suelo. Ha realizado el cultivo de abonos verdes para incorporar materia orgánica y mejorar así las características del suelo con la finalidad de incorporar materia orgánica para así mejorar las características de los suelos. Además se incorpora nitrógeno dada la simbiosis de las plantas leguminosas con las bacterias del género Rhizobium.

Comercialización: Pablo vende sus productos en otras provincias a negocios minoristas como nuez agroecológica en bolsas de 10, 20 y 25 kilogramos. Ocasionalmente vende a consumidores locales en bolsas de 1 kilogramo. En algunas ocasiones recibe, por parte de consumidores y comercializadores intermediarios una bonificación adicional por tratarse de productos agroecológicos. No posee una certificación por sistemas participativos de garantías ni de otro tipo.

En la tabla al final se proporcionan detalles adicionales sobre las prácticas agroecológicas para el manejo de nutrientes, plagas y enfermedades.

El manejo de insectos y enfermedades: La prevención es la principal herramienta. Se presenta una gran diversidad biológica dado que su predio fue diseñado para integrarse al entorno natural (monte). El predio se halla inmerso en el monte donde los árboles autóctonos proporcionan protección contra el viento y refugio a los insectos beneficiosos. También hay lugares especiales llamados "islas", dentro del predio, donde crecen naturalmente plantas de poleo. Esta diversidad brinda sitios de refugio, alimentación y apareamiento a insectos que depredan o parasitan a los insectos perjudiciales. El principal insecto que ataca a las plantas es Carpocapsa sp, cuyo manejo incluye el uso de insumos biológicos y variedades resistentes. Los fertilizantes foliares también mejoran la nutrición y la salud de las plantas, lo que aumenta su resistencia a los insectos y las enfermedades.

Arriba: Plantación de nogales en armonía con el entorno natural

Abajo: Nogales agroecologicos

Beneficios

- El incremento de la diversidad temporal y espacial provee resiliencia frente al cambio climático
- El incremento en la diversidad y el abonado de los suelos mejora sus características físicas, químicas y biológicas
- No utilizar plaguicidas y fertilizantes mejora notablemente la salud socioambiental y el bienestar de todos los seres vivos
- Se reducen los costos de producción al no utilizar insumos químicos
- Se producen alimentos más sanos dado que no contienen trazas de plaguicidas
- La cohesión social y el aprendizaje mutuo están aumentando, ya que en los últimos años más productores han visitado la granja. Pablo también ha sido invitado a dar charlas en otras instituciones educativas y asociaciones de productores.

Desafíos

- **Cambio climático:** el incremento de las temperaturas y la humedad ha provocado la emergencia de enfermedades fúngicas e impide que los árboles verbalicen (acumulen horas de frío), lo que dificulta la floración y la fructificación adecuadas, mientras que la reducción de las precipitaciones inhibe el crecimiento de las plantas y el aumento de la humedad pueden estar favoreciendo la aparición de enfermedades fúngicas. La disminución de las precipitaciones reduce las nevadas invernales y, por lo tanto, el agua disponible en los ríos durante el verano.
- **Costos de producción:** Si bien la unidad de producción cubre todos los costos de producción, no compensa totalmente el trabajo familiar, el aumento del costo de los fertilizantes adquiridos o los costos de transporte de los frutos secos al mercado (asociados con el aumento de los costos del combustible).
- **Escala de producción:** Alcanzar una escala de producción adecuada requiere la reposición de las plantas "viejas" u "obsoletas" con nuevas plantas, que son caras. Para evitar esos costos, los productores siembran menos plantas nuevas y, por lo tanto, tienen una producción menor de la que podrían alcanzar. El costo de injertar nuevos «brotes» o «ramas productivas» también es elevado, tanto en términos de mano de obra como de insumos (nuevos brotes).
- **Agua:** El acceso al suministro de agua es problemático debido a la falta de organización entre los productores, lo que hace que los canales de riego no se mantengan en buenas condiciones. La escasez de agua se ve agravada por el aumento en la demanda de los grandes productores de aceitunas, pistachos, nueces y uvas.

El letrero da la bienvenida a los visitantes a la finca agroecológica La Media Luna.

Acciones frente al cambio climático y otros desafíos

- Diseñar la unidad productiva tomada como un organismo vivo con múltiples relaciones, y realizar las actividades de diseño e implantación de nueces de acuerdo al entorno natural, en armonía con las plantas que crecen (herbáceas, arbóreas y arbustivas) en el monte.
- Se incluye más diversidad biológica para apoyar la resiliencia de los agroecosistemas frente a las presiones medioambientales relacionadas con el cambio climático.
- Mantener el suelo cubierto con restos de hojas de los nogales, con las plantas silvestres que crecen espontáneamente y con la siembra de abonos verdes de vicia y avena. Esto genera materia orgánica en el suelo, lo que favorece la infiltración del agua, la retención y el mantenimiento de la humedad del suelo, lo cual resulta beneficioso durante las sequías y las lluvias intensas.
- La organización entre los productores puede abordar algunos de los costos de producción y comercialización identificados; también son necesarios cambios adicionales en las políticas (véase Recomendaciones).

Lecciones aprendidas

La unidad productiva "la Media Luna" nos posibilita compartir una serie de conocimientos y aprendizajes.

- **Integrar la unidad productiva al entorno natural**, el monte, constituido por especies como Tala, Algarrobo, Jarilla y Retamo. Se aprende acerca de la necesidad de incrementar la diversidad a fin de generar procesos de interacción entre especies, por ejemplo, el suministro de las plantas silvestres de alimento, sitios de cobijo y apareamiento para los insectos benéficos. Las plantas arbóreas actúan como cercos vivos disminuyendo la velocidad del viento y además absorben el dióxido de carbono (gas responsable del cambio climático)
- **Mitigar el cambio climático:** La utilización de una menor cantidad de labranzas en el suelo y hacerlo con herramientas (arado de cincel) que perturban menos el suelo que las labranzas convencionales determina la utilización de una menor cantidad de combustibles fósiles así como una menor emisión de dióxido de carbono
- **Adaptarse críticamente al cambio climático:** La aplicación de abono animal y la siembra de abonos verdes incrementa la cantidad de materia orgánica del suelo con la cual se mejoran sus características como la infiltración y almacenamiento de agua de lluvia y riego. Mantener el suelo cubierto evita la evaporación del agua del suelo
- **No se utilizan plaguicidas sintéticos:** Los insectos pueden manejarse mediante la generación de biodiversidad natural y cultivada, lo que minimiza los brotes de las especies dañinas y proporciona una nutrición integral del suelo. Esto último favorece el crecimiento de plantas sanas que son más resistentes de forma natural a los insectos. Con estas prácticas, no se requieren ni se utilizan pesticidas sintéticos.
- **Trabajar en una unidad productiva tomada como un organismo vivo y con múltiples relaciones**, con suelos sanos y biodiversidad de plantas, insectos y aves, aporta satisfacción a los miembros de la unidad productiva, favoreciendo su salud y bienestar.
- **La capacidad de realizar cambios oportunos**, por ejemplo, en la selección de variedades de frutos secos resistentes al ataque de insectos, aumenta la adaptabilidad y el éxito de la unidad productiva.

Recomendaciones

Productores

Promover la articulación entre productores a partir de la solidaridad y la organización comunitaria. Al organizarse, el colectivo puede afianzar la organización entre los productores con la finalidad de alcanzar diferentes objetivos;

- Adquirir abonos en mayor volumen disminuyendo los costos.
- Incidir sobre las políticas públicas relacionadas con la producción nogalera.
- Mejorar e incrementar los canales de comercialización locales y regionales.

Apoyo institucional y normativo

- Instalar políticas crediticias, desde los bancos del estado y los privados, para favorecer la incorporación de estrategias y prácticas agroecológicas.

Iniciativas de colaboración

- Permitir el surgimiento, la valorización y el compartir del conocimiento local a partir del encuentro entre productores y con los organismos oficiales y las organizaciones no gubernamentales que realizan extensión agraria.
- Promover más instancias de capacitación e intercambios de saberes desde las instituciones del estado y las creadas por los productores.
- Promover la participación de los jóvenes de las familias rurales y las instituciones de capacitación agrícola.
- Generar instancias de encuentro entre consumidores y productores a fin de promover la producción y consumo de alimentos saludables mediante canales “cortos” o locales de comercialización.

Javier Souza Casadinho & Pablo Montilla

ANEXO
Tabla: Prácticas agroecológicas para el manejo de nutrientes, plagas y enfermedades

Método	Detalles y beneficios	Principios
Cultivo diversificado de plantas perennes junto al cultivo de abonos verdes y plantas silvestres y plantas aromáticas	El diseño incluye el cultivo de plantas de nogal, el cultivo de avena como abono verde y de espacios específicos donde crecen plantas medicinales y aromáticas (islas y corredores). Nutre a los suelos y brinda sitios de refugio y alimentación a los insectos benéficos	Sinergía, salud socioambiental, diversificación, manejo ecológico de insectos y enfermedades, nutrición integral de los suelos. No usar plaguicidas sintéticos; alimentación de polinizadores
Cercos vivos	Se permite el crecimiento de árboles nativos de retamo, jarilla, tala, algarrobo para brindar sitios de alojamiento y protección a los insectos benéficos, protección contra el viento	Sinergía, biodiversidad, reducción de insumos, protección de la salud humana, salud vegetal, ciclo del agua. Paisajes integrados
Herramientas mecánicas adecuadas	Trabajar el suelo con una grada y un arado de discos incorpora los residuos de los cultivos (residuos vegetales) al suelo, controla las plantas silvestres y prepara el suelo para la cosecha. El uso de un arado de cincel causa menos alteraciones en la estructura del suelo y en los organismos (bacterias, hongos e insectos) que viven en él.	Biodiversidad, biología del suelo, salud del ecosistema
Uso de estiércol de cabra y de gallina	Aplicación de estiércol de cabra en la base de las plantas para mejorar la fertilidad del suelo. Los fertilizantes se compran a productores locales (criadores de cabras) o a intermediarios que los traen de zonas más lejanas.	Reducción de insumos, mejora las características químicas, físicas y biológicas del suelo, ciclo de nutrientes, salud de las plantas y prevención de insectos y enfermedades, utilización de recursos locales.
Abonos verdes	Se siembra avena para mejorar la estructura y la fertilidad de los suelos y se cultiva en asociación con la veza y el centeno. Se siembra el cultivo de Vicia tanto para incorporar materia orgánica y así mejorar la estructura y fertilidad de los suelos así como para incorporar nitrógeno mediante la simbiosis de estas plantas con bacterias del suelo	Reducción de insumos, fertilidad del suelo y biodiversidad, ciclo de nutrientes, salud de las plantas y prevención de plagas y enfermedades, utilización de recursos locales. Incremento en la diversidad biológica del suelo
Abono foliar	Elaborado a partir de estiércol de vaca y sales minerales (Supermagro), se aplica a las hojas de las plantas para la absorción de los nutrientes, aumentar la resistencia de las plantas a los ataques de insectos y enfermedades.	Reducción de insumos, ciclo de nutrientes, salud de las plantas y prevención de insectos y enfermedades, utilización de recursos locales
Variedades resistentes	Plantación de variedades de nueces resistentes conocidas como «Sunday» y «David», que tienen una cáscara más dura.	Reducción del uso de plaguicidas, protegiendo la salud de la comunidad.
Uso de bioinsumos	Aplicación de insumos en base a virus para el manejo de Carpocapsa; uso de tiras de feromonas sexuales para confundir a los machos durante el apareamiento.	Reducción del uso de plaguicidas, manejo natural de insectos, salud comunitaria.

Pablo Montilla

La Red de Acción Internacional contra los Pesticidas (PAN, por sus siglas en inglés) es una coalición mundial de más de 600 organizaciones no gubernamentales e instituciones participantes en 90 países, que trabaja para sustituir los plaguicidas peligrosos por alternativas ecológicas y socialmente justas.
Web: pan-international.org
Facebook: PesticideActionNetworkInternational
BlueSky: @pesticideaction.bsky.social

Pablo Montilla, La Media Luna
Correo: pmontilla@agro.uba.ar
Tel: 0054 9 3825 437251

Red de Acción sobre Plaguicidas y sus Alternativas de América Latina (RAP-AL)
Fundada en junio de 1983, RAP-AL es una red de organizaciones, instituciones, universidades, asociaciones e individuos que se oponen al uso masivo e indiscriminado de plaguicidas, especialmente los altamente peligrosos, y a los cultivos transgenicos planteando propuestas basadas en la agroecología para reducir y eliminar su uso a fin de mejorara la salud socioambiental y lograr la soberanía alimentaria.
Web: rap-al.org
X: @RAP_ALatina
YouTube: @redRAPChile

Javier Souza Casadinho, Director Regional de RAP-AL
Centro de Estudios y Tecnologías Apropiadas de la Argentina
Ubicación: Marcos Paz Provincia de Buenos Aires
Correo: csouza@agro.uba.ar
Tel: 54.11.36171782

Este estudio de caso ha sido elaborado por **RAP-AL**, la oficina de PAN en América Latina, en colaboración con **PAN International**. Forma parte de una serie de estudios de PAN de todo el mundo que muestran los beneficios y las contribuciones de la agroecología a la resiliencia climática, la seguridad alimentaria, la salud y la protección de la biodiversidad. La serie ha sido elaborada por miembros del Grupo de Trabajo de Agroecología de PAN International.

La serie completa está disponible en varios idiomas a través del código QR.

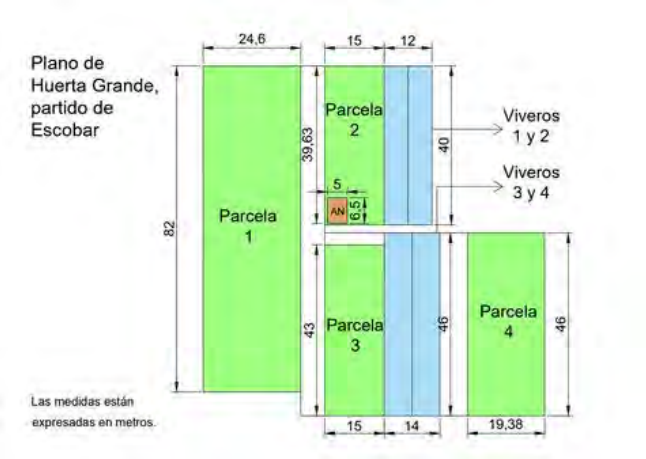
La transición a la agroecología en el huerto de Marcela Benbassat en Loma Verde Escobar, Argentina

Resumen

Marcela Benbassat cultiva verduras en una granja situada cerca de la ciudad de Buenos Aires. Se trata de una zona donde coexisten productores de hortalizas con zonas de viviendas por lo cual se han producido conflictos en el uso de plaguicidas. Las actividades de producción de hortalizas, que se realizan desde hace 70 años, demandan un alto uso de plaguicidas a fin de incrementar la productividad y la calidad formal de los productos. El alto uso de plaguicidas que genera procesos de resistencia en los insectos junto a la escasez de biodiversidad refuerzan la dependencia hacia estos insumos. Investigaciones realizadas sobre la calidad de las hortalizas demuestran el alto contenido de sustancias químicas.

Ante esta situación emergen en los últimos años productores agroecológicos los cuales buscan producir alimentos de alta calidad intrínseca a partir de la diversidad biológica y la nutrición integral de los suelos. Estos productores comercializan su producción en la propia unidad productiva y en ferias y mercados locales. Entre las motivaciones para producir de modo agroecológico se hallan: proteger la salud ambiental, producir alimentos sanos y reducir los costos de producción. Existen casos donde los productores y consumidores se han asociado, en lo que se denomina Comunidad que Sostiene a la Agricultura (CSA), a fin de planificar en conjunto las actividades (cultivos a realizar, cría de animales, elaboración de productos), compartiendo riesgos y beneficios.

Croquis de la unidad productiva



Unidad productiva: Huerta grande
Productora: Marcela Benbassat
Ubicaciòn: Loma verde Escobar, provincia de Buenos Aires

Pertenencia a organizaciones: Participa de la Asociación Argentina de biodinámica

Vínculo con las políticas públicas: Se le fue otorgado un certificado de productora agroecológica, le entregaron frutales por parte del Ministerio de Asuntos Agrarios de la provincia de Buenos Aires. La granja también recibió 30 plantas frutales como parte de un proyecto vinculado al mismo ministerio.

Tecnologías utilizadas: No poseen tractor, sí un motocultivador y herramientas de mano (palas, azadas, rastrillos, layas).

Características de la unidad productiva

La unidad productiva posee una dimensión de 0,5 hectáreas, 21% bajo la superficie de invernáculos. La misma es arrendada, alquilada, desde hace 12 años. El riego es por goteo con extracción de agua de pozo por bomba eléctrica. Además de Marcela Benbassat trabajan en el mismo 3 trabajadores asalariados que no forman parte de la familia.

La comercialización se realiza mediante ventas directas en el predio a partir de pedidos realizados por medios electrónicos (Internet, Whatsapp), en lo que se denomina tienda "on line" con retiro de los productos en el predio o envío a domicilio (incluyendo el pago de gastos de traslado). Además se comercializa un punto de entrega de productos ubicado en la localidad cercana de Vicente López. La unidad productiva posee un local donde se comercializan productos propios y otros productos elaborados (pan, dulces, harinas, vino, aceitunas) provenientes de otros productores residentes en diversos territorios de la Argentina.

Créditos de todas las fotos: Javier Souza Casadinho

Prácticas y enfoques agroecológicos

Cultivos: a) Hortalizas (lechuga, acelga, alcachofas, calabaza, rúcula, calabaza italiana, etc.). b) Plantas medicinales (menta, romero, orégano). c) Árboles frutales que aún no están en producción. Arrancan profundamente cada dos años, luego hacen caballones de 40 metros de largo por 1 metro de ancho donde cultivan diversas especies de plantas. No tienen animales, pero sí cuatro colmenas.

Manejo de semillas: Producen sus propias semillas (excepto las de tomate), también compran en un semillero que produce según las normas biodinámicas y han recibido semillas de programas estatales. Compran plántulas de lechuga.

Manejo de nutrientes: Para mejorar la fertilidad del suelo y la absorción de nutrientes, la granja utiliza compost de la propia granja, estiércol del ganado y abono verde, así como otros productos naturales.
Manejo de plagas y enfermedades: El enfoque principal se basa en (a) la prevención, diversificando las especies naturales y cultivadas en el diseño del huerto, lo que atrae a los insectos beneficiosos y repele a los dañinos, y (b) el cultivo de cosechas sanas mediante la gestión de la nutrición del suelo, lo que aumenta la resistencia de las plantas a las plagas de insectos y las enfermedades. Cuando es necesario, se emplean diversos tratamientos naturales (eliminación manual, insumos biológicos, tratamientos de semillas sin químicos).

En la tabla al final se proporcionan detalles adicionales sobre las prácticas agroecológicas para el manejo de nutrientes, plagas y enfermedades.

Características adicionales del agroecosistema:

Aspectos físicos

- Cuentan con cercas vivas donde cultivan ligustro y palmeras pindo para obtener material para el compost, así como leña para quemar durante las heladas y para proteger los cultivos del viento y la deriva de plaguicidas de las granjas cercanas.
- Los árboles también participan en el ciclo del agua, absorbiendo el agua de lluvia, utilizándola en sus procesos metabólicos para luego transpirarla.

Aspectos económicos y sociales

- *Económico:* Aunque cayeron las ventas de los productos por la crisis económica de Argentina, en la unidad productiva se obtienen beneficios económicos. Se incrementan los gastos en material plástico para la protección contra el frío. La unidad productiva cubre todos los costos y también remunera el capital inmovilizado siendo financieramente viable.
- *Género y juventud:* Hay equidad de género e intergeneracional, los empleados poseen menos de 30 años.
- *Organización comunitaria:* Los vecinos visitan el predio, conocen las prácticas, ejemplo abonado del suelo con estiércol de ave compostada, cooperan con otras unidades productivas intercambiando productos y alternando los días de venta, se realizan acuerdos comerciales de intercambio de productos y el predio está abierto a vecinos y visitantes.

Plantas de esponja vegetales que se cultivan para dar sombra los tomates

Impactos derivados del cambio climático y las respuestas de los agricultores

El rápido cambio climático y los fenómenos meteorológicos extremos han planteado numerosos retos a la agricultura de la región. A continuación se detallan algunos de estos efectos adversos y las respuestas de los agricultores.

- Más heladas (temperaturas por debajo de cero grados) y son más intensas.
- temperaturas elevadas con la incidencia en la germinación de las semillas, una mayor necesidad de riego, las plantas sufren el calor y detienen su crecimiento. Hay que ventilar más, abrir los invernáculos.
- Vientos más fuertes que pueden romper el invernadero y levantar polvo, y más lluvias en verano.
- El exceso de lluvia en verano y la humedad pueden favorecer la aparición de enfermedades fúngicas como Sclerotina sp. en el cultivo de lechuga.
- Algunas poblaciones de insectos aumentan con el aumento de las temperaturas (saltamontes, ácaros).

Los agricultores han respondido con estas medidas:

- Aumento del riego debido a la falta de lluvias, aunque esto incrementa los costos de producción (electricidad).
- Para evitar la evaporación del agua del suelo siembran con mayor densidad y colocan mulching elaborado con hojas provenientes de vegetales.
- Los daños a los cultivos causados por las heladas y las bajas temperaturas se controlan quemando madera para generar calor y colocando plástico (anti escarcha) en los invernaderos.
- Respecto a la dinámica de la población de los insectos, con las altas temperaturas se incrementa la población de algunos de ellos, como las tucuras, para lo cual trabajan con más diversidad y bioinsumos preparados en base a los mismos insectos que son incinerados, esparciendo sus cenizas como polvo o mediante aspersiones líquidas sobre el cultivo.
- Cuando aparecen arañuelas en el cultivo de tomate para lo cual sombrean las plantas con otras plantas como la esponja vegetal, aplican paja en el suelo y pulverizan las plantas con una maceración de cola de caballo (Equisetum sp.).
- De manera preventiva hacen rotaciones y asociaciones de cultivo.
- La plantación de cercas vivas de árboles que reducen la velocidad del viento puede minimizar los daños a los invernaderos.
- Para reducir las enfermedades fúngicas causadas por la humedad, sembrar una mayor variedad de plantas, enriquecer el suelo con materia orgánica, rotar los cultivos y aumentar la ventilación en los invernaderos.
- Para prevenir brotes de plagas, sembrar cultivos en rotación y asociación

Resultados y beneficios

- Producen sus propias semillas agroecológicas
- Practican modos de cultivo innovadores (esponja vegetal - loofah - por encima de las plantas de tomate para producir sombreado) y cosecha (apio solo cortan las hojas).
- Sustentan la vida en el suelo y lo mantienen sano a partir de no utilizar fertilizantes sintéticos, de realizar un mínimo laboreo y de incorporar abonos orgánicos.
- Generan diversidad productiva respetando la diversidad natural y cultivada, tanto en el tiempo como en el espacio.
- Adopción de nuevas especies de hortalizas de especies como lechuga, kale, etc.
- Plantar árboles para promover sitios de apareamiento y refugio de aves que se alimentan de insectos.
- Mantener la excelencia productiva, producir hortalizas ricas, saludables, experimentar siempre.

Lecciones aprendidas

La agricultora identificó varias lecciones aprendidas de su experiencia en la gestión de la finca con prácticas agroecológicas:

- Se destacó la necesidad de observar la naturaleza, sus procesos, las relaciones establecidas entre los organismos y sus ciclos, junto a los cambios que se originan por ejemplo frente a la crisis climática.
- La necesidad de generar cambios, de innovar y de experimentar, incluyendo prácticas para hacer frente a las nuevas situaciones ya en los aspectos productivos, como en comercialización, y en el consumo, se mencionó, por ejemplo, incluir prácticas para manejar insectos, en la estrategia de realizar la cosecha de hortalizas solo por pedido de los consumidores e incluso cultivar especies nuevas como el kale.
- También se destaca la necesidad de obtener y conservar sus propias semillas no solo porque es más económico sino porque las mismas se van adaptando a las condiciones del lugar y además las pueden utilizar en el momento oportuno (cuando las necesitan).
- Se menciona la idea de mantener una excelencia productiva que da origen a alimentos sanos y nutritivos.

Marcela Benbassat recibe a agricultores visitantes

Lecciones apprendidas (cont.)

Factores que ayudaron a los agricultores en la transición

- Cabe destacar en primer lugar la construcción e intercambio de saberes y conocimientos con otros productores y técnicos agrícolas. También se destacan sus propias convicciones sobre la inclusión de los seres humanos en la naturaleza y la necesidad de respetar los ciclos naturales y la vida en el planeta. La relación con los consumidores posibilita planificar la producción y obtener ingresos genuinos.
- La aceptación, por los consumidores, de sus hortalizas, que junto a la posibilidad de comercializar sus productos, y los provenientes de otros productores, en el mismo predio, permite no solo incrementar el volumen de ingresos sino recibir a los consumidores quienes pueden visitar la unidad productiva.

Cómo se pueden superar estos obstáculos

Según la Sra. Benbassat, su granja busca superar estos retos mediante:

- Ayudándose entre productores en las fases de producción y comercialización
- Aprovechando la mano de obra familiar y la de los trabajadores contratados
- Estableciendo contacto directo con los consumidores
- Siendo creativos e innovando siempre
- Dialogando con los productores convencionales a fin de que conozcan las ventajas de producir bajo el paradigma agroecológico

Los obstáculos que dificultaron el proceso

- El acceso a la tierra. Marcela es arrendataria quien paga un alquiler mensual para poder utilizarla. En los últimos años se ha incrementado el pago por el alquiler, además al no ser dueña de la tierra no puede planificar a mediano y largo plazo, por ejemplo incluir más árboles frutales u otros cultivos perennes.
- El costo de la energía necesaria para el riego. En los últimos años el costo de la electricidad se ha encarecido, aspecto que limita las posibilidades de regar cuando es necesario.
- La falta de apoyo con políticas públicas. Se refiere al acceso al crédito en condiciones adecuadas (tasas de interés y condiciones de pago). También se mencionó la carencia de políticas que promuevan el consumo de alimentos sanos y saludables provenientes de unidades productivas agroecológicas.
- La existencia de unidades agrícolas convencionales que apliquen plaguicidas sintéticos y que puedan contaminar las hortalizas producidas de manera agroecológica.

El consejo de Marcela a otros agricultores interesados en pasarse a la agricultura orgánica:

"Lo más importante es que todas las personas deben unirse para cuidar el agua, la vida y el futuro del planeta. Los agricultores agroecológicos pueden ser un ejemplo para otros productores... mostrando el camino hacia la salud y el bienestar y el buen vivir."

Productores visitando el predio

Recomendaciones

Apoyo político e institucional

- Aumentar el apoyo municipal, por ejemplo, reduciendo impuestos y tasas, mejorando el acceso a los mercados y comprando una parte de la producción de los agricultores agroecológicos para alimentar a las personas en hospitales, residencias de ancianos y escuelas.
- Implementar planes de acceso a la tierra de manera efectiva.

Iniciativas colaborativas

- Establecer más mercados locales creados conjuntamente por el Estado, los productores y los consumidores.
- Recrear sistemas de certificación participativos para garantizar la producción agroecológica de forma conjunta entre consumidores, productores, universidades e institutos de investigación con el apoyo del Estado, basándose en las respectivas normativas oficiales (ordenanzas).
- Establecer sistemas de comunicación e intercambio de conocimientos organizados de forma sistemática y continua, como las Escuelas Populares de Agroecología. Los consumidores deben participar en las reuniones.
- Realizar más investigaciones experimentales sobre prácticas y tecnologías agroecológicas. Se deben utilizar las propias tierras de los productores para llevar a cabo actividades de investigación-acción participativa en colaboración con instituciones de investigación y universidades.
- Fomentar los intercambios entre productores de semillas, conocimientos y productos.

Responsabilidades éticas

- Cuidar el agua, la vida y el planeta a través de procesos que incluyan la praxis ambiental, que implica la reflexión junto con la acción.
- Cuidar desde el alma, entendiendo que una de las dimensiones más importantes de la agroecología es la espiritualidad, que permite recuperar la noción de trascendencia y los vínculos con todos los seres vivos.
- Ser referentes para otros productores mediante la creación de agroecosistemas socioambientalmente sostenibles y económicamente viables.

La agroecología es salud, para los seres humanos y la Madre Tierra, para y en la producción de vegetales saludables. Salud para todos.

La gran diversidad de plantas en el jardín de Marcela

ANEXO

Tabla: Prácticas agroecológicas para el manejo de nutrientes, plagas y enfermedades

Método	Detalles y beneficios	Principios
Cultivo diversificado con plantas hortícolas, aromáticas y medicinales	El diseño incluye una amplia variedad de especies naturales y cultivadas en rotación y en asociación. Por ejemplo, combinando cultivos que, cuando se plantan juntos, repelen insectos dañinos o atraen depredadores y parásitos.	Sinergia, seguridad alimentaria, salud familiar, diversificación económica y alimentaria, reducción de insumos, biodiversidad, salud vegetal, reducción de uso de plaguicidas, protección de polinizadores.
Cercos vivas	Ligustros y palmeras pindo cultivados para proporcionar material para abono, leña para quemar y proteger los cultivos de las heladas y el viento, así como barreras contra la deriva de pesticidas de las granjas cercanas.	Sinergia, biodiversidad, reducción de insumos, protección de la salud humana, salud vegetal, ciclo del agua.
Compostaje de estiércol ganadero	Compostaje y aplicación de estiércol ganadero para mejorar la fertilidad del suelo. A veces, el estiércol se aplica directamente al suelo.	Reducción de insumos externos, fertilidad del suelo y biodiversidad, ciclo de nutrientes, salud de las plantas y prevención de plagas y enfermedades, utilización de recursos locales.
Abono verde	Elaborado a partir de materia vegetal, como arvejas, y aplicado al suelo para mejorar su estructura, la retención de humedad y fertilidad.	Reducción de insumos, fertilidad del suelo y biodiversidad, ciclo de nutrientes, salud de las plantas y prevención de plagas y enfermedades, utilización de recursos.
Cenizas y astillas de madera	Se obtienen cenizas tras quemar ramas y leña, y astillas de madera aplicadas al suelo; aportan nutrientes beneficiosos (fósforo, calcio).	Reducción de insumos, fertilidad del suelo, ciclo de nutrientes, salud de las plantas, utilización de recursos locales.
Mantillo del suelo	Se mezcla la primera capa del suelo existente debajo de los árboles con agua para fertilizar el suelo, proteger la superficie del suelo y retener la humedad del suelo	Reducción de insumos externos, calidad del suelo, ciclo de nutrientes, salud de las plantas y prevención de plagas y enfermedades, utilización de recursos locales.
Fertilizante foliar	Elaborado a partir de estiércol de vaca y sales minerales (Supermagro), se aplica a las hojas de las plantas para una rápida absorción de los nutrientes.	Reducción de insumos externos, calidad del suelo, ciclo de nutrientes, salud de las plantas y prevención de plagas y enfermedades, utilización de recursos locales.
Uso de bioinsumos en base a Bacterias Rhizobium y hongos micorrízicos	Mejora la absorción de nutrientes del suelo por parte de las plantas	Reducción de insumos externos, salud de las plantas y prevención de insectos y enfermedades, utilización de recursos
Bioinsumos (preparados naturales)	Preparados en alcohol a base de plantas (ajo, romero, ruda), maceración de ortiga en agua aplicadas según sea necesario para el control natural de plagas. Maceración de cola de caballo (Equisetum sp) aplicada para los ácaros.	Reducción de uso de plaguicidas, manejo natural de insectos y enfermedades, agricultura biodinámica, utilización de recursos locales y salud comunitaria.

ANEXO
Tabla: Prácticas agroecológicas para el manejo de nutrientes, plagas y enfermedades

Método	Detalles y beneficios	Principios
Eliminación manual de plagas	Los escarabajos y algunos otros insectos se recogen a mano. Se preparan quemándolos y esparciendo sus cenizas por la propiedad tratando de disuadir el acercamiento de otros insectos.	Reducción del uso de plaguicidas, manejo natural de plagas, salud comunitaria.
Estrés térmico y aparición de ácaros	Las altas temperaturas junto a las condiciones de baja humedad son propicias para la aparición de ácaros en los cultivos de tomate. Dar sombra a las plantas con otras plantas, como la esponja vegetal, y aplicar paja al suelo reduce el estrés térmico de las plantas y los brotes de aparición de ácaros.	Reducción de uso de plaguicidas, manejo natural de plagas, utilización de recursos, salud comunitaria. adaptación al cambio climático.
Jabón de potasio, aceite de neem	Los preparados comerciales repelen y controlan los insectos.	Reducción del uso de plaguicidas, manejo natural de plagas, salud comunitaria.
Solución de Trichoderma	Semillas y plántulas sumergidas en una solución de Trichoderma, un hongo beneficioso que combate las enfermedades de las plantas, favorece el crecimiento y aumenta la resistencia al estrés ambiental.	Reducción del uso de plaguicidas, salud y prevención de enfermedades de las plantas; resiliencia; salud de la comunidad.

La Red de Acción Internacional contra los Pesticidas (PAN, por sus siglas en inglés) es una coalición mundial de más de 600 organizaciones no gubernamentales e instituciones participantes en 90 países, que trabaja para sustituir los plaguicidas peligrosos por alternativas ecológicas y socialmente justas.
Web: pan-international.org
Facebook: PesticideActionNetworkInternational
BlueSky: @pesticideaction.bsky.social

Marcela Benbassat, Huerta Grande
Correo: Benbassat@agro.uba.ar
Tel: 0054 911404573
Web: huertagrandebiodinamica.com.ar

Red de Acción sobre Plaguicidas y sus Alternativas de América Latina (RAP-AL)
Fundada en junio de 1983, RAP-AL es una red de organizaciones, instituciones, universidades, asociaciones e individuos que se oponen al uso masivo e indiscriminado de plaguicidas, especialmente los altamente peligrosos, y a los cultivos transgenicos planteando propuestas basadas en la agroecología para reducir y eliminar su uso a fin de mejorara la salud socioambiental y lograr la soberanía alimentaria.
Web: rap-al.org
X: @RAP_ALatina
YouTube: @redRAPChile

Javier Souza Casadinho, Director Regional de RAP-AL
Centro de Estudios y Tecnologías Apropiadas de la Argentina
Ubicación: Marcos Paz Provincia de Buenos Aires
Correo: csouza@agro.uba.ar
Tel: 54.11.36171782

Este estudio de caso ha sido elaborado por **RAP-AL**, la oficina de PAN en América Latina, en colaboración con **PAN International**. Forma parte de una serie de estudios de PAN de todo el mundo que muestran los beneficios y las contribuciones de la agroecología a la resiliencia climática, la seguridad alimentaria, la salud y la protección de la biodiversidad. La serie ha sido elaborada por miembros del Grupo de Trabajo de Agroecología de PAN International. La serie completa está disponible en varios idiomas a través del código QR.

Alternativas agroecológicas para el manejo de cultivos sin el uso de Plaguicidas Altamente Peligrosos en Costa Rica

Instituto Regional de Estudios
en Sustancias Tóxicas (IRET)

PAN
pesticide action network international

IRET

Alternativas agroecológicas para el manejo de cultivos sin el uso de Plaguicidas Altamente Peligrosos en Costa Rica

Resumen

La finca "Los Sukias", ubicada en Bebedero, Cañas, Guanacaste, se ha consolidado como un referente en la producción agrícola orgánica a gran escala. Con suelos arcillosos y franco-arenosos y acceso al riego por inundación del río Bebedero, cultiva principalmente arroz (Oryza sativa L.) y caña de azúcar (Saccharum officinarum L.). Desde 2012, ha pasado de un modelo convencional a un sistema regenerativo, eliminando por completo el uso de agroquímicos y adoptando prácticas agroecológicas certificadas bajo la marca "EcoArroz". La labranza mínima, la rotación de cultivos, el acolchado, los bioinsumos y el manejo integrado de plagas son los pilares del modelo de producción, que mejora la calidad del suelo y fortalece la biodiversidad.

Los beneficios de este tipo de sistema de producción son tangibles: rendimientos cercanos a las ocho toneladas por hectárea, reducción de los costos de producción en comparación con la agricultura convencional y precios más altos debido a su valor como producto orgánico. Esto ha posicionado a Los Sukias en mercados diferenciados. Más allá de la productividad, el modelo también proporciona beneficios ambientales y sociales: captura de carbono, reducción de emisiones, retención de agua y conservación de la flora y la fauna, entre otros. La experiencia de Los Sukias demuestra la viabilidad de producir alimentos de forma sostenible, rentable y ética, constituyendo un modelo replicable que posiciona la agroecología como una solución climática, una alternativa real para la producción agrícola en Costa Rica y una fuente de inspiración a nivel nacional.

Propietario de la finca: Andrés Vázquez Ulate.

Ubicación: La finca está situada en el distrito de Bebedero, cantón de Cañas, provincia de Guanacaste, Costa Rica, a una altitud de entre 15 y 20 metros sobre el nivel del mar. Se trata de una zona estacionalmente húmeda y seca, con una temporada de lluvias de mayo a noviembre y una temporada seca de diciembre a abril, pero con acceso a agua de riego.

Área productiva de la propiedad: La finca cuenta actualmente con 216 hectáreas de superficie agrícola, de las cuales aproximadamente 84 hectáreas se cultivan con arroz orgánico certificado, 5 hectáreas con camote orgánico y otras 127 hectáreas se arriendan para producir caña de azúcar orgánica. El resto está cubierto por bosques, zonas de amortiguación, caminos y viviendas. El área de caña de azúcar está manejada actualmente por el Ingenio El Viejo, ya que el proceso de molienda debe estar separado del proceso convencional. El Viejo también cuenta con más de 2400 hectáreas de caña de azúcar orgánica certificada. El arroz se cultiva en parcelas arrendadas desde hace más de 25 años, 47 hectáreas en terrenos arrendados a Aquacorporación y 37 hectáreas en Paso Lajas, todas ellas con certificación orgánica.

Antecedentes

En la región de Bebedero, Cañas, Guanacaste, en las llanuras del río Bebedero, la finca Los Sukias desarrolló durante años un modelo de producción agrícola de carácter convencional, orientado principalmente a la siembra intensiva de arroz desde el año 1983. En 1999 el área de la finca era de 163 hectáreas y se dedicaba al cultivo de caña de azúcar, arroz y ganadería. Uno de los principales problemas que enfrentaba el cultivo de arroz en aquel entonces era, entre tantos, el control del arroz maleza. En respuesta a esta y otras problemáticas, y en el marco de un proyecto de investigación documentado por el Instituto Tecnológico de Costa Rica (TEC), se implementó un sistema integrado de manejo que combinaba diversas estrategias químicas, físicas, mecánicas y culturales en un periodo comprendido entre el año 1999 al 2006.

Vista aérea de la finca Los Sukias.

Créditos de las fotos: Andrés Vasquez

Antecedentes (cont.)

Los resultados fueron importantes: el banco de semillas de arroz contaminante se redujo y el rendimiento del cultivo aumentó de 4,6 toneladas por hectárea en 1999 a más de 7 toneladas por hectárea en 2006. Sin embargo, con el paso del tiempo, la visión de producción en la finca evolucionó.

Hacia 2012, Los Sukias decidió dar un giro significativo hacia un modelo más sostenible y respetuoso con el medio ambiente. Fue entonces cuando comenzó a sustituir o reducir de manera considerable el uso de insecticidas y fungicidas sintéticos, incorporando en su lugar productos biológicos, así como hongos y bacterias inoculantes o biocontroladores. Este cambio de paradigma fue clave para posicionar su arroz como "EcoArroz". Este proceso de transformación no solo implicó un cambio técnico en las prácticas agrícolas, sino también una evolución conceptual en la gestión de la finca, incorporando principios de agroecología y manejo integrado que ahora constituyen el núcleo de su modelo productivo. La finca Los Sukias representa un ejemplo de manejo agrícola sostenible. La implementación de prácticas agroecológicas ha permitido mejoras en productividad y sostenibilidad. Este enfoque constituye una alternativa viable para zonas productoras de arroz en Costa Rica y aporta evidencia sólida sobre la efectividad del manejo integrado en contextos de producción libre de plaguicidas, fortaleciendo la posición de Los Sukias en innovación agrícola.

Características físicas y sociales de la finca

Cultivos: La finca se dedica a la producción de caña de azúcar y arroz de manera orgánica integrando distintas técnicas que permiten la producción a gran escala reduciendo el impacto ambiental y el uso de insumos químicos. También se cultiva lechuga, chile, albahaca, camote y tomate a pequeña escala.

Relación jurídica con la tierra: Propietario, con derecho a utilizarla para la producción de alimentos, también se subcontrata a proveedores de servicios. La finca no tiene donantes.

Número de trabajadores: aproximadamente ocho trabajadores

Tipo de suelo: La mayoría del suelo en la finca es arcilloso, con acceso a riego por inundación. Otra parte es franco arenoso y bien drenado.

Acceso a agua para riego (ríos, lagos, otros): La fuente de agua de la finca proviene en gran parte del río Bebedero y de los canales de riego del Servicio Nacional de Riego y Avenamiento (SENARA).

Bioma: En Guanacaste, el bioma original corresponde al bosque tropical seco, compuesto por suelos predominantemente de origen vertisol. Presenta árboles caducifolios adaptados a largos periodos de sequía. Gran parte del ecosistema ha sido reemplazado por sistemas agropecuarios intensivos, predominando pastizales para ganadería y cultivos como el arroz, la caña, el melón, entre otras.

Clima de la zona (temperaturas, precipitaciones, etc.): La zona presenta temperaturas máximas de 32.96°C, mínimas de 23.75°C y un promedio de 28.35°C, localizada en latitud 10 39109 y longitud 085 18060; con una precipitación promedio anual de 1691 mm.

Visita de la Asociación Costarricense para el Estudio de las Malezas (ACEM, por sus siglas en español), para una capacitación.

Prácticas agroecológicas

La finca Los Sukias emplea un modelo de producción agroecológica basado en la conservación del suelo y el uso de insumos biológicos. Las prácticas incluyen labranza mínima, incorporación de residuos de cultivos, plantación de cultivos de cobertura como Mucuna sp. y Crotalaria sp., y gestión del agua mediante inundaciones temporales para controlar las malezas y las plagas. Estas técnicas mejoran la estructura del suelo, promueven la biodiversidad, fomentan la actividad microbiana y reducen el uso de agroquímicos. Además, el arroz se establece mediante trasplante mecánico con semillas pregerminadas para lograr un rápido cierre del cultivo y una menor competencia con las malezas.

El manejo del sistema se complementa con la producción interna de biofertilizantes (como té de lombriz, harina de huesos y compost enriquecido), biodigestores que generan fertilizante líquido y biogás, y prácticas de control biológico y manual de plagas y enfermedades. Las plantas silvestres y los animales presentes en la finca cumplen funciones ecológicas, proporcionando fertilización natural, control de insectos plaga y atracción de polinizadores. Este enfoque permite mantener rendimientos competitivos a bajos costos, mejorar la salud del agroecosistema y consolidar un sistema agrícola sostenible y autosuficiente, reduciendo la necesidad de insumos químicos y fortaleciendo la resiliencia de los cultivos frente a factores bióticos y abióticos.

Sistema de cultivos diversificados

La diversificación del sistema combina el uso de cultivos de cobertura, plantas silvestres, barreras vivas o cultivos intercalados para mejorar la salud del suelo mediante el aporte de materia orgánica, estimular la fijación biológica de nitrógeno y la actividad microbiana. Además, al mantener una mayor variedad de plantas, se crean hábitats para polinizadores y organismos beneficiosos que contribuyen al equilibrio ecológico del agroecosistema. De esta manera, la diversidad funcional del sistema ayuda a regular de forma natural las poblaciones de plagas y enfermedades.

El sistema incluye la siembra de arroz entre noviembre y diciembre (esperando los meses de mayor insolación) mediante trasplante mecánico, utilizando semillas pregerminadas a alta densidad (150 kg/ha), lo que favorece el rápido cierre del cultivo y reduce la competencia con las malezas. La cosecha se realiza entre marzo y abril, meses de la estación seca que permiten menos daños al cultivo. Después de la cosecha, los campos se gestionan con mantillos como tejido de arroz seco triturado. Las plantas de arroz rebrotan y permanecen en el campo durante tres meses para una segunda cosecha. Después, en agosto o septiembre, se siembra Crotalaria sp. (o Mucuna sp.) en el suelo a una densidad de 20 kg/ha de semillas como mantillo vivo/cultivo de cobertura que fija 120 kg/ha de nitrógeno. Después de 3 meses, el cultivo de cobertura se incorpora al suelo para proporcionar materia orgánica. Los bordes del cultivo, los canales de riego y las zonas circundantes se mantienen con vegetación de plantas silvestres durante todo el ciclo de cultivo del arroz.

Adopción y asimilación

Se han implementado de forma consistente métodos agroecológicos que convierten a la finca en referente nacional de producción responsable. Por su aporte al sector agrícola, Vásquez recibió la Medalla al Mérito Agrícola en 2016. En zonas de Guanacaste, medios locales como "Guanacaste a la Altura" han resaltado su compromiso y liderazgo con el cultivo sostenible, contribuyendo a difundir las prácticas regenerativas en la región.

Beneficios

Mitigación del cambio climático

- El sistema orgánico regenerativo evita el uso intensivo de fertilizantes y plaguicidas sintéticos, lo que reduce la huella de carbono asociada con la producción y distribución de productos agroquímicos y otros métodos de producción agrícola que hacen un uso intensivo de combustibles fósiles.
- Las barreras vivas, muros y taludes con vegetación, así como la cobertura permanente con especies como *Mucuna* sp. y *Crotalaria* sp., contribuyen a la captura de carbono del suelo. Según la experiencia de la finca, se observa una recuperación de materia orgánica y fertilidad, lo cual aumenta la capacidad de retener carbono.

Adaptación al clima

- El manejo de cobertura vegetal y rotación de cultivos mejora la estructura del suelo, lo que brinda capacidad de retención de agua frente a periodos secos o lluvias intensas.
- Árboles como cercas vivas disminuyen la velocidad de los vientos, la escorrentía del agua y temperaturas extremas.

Biodiversidad

- La conservación de plantas silvestres en bordes y rondas, el uso de barreras vivas y cultivos de cobertura favorecen la presencia de polinizadores e insectos benéficos (mariquitas, libélulas, arañas, ciempiés, milpiés, etc.)
- La biodiversidad dentro del sistema genera espacios de refugio y alimento para animales como las aves, sapos, ranas y la visita de coyotes.

Económicos

Los costos de producción del arroz oscilan entre US$2,350 y US$2,550/ha, y un saco de arroz se vende por unos US$60 debido a que es orgánico. Por el contrario, el costo de producir arroz de forma convencional se encuentra entre US$11,765 y 13,725/ha (cinco veces más) y el precio de venta es de US$28,40 (la mitad del precio del arroz orgánico). En la tabla 1 se enumeran algunos de los costos de producción del cultivo de arroz orgánico.

Tabla 1. Costos indicados por el productor en el manejo del arroz orgánico.

Ítem	Costos en dólares EE UU/ ha
Lixiviado	$ 0.20
Bambusina y melaza	$ 1.18
Biol de huesos	$ 1.37
Biofermento tipo té de lombriz	$ 2.60
Control manual de malezas	$ 68.63
Compost enriquecido con ceniza (producción)	$ 176.47
Compost enriquecido con ceniza (producción) en lotes con Mucuna sp.	$ 47.06

Cabe señalar que el compost enriquecido con ceniza tiene un costo de producción aproximado de US$1.20 por saco de 45 kilogramos. En el manejo productivo, se aplican cerca de 150 sacos por hectárea, con un costo total de US$470.60 (considerando tanto la producción como la aplicación). Comparativamente, en los sistemas convencionales, la fuente principal de nitrógeno es la urea, la cual requiere 16 sacos por hectárea, alcanzando un costo aproximado de US$588, lo que representa un 20% más. Como se mencionó, en los lotes regenerativos con Mucuna sp., se aplican solo 40 sacos/ha. El arroz producido por Andrés ha sido gestionado a través de cadenas cooperativas/industriales locales y existe interés institucional por parte del Ministerio de Economía, Industria y Comercio (MEIC) y el Ministerio de Agricultura y Ganadería (MAG), en conjunto con el Sistema de Banca para el Desarrollo (SBD), para promover este tipo de producción.

Beneficios (cont.)

Económicos (cont.)

En Costa Rica, los insumos químicos utilizados en la producción convencional de arroz varían en precio y dosis de aplicación. Los herbicidas incluyen quinclorac al 25%, aplicado a una dosis de 1,4 L/ha, y pendimetalina al 50%, utilizada a 3 L/ha. Los insecticidas incluyen diazinón al 60% a una dosis de 1,6 kg/ha, mientras que la cipermetrina al 25 % se aplica a 0,2 L/ha. Los fungicidas incluyen carbendazima al 50 % a 0,6 L/ha y mancozeb al 43,5 % a 4 L/ha, entre otros. En total, los plaguicidas, insumos químicos sintéticos y otros componentes representan un costo elevado (US$11,765 and US$13,725, mencionado anteriormente) en los sistemas de cultivo de arroz convencionales. Según un informe de CONARROZ para el período 2022-2023, los sistemas de producción de arroz de Costa Rica (en su mayoría convencionales) alcanzaron rendimientos medios de aproximadamente 4,24 toneladas por hectárea, una cifra muy alejada de las 7 a 8 toneladas alcanzadas por Vázquez.

Salud socioambiental

- Trabajadores, consumidores y familia no se exponen a moléculas tóxicas gracias a la producción ecológica y sostenible (disminuye riesgo de intoxicación).
- La eliminación total de plaguicidas sintéticos evita la contaminación de canales de riego y fuentes de agua, beneficiando tanto la fauna acuática como las comunidades aledañas, humedales de importancia Ramsar y parques nacionales.
- Alta producción de arroz orgánico, uno de los cultivos más consumidos histórica y mundialmente por la sociedad.
- La agricultura orgánica representa un modelo más sostenible, que protege el medio ambiente y evita los daños a largo plazo asociados con el uso de agroquímicos.

Género e igualdad de género

La familia participa en la producción de arroz y caña de azúcar; la esposa se encarga de la gestión general y parte del laboratorio para la producción de Trichoderma spp. (hongo beneficioso que reduce las enfermedades en las plantas) y otros agentes de control biológico.

Organización comunitaria

La experiencia de la finca Los Sukias ha servido como espacio demostrativo para productores vecinos, estudiantes y profesionales, promoviendo el intercambio de saberes. Reciben frecuentes visitas de estudiantes de escuelas y universidades agrícolas, grupos de productores, asociaciones profesionales y personas interesadas en la agroecología.

Alcances

El trabajo de Andrés Vásquez ha sido reconocido oficialmente con la Medalla Nacional al Mérito Agrícola 2016, otorgada por el Ministerio de Agricultura y Ganadería y la Presidencia de la República de Costa Rica. Este galardón destacó su trayectoria, innovación y compromiso con la producción sostenible, especialmente en la reducción del uso de agroquímicos.

Las prácticas implementadas en la finca han generado resultados concretos, incluyendo aumentos en el rendimiento y un posicionamiento sólido del producto en mercados que valoran la inocuidad y la sostenibilidad, como lo refleja su recepción por parte de Coope Liberia bajo la marca Sabanero.

Vásquez ha asumido un papel activo en la educación y transferencia de conocimiento agroecológico a nivel internacional, participando en congresos y capacitaciones en países como Colombia y Venezuela, compartiendo sus experiencias y fomentando la adopción de prácticas agrícolas sostenibles.

Lecciones aprendidas

- La experiencia demuestra que los sistemas agroecológicos no son exclusivos de pequeñas huertas o parcelas experimentales. En fincas de gran extensión, como Los Sukias, se evidencia que es viable mantener rendimientos competitivos sin necesidad de plaguicidas.
- Muchos productores en Costa Rica aún perciben la agricultura convencional como la única forma rentable de producir. Este sesgo cultural y comercial dificulta la adopción de modelos ecológicos sostenibles.
- Es posible producir alimentos de manera rentable sin comprometer la salud del suelo, el agua, la biodiversidad y las personas.
- La transición agroecológica requiere experimentar, y no todos los productores se encuentran cómodos asumiendo la incertidumbre de cambiar un tipo de sistema que han manejado por años independientemente de su sostenibilidad.

Recomendaciones

Aprendizaje y colaboración

- Explorar la producción ecológica a través de la experimentación con parcelas demostrativas, donde cada productor pueda observar resultados reales en condiciones locales.
- Realizar redes de intercambio y aprendizaje horizontal entre agricultores que ya aplican prácticas ecológicas y aquellos que inician su transición.

Políticas

- Unir esfuerzos entre instituciones, organizaciones y agricultores, creando espacios permanentes de diálogo y transferencia de conocimientos, a fin de fomentar la adopción de prácticas agrícolas sostenibles.
- Promover la educación ambiental desde la escuela hasta la universidad, fortaleciendo la conciencia social sobre la alimentación sostenible.
- Establecer un enfoque interministerial que articule la coordinación entre el Ministerio de Salud, el Ministerio de Agricultura y Ganadería (MAG), el Ministerio de Ambiente y Energía (MINAE), el Servicio Nacional de Aguas Subterráneas, Riego y Drenaje (SENARA) y el Ministerio de Educación Pública (MEP) de Costa Rica, con el objetivo de diseñar e implementar acciones enfocadas en la mitigación, resiliencia y adaptación al cambio climático.

Ambiental

- Fomentar la restauración ecológica en áreas degradadas con especies nativas de sucesión ecológica y agroforestería/silvicultura.
- Impulsar la producción circular aprovechando residuos agrícolas y orgánicos para la generación de energía y abonos, así como la integración de animales para un sistema más diverso y dinámico.

Ética y moral

- Promover una visión integral de la ecología, donde el ser humano sea cuidador y no explotador de los recursos naturales.
- Impulsar un modelo productivo a favor de la vida, donde la producción no se mida solo por rendimientos económicos, sino por la capacidad de regenerar suelos, nutrir comunidades y coexistir con el entorno.

Anexo 1: Prácticas agroecológicas implementadas en la finca Sukias

Práctica	Información general	Principios agroecológicos
Método de labranza del suelo	Labranza mínima con incorporación de paja de arroz; humedecimiento y pase de rastra superficial (3-5 cm) para disminuir la erosión y mejorar la salud del suelo.	Salud del suelo, reciclaje de nutrientes, reducción de la erosión del suelo.
Conservación del suelo	Uso de *Mucuna* sp. como abono verde y control natural de malezas. Inundación del suelo durante 1-2 meses para inducir anoxia y eliminar las larvas de plagas (*Phyllophaga* spp.). Presencia de aves que aportan 15-30 t/ha de abono. Uso de *Crotalaria* sp. para fijar nitrógeno y restaurar biológicamente el suelo. Vegetación en canales, bordes de cultivo, barreras vivas, etc.	Synergy, system diversification, nutrient recycling, improvement of the soil's physical, chemical, and biological properties
Tipos de biofertilizantes	Producción de 5000 litros al mes de biofermentos. Producción de té de lombriz, biofermento de harina de huesos, compost con ceniza y harina de pescado. Dosificación: 25-30 kg/ha (té de lombrices), 5 litros/ha (harina de huesos). El compost proporciona entre 25 y 50 kg de nitrógeno por ha; el uso se reduce a 40 sacos por hectárea en zonas regenerativas. Biodigestor que produce 40-60 L/día de fertilizante líquido y 4-5 horas de biogás. Los arrozales se inoculan con Azolla, una planta formada por la interacción simbiótica entre un helecho y el alga *Anabaena azollae*, que fija el nitrógeno atmosférico.	Mejora de la estructura del suelo, conservación de la biodiversidad, microbiología del suelo.
Origen y siembra de semillas / plántulas / plantas	Variedades FLAR (semillas seleccionadas). Siembra mecánica con semillas pregerminadas (150 kg/ha). Cosecha en marzo-abril. Cubierta con *Crotalaria* sp. o *Mucuna* sp. (20 kg/ha) que fija 120 kg N/ha.	Reciclaje de biomasa, reducción de la erosión del suelo, mayor fertilidad, diversificación.
Prácticas para el control de plagas y enfermedades	Control manual y mecánico de malezas (*Echinochloa* spp., *Aeschynomene* spp.). Uso de biofermentos y ácido piroleñoso para el manejo de plagas y enfermedades. Trampas luminosas con agua jabonosa para plagas de lepidópteros y coleópteros. Refugio para insectos beneficiosos (mariquitas, libélulas, arañas). Control biológico de *Phyllophaga* spp. mediante ciempiés y milpiés. Las aves, ranas y sapos contribuyen al control.	Control biológico de plagas, aumento de la biodiversidad funcional, reducción del uso de productos químicos y mayor resiliencia del sistema de producción.
Uso de plantas silvestres	Barreras vivas con árboles y vegetación espontánea (*Tridax procumbens, Euphorbia prostrata*, cucurbitáceas) para el control biológico de plagas y atracción de polinizadores.	Diversidad, servicios ecosistémicos, conservación del hábitat, atracción de organismos beneficiosos y polinizadores.
Animales	La finca tiene sus propias gallinas y también recibe la visita de diversas especies silvestres, como garzas, patos y coyotes, que provienen del ecosistema natural circundante.	Equilibrio ecológico, interacción entre animales y plantas, reciclaje de nutrientes.

Anexo 2: Componentes del sistema productivo agroecológico de Los Sukias
Fotos por Andrés Vázquez

Componente	Contribución dentro del sistema de cultivo agroecológico	Fotografia
Flores silvestres	Promueven la biodiversidad al atraer polinizadores y enemigos naturales de las plagas, contribuyendo al equilibrio ecológico del sistema.	
Libélulas	Actúan como depredadores naturales de plagas de insectos, especialmente de pequeños insectos del orden Díptera, lo que contribuye al control biológico en los cultivos de arroz.	
Mariquitas	Son controladores biológicos eficaces, ya que se alimentan de pulgones, ácaros y otros insectos fitófagos que consumen el cultivo de arroz.	
Arañas	Contribuyen al control biológico de plagas al capturar una gran variedad de insectos (lepidópteros, coleópteros, dípteros, etc.) en todas las etapas del cultivo.	 
Aves	Regulan las poblaciones de insectos y otros invertebrados, además de ser un indicador de calidad ambiental y baja contaminación química.	
Arroz orgánico con cercas vivas y árboles en los bordes de la finca	Proporcionan sombra, reducen la erosión eólica, mejoran la biodiversidad y proporcionan refugio y alimento a aves e insectos beneficiosos. También contribuyen a la captura de carbono y a la regulación del microclima.	
Arvenses en rondas de lotes	Funcionan como fuentes de alimento, refugios para polinizadores y enemigos naturales de las plagas, reducen la escorrentía y ayudan a mantener la estabilidad ecológica del medio ambiente.	

Componente	Contribución dentro del sistema de cultivo agroecológico	Fotografía
Aplicación de abono orgánico	Mejora la estructura y la fertilidad del suelo, aumenta la retención de humedad y favorece la actividad microbiana.	
Biodigestor	Permite el uso de residuos orgánicos para generar biogás y biofertilizantes, reduciendo costos y las emisiones contaminantes.	
Mucuna sp. controlando malezas	Actúa como cultivo de cobertura, abono verde y fijador de nitrógeno, mejorando la fertilidad, la estructura y las propiedades físicas, químicas y biológicas del suelo, además de controlar las malezas por la cobertura.	
Crotalaria sp. como cobertura	Así como *Mucuna* sp. es un cultivo de cobertura que mejora la fertilidad, la estructura y las propiedades físicas, químicas y biológicas del suelo, controlador de malezas.	
Formación: visita de la Asociación Costarricense para el Estudio de las Malezas (ACEM).	La finca está abierta a estudiantes, profesores e instituciones educativas, y ofrece experiencias de campo que les permiten observar y comprender directamente los beneficios de los sistemas agroecológicos, desde la gestión ecológica del suelo hasta el control biológico de plagas y la conservación de los ecosistemas asociados.	
Rondas con diferentes especies de arvenses	Aumentan la diversidad de la flora y la fauna, fortalecen las redes tróficas y mejoran la resiliencia del sistema frente a plagas o perturbaciones.	
Bordes de los canales de riego protegidos con coberturas vivas.	Evitan la erosión de los canales de riego, mejoran la infiltración y la calidad del agua, y actúan como corredores biológicos que facilitan el movimiento de la fauna silvestre beneficiosa.	

Referencias principales

Alvarado, J. 2015. Soils of Costa Rica, Vertisol order. INTA-CR.
https://www.mag.go.cr/bibliotecavirtual/av-1823.pdf

Delgado, G. 2025. CoopeLiberia R.L. is an example of diversification and business development. Panorama.
https://www.panoramadigital.co.cr/coopeliberia-r-l-es-un-ejemplo-de-diversificacion-y-desarrollo-empresarial/

Estrada, R. 2023. Agricultural companies seeking organic alternatives. Revista Milenium.
https://www.revistamilenium.com/empresas-agropecuarias-se-apoyan-en-el-ina-en-busca-de-alternativas-organicas/

Gonzalez, E. 2016. MEIC and MAG promote the cultivation of ECO Rice. El Mundo.
https://elmundo.cr/costa-rica/meic-y-mag-fomentan-el-cultivo-de-ecoarroz/

Murcia, L. 2022. Costa Rica, a regional pioneer in organic agriculture, still has many pending issues. Teletica.
https://www.teletica.com/nacional/costa-rica-pionero-regional-en-la-agricultura-organica-tiene-todavia-muchos-pendientes_307007

Rodriguez, C. 2020. Camilo Rodríguez publications Facebook page. Facebook.
https://www.facebook.com/escritorcamilorodriguez/posts/andr%C3%A9s-v%C3%A1squez-ulate-productor-de-arroznosotros-estamos-ense%C3%B1ando muchaspr%C3%A1ctic/3334872446629782/

Servicio Fitosanitario del Estado (SFE). 2025. Online consultation. Insumosys.
https://app.sfe.go.cr/SFEInsumos/aspx/Seguridad/Home.aspx

Vargas, A. 2023. Annual Statistical Report 2022-2023, Statistical Control of Rice. CONARROZ.
https://conarroz.com/userfile/file/Operaciones/Informeanualestad%C3%ADstico22-23.pdf

Vásquez, A. 2007. Implementation of an integrated management system for the control of contaminating rice (Oryza sativa) in commercial rice plantations, on the Los Sukias cattle farm, Cañas, Guanacaste. [Bachelor's thesis]. Costa Rica Institute of Technology.
https://repositoriotec.tec.ac.cr/handle/2238/2811?locale-attribute=en%20Document

Vázquez, A. 2025. Andrés Vásquez Ulate publications Facebook page. Facebook.
https://www.facebook.com/andres.vasquezulate

Vega, F. 2016. National Medal for Agricultural Merit 2016. Revista Arrocera.
https://conarroz.com/images/revista/Revista21.pdf

Villalobos, W. 2017. Senara's new project promises more water for agriculture but leaves its proper use in the hands of producers. La Voz de Guanacaste.
https://vozdeguanacaste.com/nuevo-proyecto-de-senara-promete-mas-agua-para-agricultura-pero-deja-buen-uso-en-manos-de-productores/

La Red de Acción Internacional contra los Pesticidas - PAN por sus siglas en inglés - es una coalición mundial de más de 600 organizaciones no gubernamentales e instituciones participantes en 90 países, que trabaja para sustituir los plaguicidas peligrosos por alternativas ecológicas y socialmente justas.
Web: pan-international.org
Facebook: PesticideActionNetworkInternational
BlueSky: @pesticideaction.bsky.social

Andrés Vásquez Ulate, La finca Los Sukias
Tel: +506 88553493

Instituto Regional de Estudios en Sustancias Tóxicas (IRET)
El IRET es un instituto preocupado por el impacto de las sustancias tóxicas en los sistemas agrícolas, el medio ambiente y la salud humana que lleva a cabo investigaciones y promueve alternativas agroecológicas para una producción sostenible.

Ubicación: Heredia, Costa Rica
Fernando Ramírez M.
Correo: iret@.ac.cr
Tel: +(506) 2277-3584
Web: iret.una.ac.cr
Facebook: Iret Una Costa Rica

Este estudio de caso ha sido elaborado por IRET en colaboración con PAN International. Forma parte de una serie de estudios de PAN de todo el mundo que muestran los beneficios y las contribuciones de la agroecología a la resiliencia climática, la seguridad alimentaria, la salud y la protección de la biodiversidad. La serie ha sido elaborada por miembros del Grupo de Trabajo de Agroecología de PAN International. La serie completa está disponible en varios idiomas a través del código QR.

La financiación para desarrollar este estudio de caso ha sido proporcionada por Global Greengrants Fund.

MEILLEURES PRATIQUES AGROÉCOLOGIQUES À TRAVERS LES CHAMPS ÉCOLES PAYSANS AU BÉNIN

Meilleures pratiques agroécologiques à travers les champs écoles paysans au Bénin

Résumé

Au Bénin, l'agroécologie a progressivement gagné du terrain au cours de la dernière décennie, grâce à des initiatives conjointes menées par des producteurs, des ONG (organisations non gouvernementales), des centres de recherche nationaux et internationaux, ainsi que des autorités publiques et privées. Le soutien de ces organisations a permis l'adoption croissante de pratiques agricoles durables et de haute qualité, telles que la lutte biologique, la gestion intégrée des ravageurs et la promotion des connaissances autochtones. L'étude de cas a analysé les meilleures pratiques agroécologiques introduites et mises en œuvre par le biais d'écoles pratiques d'agriculture (EPA) créées dans le cadre de divers projets et programmes de développement au Bénin. Ces pratiques agroécologiques ont apporté de nombreux avantages, notamment l'atténuation et l'adaptation au changement climatique, l'augmentation des revenus des ménages et la sécurité alimentaire, l'autonomisation des femmes et l'égalité des sexes, des avantages pour la santé et la biodiversité, la cohésion sociale et le renforcement des communautés. Afin de permettre une adoption généralisée de l'agroécologie à travers le Bénin, les décideurs politiques sont invités à élaborer et à mettre en œuvre des politiques et des initiatives institutionnelles, politiques, financières et techniques appropriées.

Organisation chef de file : GAPROFFA (Groupe d'Action pour la Promotion et la protection de la Flore et de la Faune)

Partenaires impliqués : Institut Nationale des Recherches Agricoles du Bénin (INRAB), Institut Internationale d'Agriculture Tropicale (IITA), les Universités , les lycées agricoles du Bénin, Projet ENABLE TAAT (Technologie pour la Transformation de l'Agriculture Africaine), PRIMA (Programme régionale d'Intégration des Marchés Agricoles), ENABEL (Rikolto).

Formation des jeunes sur les pratiques agroécologiques

Contexte

L'agroécologie au Bénin connaît depuis une décennie un essor progressif grâce aux initiatives conjointes des producteurs, des ONG (Organisation Non Gouvernementale), les centres de recherche national et international, des pouvoirs publics et privés. Portée par des organisations comme l'OBEPAB (Organisation Béninoise de la Promotion de l'Agriculture Biologiques), FAEB (Fédération des Agroécologies du Bénin) et plusieurs coopératives paysannes, elle se traduit par l'adoption croissante de pratiques agricoles de qualité et durables telles que la lutte biologique, la lutte intégrée et la valorisation des savoirs endogènes. Appuyée par l'INRAB (Institut National des Recherches Agricoles du Bénin), l'IITA (Institut International d'Agriculture Tropicale), les universités, les lycées agricoles. L'étude de cas a analysé les meilleures pratiques agroécologiques introduites et mises en œuvre à travers les champs écoles paysans (CEP) installés par les projets et programmes de développement tels que ENABLE-TAAT (Technologies pour la transformation d'agriculture Africaine), dans l'entrepreneuriat des jeunes, Rikolto dans le programme Riz et PRIMA (Programme régional d'intégration des marchés agricoles) sur la production maraîchère, légumineuse et vivrière financé par la BAD (Banque Africaine de Développement), la coopérative Belge (ENABEL) et le Fond international de développement Agricole (FIDA) respectivement au Bénin.

Le Bénin, dont l'économie repose majoritairement sur l'agriculture, fait face à d'importants défis liés à la sécurité alimentaire, à la gestion durable de ses ressources naturelles et aux effets croissants du changement climatique. La dégradation des sols, la variabilité des pluies, ainsi que la dépendance à l'usage de pesticides hautement dangereux (HHP) compromettent la santé des producteurs, la biodiversité et la qualité des écosystèmes. Dans ce contexte, la transition vers des pratiques agroécologiques apparaît comme une solution durable, capable d'améliorer la résilience des systèmes agricoles, de réduire l'usage de produits chimiques nocifs et de renforcer la souveraineté alimentaire du pays.

Méthodes

L'approche méthodologique utilisée est la collecte les données de manière collaborative, en impliquant directement les producteurs, les animateurs des Champs Écoles Paysans (CEP), et les responsables des projets partenaires dans l'observation, l'expérimentation et l'évaluation des pratiques agroécologiques (l'approche participative) sur les parcelles de démonstration, les formations techniques et les échanges entre pairs. Les groupes de discussion ont été également faits pour recueillir les perceptions des producteurs incluant les hommes, les femmes et les jeunes. Les données quantitatives ont été collectées à l'aide de la méthode score en utilisant des cailloux. Une revue de littérature a été aussi faite pour collecter des données secondaires sur l'agroécologie au Bénin.

Concrètement, les informations ont été recueillies au moyen d'entretiens semi-structurés, de discussions de groupe et d'observations de terrain réalisées sur les sites des CEP. Les participants interrogés incluent à la fois les producteurs bénéficiaires, les responsables techniques et les coordonnateurs des programmes cités (ENABLE-TAAT, Rikolto, PRIMA).

Au total, sept (7) champs écoles paysans (CEP) ont été visités sur les spéculations : maïs, manioc, riz, culture maraîchère, pisciculture, culture pérenne.

Ecoles champs paysans des producteurs de riz

Focus groupe mixte (Hommes, jeunes et femmes) riziculteurs

Pratiques agroécologiques

La synthèse de la revue de littérature faite au niveau des Centres de recherches a révélé des pratiques agroécologiques comme : l'utilisation des extraits botaniques (l'extrait de neem, les engrais à base de tourteaux de neem), association de cultures avec la citronnelle, les champignons, la Vernonia amygdalina en tant que biopesticides et biofertilisants. A l'endroit de ces pratiques agroécologiques, plusieurs acteurs du secteur privé ont été identifiés dans le dynamisme d'adoption et de diffusion de ces alternatives agroécologiques : Eléphant vert, CIM-BIO, Biophyto, FUPRO-Benin (Fédération des Unions de Producteurs du Bénin).

Après les investigations, les résultats de cette étude ont montré que la diversification des cultures, l'associations et rotations culturales, la gestion intégrée des ravageurs, le compostage/ bokashi, l'agroforesterie et les techniques de conservation des sols sont des alternatives agroécologiques utilisées par les producteurs dans les champs. En plus de ces méthodes, le paillage, le vermicompostage (thé) ont été utilisés par les producteurs pour garder l'humidité du sol et faciliter la germination des cultures.

Lors de la plantation les cultures annuelles (maïs, manioc, riz), les producteurs adoptent des pratiques agroécologiques comme le labour réduit, le compost fabriqué à base des excréments des animaux, le fumier organique décomposé pour la restauration du sol, l'utilisation des semences locales paysannes conservées après récolte et l'analyse agroécosystème pour une prise de décision des producteurs dans le traitement ou non des cultures. Pendant les cultures pérennes, ils adoptent des pratiques agroécologiques comme l'interculture avec légumineuses et tubercules, l'application de microorganismes efficaces. Toutes ces méthodes sont accompagnées de fiches techniques dans lesquelles leurs principes et descriptions sont bien détaillés et mise à la disposition des animateurs des Champs Ecoles Paysans (CEP) et aussi à la disposition des producteurs en langue locale.

En termes d'adoption des meilleures pratiques agroécologiques dans les CEP visités, +2500 producteurs pratiquent les alternatives agroécologiques dans le maraîchage au sud du Bénin, +3000 producteurs pratiquent les alternatives agroécologiques dans la riziculture au centre du Bénin et +1200 producteurs pratiquent les alternatives agroécologiques dans la culture de maïs, manioc, et les cultures pérennes au nord du Bénin.

Avantages de l'agroécologie

L'agroécologie, au-delà d'un simple changement de pratiques culturales, génère des impacts multidimensionnels positifs pour les producteurs et leurs communautés.

Atténuation des changements climatiques

En matière d'atténuation du changement climatique, les pratiques agroécologiques telles que l'utilisation du compost et des fertilisants organiques permettent une réduction de 20 à 30"% de l'usage d'engrais chimiques, contribuant ainsi à la baisse des émissions de gaz à effet de serre.

Séquestration du carbone

L'introduction de haies vives et de systèmes agroforestiers favorise la séquestration de carbone estimée à 1,5–2 t CO_2/ha/an, renforçant ainsi le rôle des exploitations comme puits de carbone et contribue aussi à la restauration des sols.

Adaptation au climat

Les producteurs ayant adopté des techniques de paillage et de cultures de couverture (mucuna, stylosanthes) ont constaté une amélioration significative de la résilience de leurs systèmes de production.

Sécurité alimentaire

En moyenne, une hausse de 25"% des rendements en période de sécheresse a été enregistrée chez les producteurs de riz, ce qui se traduit également par une meilleure sécurité alimentaire des ménages, avec près de deux mois supplémentaires de disponibilité alimentaire par an.

Biodiversité

L'introduction de légumineuses et de haies vives dans les parcelles a permis d'accroître la diversité végétale de plus de 40" % dans l'exploitation agricole des jeunes. Une augmentation de 30" % de la présence des pollinisateurs, notamment des abeilles et autres insectes bénéfiques, a été observée dans les parcelles agroécologiques, ce qui renforce la productivité et la stabilité des écosystèmes agricoles.

Avantages économiques

Au niveau économique, les producteurs bénéficient d'une réduction notable des charges liées aux intrants chimiques, estimée entre 20 et 35" %. Grâce à la valorisation des récoltes issues des pratiques agroécologiques sur les marchés locaux, ils dégagent un profit supérieur de 15 à 20" % par rapport aux pratiques conventionnelles.

Focus groupe des femmes productrices de riz

Bienfaits pour la santé

L'utilisation des biopesticides et la réduction du recours aux intrants chimiques ont entraîné une diminution de 40"% des cas d'intoxication signalés dans les zones de production, ce qui réduit le coût d'opportunité liés aux durées d'hospitalisation, à la surveillance et aux dépenses pour les soins. En parallèle, la diversité alimentaire des ménages s'est enrichie avec l'intégration de cultures variées (moringa, légumes feuilles), permettant une amélioration de 25" % de l'indice de diversité alimentaire suivant, notamment dans les ménages dirigés par des femmes.

Égalité des sexes

La participation féminine est significative. Dans les CEP, les femmes représentent 45 à 50" % des bénéficiaires, renforçant leur rôle dans la prise de décision, mais aussi dans la gestion des revenus agricoles. Cette implication accrue se traduit par un pouvoir décisionnel renforcé au sein des ménages. Les femmes impliquées dans les jardins bio communautaires enregistrent même jusqu'à 30 % de revenus additionnels, ce qui contribue à leur autonomisation économique qui leurs permet de contribuer à l'éducation, l'alimentation, la santé et l'insertion communautaire.

Avantages pour la communauté

- Dans les zones de mise en œuvre du projet, l'adhésion au projet aux coopératives a augmenté de 30%, traduisant une dynamique collective renforcée.
- Les initiatives communautaires telles que les tontines, les échanges de semences ou les travaux communautaires favorisent la solidarité et renforcent la cohésion sociale.
- En matière de connaissances et capacités locales, environ 80% des producteurs formés dans les champs Écoles Paysans déclarent mieux comprendre la gestion rationnelle des sols, la lutte intégrée contre les ravageurs et les maladies des plantes.
- Ce savoir acquis ne reste pas individuel : en moyenne, chaque producteur formé transmet ses connaissances à deux ou trois autres, créant ainsi une diffusion horizontale des innovations agroécologiques.

Préparation du compost

Vermicompostage (Thé)

Application du compost sur les cultures

Défis et solutions

Malgré ses effets positifs observés sur l'agriculture, l'environnement et la santé, la mise en œuvre de l'agroécologie au Bénin se heurte à plusieurs défis majeurs, dont beaucoup pourraient être surmontés grâce à des mesures politiques appropriées. Parmi ces contraintes figure :

- Insuffisance de main-d'œuvre adéquate et expérimenté en agriculture biologique
- Faible accès aux systèmes d'irrigations
- Faible taux d'adoption des pratiques agroécologiques surtout chez les jeunes à cause des pratiques agroécologiques considérées comme chronophages Insuffisance des intrants organiques comme le fumier organique, le compost et les résidus de culture, Pression foncière et la petitesse des superficies cultivables, qui rendent difficile la mise en œuvre de systèmes intégrés tels que l'agroforesterie ou l'élevage combiné
- Coût élevé des produits issus des alternatives biopesticides et agroécologiques pour les consommateurs sans tenir compte à l'avantage liés à la santé
- Manque d'information et de marketing autour des produits issus des alternatives biopesticides et agroécologiques
- Manque de financement, de crédit et de subvention pour l'agriculture vert
- Faible taux d'engagement du pouvoir public et des investisseurs privés dans la promotion de l'agroécologie au Bénin

Cependant, des pistes de solutions sont suggérés par les producteurs et les acteurs du terrain à savoir :

- Mécanisation pour réduire la pénibilité du travail
- Création de centres communautaires de compostage pour renforcer la disponibilité en intrants organiques
- Sécurisation foncière et le développement des labels locaux, des marchés bio et la facilitation de l'octroi de la certification bio
- Renforcement de la capacité des acteurs par la sensibilisation, la formation et le plaidoyer pour un changement de comportement vers les pratiques agroécologiques pour la génération future
- Facilitation de l'accès au financement pour consolider l'adoption de l'agroécologie au Bénin

Leçons apprises

Une leçon clé tirée de cette étude est que les projets de développement à court terme (3 ans, renouvelables une fois) peuvent constituer des moyens importants pour stimuler l'apprentissage et l'adoption de pratiques agroécologiques. Mais pour garantir une adoption plus large à travers le Bénin, l'État devra institutionnaliser les champs de formation des agriculteurs afin de promouvoir l'agroécologie, établir un cadre juridique (loi et décret) en faveur de l'agroécologie, et s'engager à éliminer progressivement les pesticides hautement dangereux et à promouvoir des alternatives aux pesticides chimiques.

Paillage des champs de culture

Culture de mais

Recommandations

À la lumière des résultats de cette étude et des leçons tirées du terrain, plusieurs recommandations se dégagent pour renforcer l'adoption et la durabilité des pratiques agroécologiques au Bénin.

- *Sur le plan technique et opérationnel*, il est nécessaire de poursuivre et d'intensifier le renforcement des capacités des producteurs. Cela passe par une multiplication des formations pratiques dans les Champs Écoles Paysans (CEP), la diffusion de semences locales améliorées et d'intrants biologiques accessibles, ainsi que la valorisation des innovations locales adaptées aux réalités socio-culturelles des communautés. La promotion des fiches techniques traduites en langues locales doit également être systématisée afin de faciliter la vulgarisation des pratiques agroécologiques.
- *Au niveau économique et du financement*, des mécanismes d'appui financier ciblés doivent être mis en place. Des subventions sélectives pour les intrants organiques et des exonérations sur les taxes liées à ces intrants et aux produits agroécologiques pourraient encourager la transition vers l'agroécologie. L'accès au crédit et à la microfinance verte doit être facilité, en particulier pour les petits producteurs, les jeunes et les femmes, afin qu'ils puissent investir dans des équipements de travail, des intrants et des infrastructures d'irrigation.
- *Sur le plan institutionnel et politique*, la création de filières de commercialisation des produits bio, appuyée par des labels locaux de certification bio (SPG-Système participatif de garantie), contribuerait à mieux valoriser les produits agroécologiques et à accroître les revenus des producteur, faciliter l'intégration de l'agroécologie dans les politiques agricoles nationales est incontournable. Le Ministère de l'Agriculture et ses partenaires doivent définir des stratégies claires, alignées sur les objectifs de sécurité alimentaire et de développement durable, pour encadrer la transition agroécologique. Le renforcement des programmes de recherche appliquée sur les pratiques agroécologiques, ainsi que la

Désherbage

création d'espaces de dialogue multi-acteurs (producteurs, ONG, coopératives, instituts de recherche, autorités locales), permettront de favoriser une gouvernance inclusive et participative. Le lien est direct, car la réduction de l'usage des HHP nécessite **des alternatives locales crédibles et une coordination entre acteurs.** La recherche appliquée peut justement identifier et diffuser ces alternatives, tandis que le dialogue multi-acteurs permet de définir des stratégies concertées et durables. Cela prolonge naturellement la réflexion sur les risques liés aux HHP en proposant une solution systémique et collaborative ce qui correspond bien à l'esprit de l'agroécologie.
- *Au niveau réglementaire*, il est également nécessaire de mettre en place un cadre réglementaire et juridique (loi et décret) qui limite l'utilisation abusive des pesticides chimiques, élimine progressivement et, à terme, interdise les pesticides hautement dangereux (HHP), conformément aux accords des Nations unies.
- *Au plan environnemental*, les recommandations portent sur la conservation et la gestion durable des ressources naturelles. La rotation des cultures, l'agroforesterie, l'interculture et l'usage de cultures de couverture doivent être encouragés pour préserver la biodiversité et améliorer la fertilité des sols. Des mesures de gestion durable de l'eau, telles que la récupération des eaux de pluie et l'irrigation localisée, devraient être promues pour renforcer la résilience face aux sécheresses. En parallèle, il est crucial de sensibiliser davantage les producteurs aux enjeux du changement climatique afin de renforcer leur capacité d'adaptation et d'anticipation face aux événements climatiques extrêmes.

Recommandations (suite)

La mise en œuvre de ces recommandations constitue une étape essentielle pour ancrer durablement l'agroécologie dans les systèmes de production au Bénin, tout en améliorant la résilience des communautés rurales.

De façon générale, cette étude de cas a permis d'avoir une vue d'ensemble sur les pratiques agroécologiques installés dans les CEP mises en place par les projets, programmes et les initiatives au Bénin. Elle a montré aussi la nécessité d'engagement de l'État béninois à intégrer l'agroécologie dans les programmes d'action de développement.

Le tableau ci-dessous présente les principes agroécologiques, leur description, leur principe et leurs impacts sur plusieurs aspects.

Ressources clés

Les ressources présentées constituent des références essentielles pour comprendre les dynamiques et les enjeux de la transition agroécologique au Bénin et en Afrique subsaharienne. Elles mettent en évidence la nécessité d'un cadre politique favorable, de la recherche appliquée et d'approches participatives pour renforcer la durabilité des systèmes agricoles. Les travaux de la FAO et de l'AFSA offrent une vision globale et stratégique, tandis que ceux du MAEP et de l'INRAB fournissent des orientations et résultats spécifiques au contexte béninois. Enfin, les rapports du PAN International et du PAN Africa soulignent les risques liés à l'usage des pesticides hautement dangereux (HHP) et la pertinence des alternatives agroécologiques pour protéger la santé, l'environnement et la souveraineté alimentaire.

- **PAN International. 2023.** List of Highly Hazardous Pesticides (HHPs). Pesticide Action Network International, Hamburg. https://pan-international.org (Liste mondiale de référence identifiant les pesticides hautement dangereux et proposant des alternatives agroécologiques durables.)
- **Ministère de l'Agriculture, de l'Élevage et de la Pêche (MAEP). 2019**. Stratégie nationale de développement de l'agriculture durable et plan d'action agroécologique 2019–2025. MAEP, Cotonou, Bénin. (Document de politique nationale définissant les axes stratégiques de promotion de l'agroécologie au Bénin.)
- **Institut National des Recherches Agricoles du Bénin (INRAB)**. 2024. Rapport annuel sur les innovations agricoles durables. INRAB, Cotonou, Bénin. (Rapport de recherche appliquée présentant les résultats sur les innovations agroécologiques et la gestion intégrée des ravageurs.)
- **Alliance for Food Sovereignty in Africa (AFSA)**. 2022. Agroecology for Resilient Food Systems in Africa. AFSA, Kampala. https://afsafrica.org (Recueil d'études de cas africaines démontrant les impacts positifs de l'agroécologie sur la résilience, la sécurité alimentaire et la durabilité des systèmes agricoles.)
- **Pesticide Action Network Africa (PAN Africa)**. 2022. État des pesticides hautement dangereux en Afrique de l'Ouest. PAN Africa, Dakar, Sénégal. (Analyse régionale des effets des HHP sur la santé humaine et l'environnement, présentant des alternatives agroécologiques adaptées au contexte ouest-africain.)

Annex: Tableau synthétique des méthodes

Méthodes agroécologiques	Description / Objectif	Principes de l'agroécologie	Impact sur l'atténuation au changement climatique	Impact sur l'adaptation au climat	Impact sur la biodiversité	Impact économique	Impact sur la santé socio-	Genre et Equité
Rotation des cultures	Alterner différentes cultures sur une même parcelle pour réduire les maladies et améliorer la fertilité du sol	Diversification, Synergie, Santé des sols	Réduction de l'usage d'engrais chimiques (20–30%), baisse des émissions de GES	Amélioration de la résilience, hausse des rendements (+25% en période de sécheresse)	Diversité végétale accrue (+40%), augmentation des pollinisateurs (+30%)	Réduction des charges liées aux intrants (20–35%), marge nette +15–20%	Diminution des cas d'intoxication (-40%), alimentation diversifiée (+25%)	Participation féminine 45–50%, pouvoir décisionnel accru au sein des ménages
Association de cultures / cultures intercalaires	Cultiver plusieurs espèces sur la même parcelle pour optimiser l'usage des ressources et limiter les ravageurs	Diversification, Synergie, Réduction des intrants	Moins d'engrais chimiques, amélioration de la fertilité des sols	Résilience accrue grâce aux cultures de couverture (mucuna, stylosanthes)	Diversité végétale et présence accrue d'insectes bénéfiques (+30%)	Valorisation sur les marchés locaux, marge nette supérieure (+15–20%)	Réduction de l'utilisation de pesticides chimiques, amélioration de la sécurité alimentaire	Revenus additionnels pour les femmes (+30%) dans les jardins communautaires
Agroforesterie	Intégration d'arbres et d'arbustes dans les systèmes agricoles pour améliorer la fertilité et la biodiversité	Diversification, Synergie, Conservation des ressources	Séquestration de carbone (1,5–2 t CO_2/ha/an), puits de carbone	Amélioration de la résilience et restauration des sols	Accroissement de la diversité végétale (+40%), habitats pour pollinisateurs	Réduction des intrants, augmentation des marges nettes	Alimentation enrichie (moringa, légumes feuilles), diversité alimentaire (+25%)	Participation communautaire accrue (+30% adhésion coopératives), solidarité renforcée
Vermi composte /fertilisation organique	Utilisation de matières organiques pour fertiliser le sol	Réduction des intrants, Santé des sols, Recyclage des nutriments	Réduction de l'usage d'engrais chimiques (20–30%), baisse des émissions de GES	Amélioration de la fertilité et résilience des systèmes de production	Augmentation de la diversité végétale et microbienne des sols	Réduction des charges d'intrants chimiques (20–35%)	Moins d'intoxications liées aux produits chimiques, meilleure santé des producteurs	Autonomisation des femmes grâce aux revenus additionnels issus de la valorisation

Annex: Tableau synthétique des méthodes

Méthodes agroécologiques	Description / Objectif	Principes de l'agroécologie	Impact sur l'atténuation au changement climatique	Impact sur l'adaptation au climat	Impact sur la biodiversité	Impact économique	Impact sur la santé socio-	Genre et Equité
Paillage / couverture du sol	Protection du sol contre l'érosion et maintien de l'humidité	Conservation des ressources, Santé des sols, Réduction des intrants	Conservation de l'humidité, limitation de l'usage d'intrants chimiques	Hausse des rendements (+25% en période de sécheresse)	Maintien de la couverture végétale, accroissement de la diversité	Réduction des coûts de production, marges nettes supérieures	Amélioration de la sécurité alimentaire (2 mois supplémentaires de disponibilité alimentaire)	Femmes impliquées dans la gestion des parcelles et la sécurité alimentaire des ménages
Biopesticides / lutte intégrée	Contrôle des ravageurs avec des méthodes biologiques et minimisation des pesticides chimiques	Réduction des intrants, Synergie, Santé des cultures	Moins d'émissions liées aux intrants chimiques	Meilleure protection des cultures contre les ravageurs et maladies	Préservation des pollinisateurs et auxiliaires naturels	Réduction des charges liées aux intrants chimiques	Diminution des cas d'intoxication (-40%), meilleure santé des producteurs	Femmes davantage impliquées dans les décisions de production et la gestion des revenus
Gestion de l'eau (récupération, goutte-à-goutte)	Optimisation de l'utilisation de l'eau et adaptation au climat	Conservation des ressources, Efficacité énergétique, Résilience climatique	Optimisation de l'usage de l'eau, réduction de l'empreinte environnementale	Renforcement de la résilience face à la sécheresse (+25% rendements en riz)	Soutien indirect aux cultures diversifiées et à la faune	Réduction des coûts liés à la gestion de l'eau, meilleure rentabilité	Sécurité alimentaire accrue grâce à la disponibilité en eau	Femmes bénéficiaires dans les CEP (45–50%) et rôle renforcé dans la gestion de l'eau
Culture de couverture / légumineuses	Amélioration de la fertilité et réduction de l'érosion	Diversification, Santé des sols, Réduction des intrants	Réduction de l'usage d'engrais chimiques grâce à la fixation de l'azote	Amélioration de la résilience des systèmes de production et restauration des sols	Diversité végétale accrue (+40%), habitats pour pollinisateurs	Réduction des charges d'intrants, meilleure rentabilité	Amélioration de la qualité de l'alimentation (moringa, légumes feuilles)	Implication significative des femmes (+30% revenus additionnels, 45–50% bénéficiaires CEP)

Concombre bio

Cette étude de cas a été réalisée par GAPROFFA en collaboration avec PAN International. Elle fait partie d'une série d'études PAN menées à travers le monde présentant les avantages et les contributions de l'agroécologie à la résilience climatique, à la sécurité alimentaire, à la santé et à la protection de la biodiversité. Cette série est produite par les membres du groupe de travail sur l'agroécologie de PAN International.

Le financement nécessaire à l'élaboration de cette étude de cas a été fourni par Global Greengrants Fund.

Réseau d'action contre les pesticides -PAN selon son acronyme anglais - est une coalition mondiale regroupant plus de 600 organisations non gouvernementales, institutions et particuliers dans 90 pays, qui œuvrent pour remplacer les pesticides dangereux par des alternatives écologiques et socialement justes.

Web: pan-international.org
Facebook: PesticideActionNetworkInternational
BlueSky: @pesticideaction.bsky.social

Groupe d'Action pour la Promotion et la protection de Flore et de la Faune (GAPROFFA)

Depuis 2006, GAPROFFA œuvre pour la gestion rationnelle des produits chimiques et de leurs déchets au Bénin. Elle collabore étroitement avec le Ministère du Cadre de Vie et du Développement Durable et plusieurs réseaux internationaux (PAN-Afrique, IPEN), contribuant à l'élaboration de lois, à la mise en œuvre des conventions environnementales (Stockholm, Minamata) et à la sensibilisation des acteurs sur les risques chimiques.

Dr Adetonah Sounkoura, Présidente, avec l'assistance de; Mme Houéfondé Ekouya Suzanne, Assistante

Localisation : Cotonou, République du Bénin
Tel : (+229) 95058694
Courriel : gaproffa@yahoo.fr , s.adetonah@yahoo.fr
Facebook: @GAPROFFA

PAN
pesticide action network international

ASSOCIATION JEUNESSE POUR L'ENVIRONNEMENT ET LE DEVELOPPEMENT DURABLE (AJEDD)

CARTOGRAPHIE DES PRATIQUES AGROÉCOLOGIQUES AU BURKINA FASO

Cartographie des pratiques agroécologiques au Burkina Faso

Introduction générale

Le Burkina Faso, à l'instar de nombreux pays sahéliens, fait face à des défis majeurs liés à la dégradation des ressources naturelles, à l'insécurité alimentaire, à la pauvreté rurale et aux effets croissants du changement climatique. Dans ce contexte, l'agriculture conventionnelle, largement dépendante des intrants chimiques, montre ses limites en termes de durabilité écologique et de résilience des exploitations familiales.

Face à cette situation, l'agroécologie émerge comme une alternative crédible, inclusive et durable, combinant savoirs endogènes, innovations écologiques et équité sociale. Depuis les années 1990, plusieurs initiatives ont vu le jour au Burkina Faso, portées aussi bien par des organisations paysannes, des ONG, des institutions de recherche que par des politiques publiques.

La présente cartographie s'intéresse à des pratiques agroécologiques majeures développées et diffusées au Burkina Faso. Elle s'appuie sur des visites terrain notamment la ferme bocagère de Guè, les maraîchers de la ville de Ouagadougou (zone tampouy, tanghin), et la coopérative des producteurs de légumes de Koupéla et sur la documentation nationale existante, les stratégies et plans d'action sur l'agroécologie, ainsi que sur des expériences pilotes et des publications scientifiques. L'objectif est de fournir une analyse technique, scientifique et socio-économique complète pour orienter les décideurs, les partenaires techniques et financiers, ainsi que les acteurs communautaires dans la mise à l'échuelle de ces pratiques.

Organisation cheffe de file : Association Jeunesse pour l'Environnement et le Développement Durable (AJEDD)
Partenaires impliqués : Terre Verte, groupement des producteurs, l'entreprise K
Donateurs : Global Greengrants Fund

A. LE BOCAGE SAHÉLIEN (WÉGOUBRI)

Contexte & résumé des approches

Le bocage sahélien (« wégoubri ») est une pratique agroforestière structurée autour d'un maillage continu de haies vives, diguettes, mares et clôtures, visant à restaurer les paysages dégradés du Sahel. Il se définit comme un paysage rural de prairies et/ou de champs entourés de haies vives et de bois. Le bocage est un milieu équilibré créé par l'Homme où il associe l'arbre, la culture et l'élevage et où l'Homme et la Nature vivent en harmonie.

Au Sahel, la première vocation du bocage est de garder l'eau de la pluie là où elle tombe par des aménagements de diguettes, de mares et de haies vives, afin d'atténuer l'action érosive des eaux de la mousson et de maintenir la biodiversité d'un milieu extrêmement fragile. Il est mis en œuvre au Burkina Faso par l'ONG Terre Verte qui a une expérience d'environ 30 ans. Né d'expériences pilotes (fermes de Guiè, Filly, Barga, etc.), le bocage répond aux problèmes d'érosion, ruissellement, dégradation des sols, surpâturage et perte de biodiversité, en recomposant des « communs » et des parcelles individuelles. Il englobe à la fois des dimensions techniques (digues, haies, bullis), institutionnelles (copropriété coutumière) et socio-économiques (travaux à haute intensité de main-d'œuvre, emplois locaux). (Nassirou Y. ; Wegoubri 2024). De nos jours, cette technique est utilisée dans la province de Bassitenga (région de l'Oubri), la province du Yatenga (région du Yaadga), la province du Zandoma (région du Yaadga) et la province du Sandbondtenga (région de Kuilsé) par l'ONG Terre Verte à travers les associations inter villages.

En dehors des périmètres aménagés, des producteurs hors périmètre tentent de dupliquer la technologie de façon partielle dans ces localités; preuve qu'elle permet d'accroître les rendements.

Activités du projet, adoption et mise en œuvre

Activités observées dans les périmètres pilotes : études de site, arpentage, création de pépinières (semis, marcottage, greffage), construction de diguettes en terre, installation de haies mixtes (grillage + arbustes), creusement de bullis (marres), dispositifs de clôture, formation d'apprentis, création de comités de gestion foncière. La mise en œuvre suit une démarche participative avec rémunération de main-d'œuvre locale et transfert de compétences.

Exemples chiffrés : Avec le bocage, environ 1 581 ha ont été aménagés avec plus de 541 familles bénéficiaires. Coût indicatif d'aménagement : 600–800 EUR/ha.

Rendements sorgho observés dans les périmètres bocagers : 2,7–3,2 t/ha (contre rendements traditionnels de 500 Kg à 1 t/ha sur terrain non aménagé bien).

Pratiques agroécologiques (techniques concrètes)

- Conception de périmètres bocagers (parcelles + communs).
- Haies vives mixtes (espèces locales : Cassia, Combretum, Parkia, Sclerocarya, etc.).
- Diguettes, banquettes, retenues d'eau (boulis) et canaux de dérivation.
- Semis direct d'arbustes en tranchées ; pépinières locales pour espèces endémiques.
- Rotation culturelle intégrée (zaï / jachère pâturée / cultures légumineuses).
- Intégration élevage-agriculture (pâturage contrôlé, fumier pour compost).

Avantages

Impact sur l'atténuation du changement climatique

Le bocage favorise la séquestration de carbone via l'augmentation de la biomasse arborée et du stock de carbone du sol (gain progressif à moyen terme). Les haies et arbres stockent du carbone et réduisent la pression de coupe sur les forêts lointaines (effet indirect).

Quantification : variable selon densité/espèces ; estimations pilotes suggèrent gains significatifs par ha sur 5–10 ans.

Adaptation au changement climatique

Haies + diguettes + bullis améliorent la régulation hydrique, reconstituent les microclimats, protègent cultures et fourrages contre sécheresses, augmentent la résilience des rendements et réduisent la vulnérabilité alimentaire. Le bocage facilite des rotations productives résilientes aux pluies erratiques.

Avantages socio-économiques

Coûts initiaux : 600–800 EUR/ha (aménagement). Ces coûts sont supportés par l'ONG Terre Verte à travers des dons et subventions. Bénéfice observé : +150–300 EUR/ha/an (valorisation rendement). Potentiel de diversification (production fruitière, bois d'œuvre, fourrage, néré, etc.); ce qui donne des revenus additionnels et amortisse les investissements sur quelques années. Augmentation des rendements agricoles (observations pilotes : 2×–3×). Diversification des sources de revenus (bois énergie, fruits, fourrages, produits forestiers non ligneux).Création d'emplois locaux et renforcement du tissu socio-économique.

Impact sur la biodiversité

Recréation d'écotones; Retour d'espèces disparues; Augmentation de la diversité floristique et faunistique (pollinisateurs, microfaunes du sol); Les haies constituent des corridors et refuges.

Genre

Les périmètres bocagers impliquent hommes, femmes et jeunes ; les haies fournissent ressources (fourrage, fruits) bénéfiques pour activités féminines (transformation, commercialisation). Programmes pilotes rapportent inclusion active des femmes (formation, pépinières), mais il faut renforcer accès foncier et crédit pour les femmes.

Avantages santé socio-environnementale

Réduction des pratiques de brûlis; Meilleure qualité de l'air local (moins de chauffe au bois); Alimentation diversifiée (fruits, graines); Amélioration de l'hygiène eau (bullis); Réduction de l'exposition aux pesticides chimiques ce qui contribuent à améliorer la santé; Restauration rapide de la fertilité et de la structure du sol; Réduction du ruissellement et de l'érosion ; meilleure infiltration des pluies.

Leçons

Le bocage permet aux producteurs bénéficiaires de s'organiser en coopérative pour une meilleure gestion de leur périmètre. Ainsi, des sessions de sensibilisation et de formation sont faites aux profits des bénéficiaires pour leur accompagnement dans la gestion rationnelle du périmètre. Terre Verte, via les associations inter villages qui font la promotion du bocage sahélien, organise des concours annuels pour récompenser les meilleures productions, les meilleurs périmètres.

Défis

Les défis rencontrés peuvent être les suivants: Coûts initiaux élevés des aménagements; Insécurité foncière; Manque de financement durable; Contexte sécuritaire fragile dans certaines zones.

Recommandations

Inviter le gouvernement à accompagner la mise à l'échelle du bocage avec des mécanismes de financement adaptés (subvention ciblée), la formalisation juridique des copropriétés bocagères, le renforcement des pépinières locales, l'intégration du bocage dans les Plans Communaux de Développement, la formation continue. Reporter les résultats du bocage sur la plateforme MRV (Mesure, rapport et vérification).

Témoignage d'un exploitant familial

« Après l'aménagement bocager, des espèces ont réapparu, les rendements de sorgho sont élevés et nous vendons les herbes. »

Haies mistes de deux parcelles séparer par une piste.

Parcelles laissée pour jachere.

Champs de sorgho blanc.

Champs de sorgho rouge avec le zaï.

B. ZAÏ ET DEMI-LUNES

Contexte & résumé des approches

Zaï et demi-lune sont des pratiques traditionnelles améliorées destinées à capter l'eau et concentrer les amendements organiques autour de la plante, permettant la restauration de sols très dégradés dans des conditions de pluviométrie faible (ex. 400–500 mm/an). Le zaï est historiquement développé dans le Yatenga ; il consiste en alvéoles creusées remplis de compost/fumier. Il est utilisé un peu partout au Burkina Faso.

Les demi-lunes (demi-lune creusée en courbe) permettent la collecte de ruissellement sur de plus grandes surfaces.

Aujourd'hui, ces pratiques sont utilisées dans tout le Burkina Faso, en particulier dans les régions de Yaadga, Soum et Liptako, ainsi que dans les régions de Kuilsé, Nando et Oubri

Activités projet, adoption et mise en œuvre

Le projet de promotion du zaï et des demi lunes comprenait : la formation des agriculteurs, l'organisation de chantiers collectifs (travaux à forte intensité de main-d'œuvre), la fourniture de compost ou le soutien aux stations de compostage, la distribution de semences résistantes, le soutien logistique (outils) et des démonstrations sur des parcelles de terre. Ces pratiques de conservation de l'eau et des sols ont été diffusées par le biais de fermes pilotes et de réseaux d'agriculteurs.

Adoption croissante: L'adoption de ces pratiques par les agriculteurs a augmenté grâce à des démonstrations de rendement et à la capitalisation via des pépinières et le compostage. Les rendements de la demi-lune + fumier peuvent atteindre 1,2 à 1,6 t/ha de sorgho contre des rendements en grains de 112"% et en paille de 49"% pour le zaï par rapport aux champs non aménagés.

Pratiques agroécologiques

- **Zaï :** creusement d'alvéoles (~30 cm diam., 15–20 cm profondeur), remplissage de compost/fumier, semis au bord.
- **Demi-lune :** creusement d'une cuvette en forme de demi-lune captant ruissellement, plantation d'arbustes/semis.
- **Compléments** : paillage, association de cultures (céréales + légumineuses), fumure organique, jachères pâturées contrôlées.

Champ préparé avec le Zaï, amendé de compost

Avantages

Impact sur l'atténuation du changement climatique

Amélioration de la matière organique du sol augmentation du stock de carbone organique ; réduction de la pression sur les forêts (moins de déboisement). La quantification locale est rendue possible grâce à la surveillance des sols (SOC).

Impact sur l'adaptation au changement climatique

Les zaï/demi-lunes augmentent la résilience face aux précipitations irrégulières, permettent des récoltes plus fiables et réduisent le risque de mauvaises récoltes, améliorant ainsi la sécurité alimentaire.

Avantages économiques

Augmentation des rendements (dans les projets pilotes, le zaï a montré des gains significatifs), réduction des achats d'intrants chimiques si le compost est utilisé correctement ; coûts : faibles frais de main d'œuvre, investissement dans le compost. Rentabilité positive souvent dès la première ou la deuxième année. Faible coût technologique grâce au travail manuel, forte appropriation paysanne.

Biodiversité

Restauration de la microfaune du sol, meilleure structure biologique, possibilité d'introduire arbres et haies qui attirent pollinisateurs et faune auxiliaire. Contribue à la restauration organique du sol et recharge en matière organique.

Genre

Les femmes sont impliquées à travers la production, et l'épandage du compost dans les trous creusés.

Santé socio-environnementale

Réduction de l'utilisation d'intrants chimiques, amélioration de la qualité des aliments, réduction des risques liés à la toxicité des pesticides. Favorise levée rapide et implantation même avec faibles pluies ; rendement amélioré dès la 1re année.

Leçons

L'accès au compost est un goulot d'étranglement ; l'association élevage/ agriculture permet l'approvisionnement en fumier.

Défis

Disponibilité continue d'amendements organiques, besoin de mécanisation légère pour le creusage à grande échelle, nécessite une abondance de main-d'œuvre.

Recommandations

Création de sites de compostage communautaires, appui matériel pour creusage, boîte à image-une ressource visuelle de mise en place et d'extension des techniques en langues locales pour les communautés locales; nécessité de garantir l'accès des femmes aux parcelles et au compost.

Témoignage d'un Producteur du Yatenga

« Le zaï m'a permis de semer plus tôt et d'avoir une récolte même quand les pluies étaient faibles. »

Maïs produit avec le Zaï

Démi-lunes pratiquées dans un champ

Evolution du Maïs avec la technique des démi-lune

C. BIOPESTICIDES (FABRICATION ET USAGE LOCAUX : APPICHI, KOGLE-ZANGA, ME, ENGRAIS LIQUIDE)

Contexte & résumé des approches

Les biopesticides et bio-intrants développés localement (préparations à base de piment, ail, gingembre, neem, cendre, micro-organismes efficaces (ME)) répondent au besoin de réduire l'usage de pesticides synthétiques, de maîtriser les coûts et d'améliorer la sécurité sanitaire.

De plus, en réduisant la dépendance aux intrants chimiques fabriqués à partir de combustibles fossiles, ces biopesticides atténuent également le changement climatique et renforcent l'adaptation au climat. Le Burkina dispose d'un tissu d'expériences locales documentées (recettes traditionnelles améliorées et protocoles de fabrication).

Les biopesticides sont produites localement par certaines ONGs et associations pour accompagner leur pratique agroécologique. C'est le cas pour l'association Béog néeré agroécologie, l'AJEDD, l'Association pour la Recherche et la formation en Agroécologie, l'ONG Manetese. Aux côtés de ces structures, nous retrouvons d'autres acteurs dans la chaîne de production et de commercialisation. C'est le cas de Faso Intrant Agricole, de la société Koob Tuuma à Ouagadougou.

Les biopesticides sont beaucoup utilisés dans le maraîchage et dans les périphéries de Ouagadougou où se pratique le maraîchage, il utilise une quantité accrue mélangée aux pesticides chimiques.

Activités projet, adoption et mise en œuvre

Activités : ateliers de formation à la fabrication (Appichi, Kogle-zanga), démonstrations en parcelles, diffusion de fiches techniques, constitution d'unités locales de production, contrôle qualité de base (temps fermentation, dilution), diagnostic des ravageurs. Adoption croissante en maraîchage et pépinières.

Pratiques agroécologiques (recettes & protocoles)

- **APPICHI** : gingembre, piment rouge, ail, alcool, fermentation (processus 15 jours) - dilution avant pulvérisation (0,5 L/15 L eau ou selon recette).
- **Kogle-zanga** : piment sec, ail, oignon, savon local, huile de neem — 3 solutions mixées - application préventive 1×/semaine (50–80 mL/15 L selon culture).
- **Micro-organismes efficaces (ME)** : préparation à base de terre forestière, sucre, lait, son ; fermentation 21 j - utilisation foliaire (dilutions 1 l/16 l d'eau).
- **Engrais liquide** : mélange de différentes matières organiques fermentées 14 j - dilution 1L/20L d'eau ; usage pépinières/jardins.

Ces bio pesticides sont utilisés contre les insectes tels que la mouche blanche, les pucerons, les cochenilles et les chenilles.

Note sécurité : respecter dilutions, période de fermentation et équipements de protection ; formation à la toxicologie des ingrédients (piment, alcool).

Avantages

Atténuation du changement climatique

Réduction émission liée à production/importation d'intrants chimiques (transports, fabrication), et à l'utilisation d'intrants minéraux. Stockage de carbone indirect via une meilleure santé du sol avec engrais organiques.

Adaptation au changement climatique

Meilleure protection des cultures, réduction des pertes liées aux ravageurs/pestes ; sécurité alimentaire accrue et résilience économique des ménages.

Avantages socio-économiques

Faibles coûts de production (ingrédients locaux) - réduction dépenses intrants ; potentiel commercial local (vente aux groupements, maraîchers).

Réduction de dépendance aux pesticides chimiques coûteux et dangereux ; coûts de production faibles (ingrédients locaux). Empowerment local (production locale, création d'emplois).

Biodiversité

Moins d'impact non ciblé sur insectes auxiliaires et microfaune ; conservation de pollinisateurs ; amélioration du sol à long terme.

Egalité des sexes

Production/petites unités de fabrication favorisent l'insertion économique des femmes (petites entreprises, tontines) ; formation ciblée recommandée pour autonomiser les productrices.

Santé socio-environnementale

Moins d'exposition aux pesticides toxiques pour agriculteurs et consommateurs ; meilleure qualité sanitaire des aliments ; bénéfices pour la santé publique. Produits biodégradables ; faible résidu des pesticides dans aliments.

Leçons

Biopesticides locaux efficaces en prévention; qualité et standardisation essentielles; Il est essentiel de maintenir la qualité et la normalisation; une formation continue est indispensable.

Défis

Variabilité qualité (concentrations), besoins en conservation/stabilité, acceptation marchande des biopesticides, absence de cadre réglementaire national pour biopesticides.

Recommandations

Standardisation protocoles, appui laboratoires pour analyses de toxicité et efficacité, certifications locales/labels, intégration dans Stratégie Nationale de l'Agroécologie (SNAE) comme intrant autorisé, étudie modèles d'affaires (unités collectives de production, micro-entreprises).

Témoignage d'une productrice maraîchère

« Le Kogle-zanga nous a permis de réduire les dégâts de mouches blanches ; je vends davantage et j'ai réduit mes dépenses en pesticides. »

Bocal vide de biopesticide

Equipe AJEDD échangeant avec un producteur entrain de'utiliser l'APPICHI

Biopesticide APPICHI

SYNTHÈSE COMPARATIVE & CONTRIBUTIONS GLOBALES

Adaptation (résilience)

Ces pratiques contribuent ensemble à réduire la vulnérabilité climatique des systèmes agricoles et à stabiliser revenus et sécurité alimentaire.

- **Bocage**: rétention eau, protection cultures, microclimats, sécurité fourragère.
- **Zaï/demi-lune:** levée précoce, récoltes plus sûres, restauration du sol.
- **Biopesticides**: préservation des récoltes face à des ravageurs, réduction des pertes.

Atténuation (réduction émissions)

- **Bocage & haies:** séquestration carbone (biomasse/sol).
- **Biopesticides & engrais bio:** réduction usages intrants minéraux (empreinte carbone de production et transport).
- **Charbon vert & valorisation déchets:** réduction déforestation et émissions liées à production Bois-énergie traditionnelle.

Impacts socio-économiques et de gouvernance

- Création d'emplois verts (pépinières, unités biopesticides, transformation).
- Modèles de copropriété (bocage) et gouvernance locale renforçant cohésion sociale.
- Besoin récurrent d'accès au financement, formalisation juridique, intégration dans politiques locales/planification.

Recommandations opérationnelles

Le Burkina Faso a d'ors et déjà franchi une étape importante avec l'adoption de la Stratégie nationale de l'agroécologie (SNAE), qui traduit l'engagement du gouvernement à promouvoir une agriculture durable, inclusive et résiliente. Pour concrétiser pleinement cette vision, il demeure nécessaire que les décideurs nationaux et locaux doivent également:

- Investir dans la recherche, la vulgarisation et l'éducation en matière d'agroécologie, afin de permettre aux producteurs d'adopter plus largement les pratiques durables sur l'ensemble du territoire.
- Renforcer les mesures existantes par des politiques cohérentes, des mécanismes juridiques et financiers adaptés, et des programmes de soutien ciblés.

Ces actions renforceront la souveraineté alimentaire, restaureront les écosystèmes et consolideront la résilience économique et environnementale des communautés rurales.

Nos recommandations opérationnelles spécifiques visant à soutenir l'expansion du bocage sahélien, les zaïs et demi-lunes pour la conservation de l'eau et des sols, et la production et l'utilisation de biopesticides comprennent les éléments suivants:

1. **Financer pépinières & aménagement bocager** via fonds dédiés + microcrédit.
2. **Institutionnaliser** les périmètres bocagers (statut juridique), intégrer dans PCD.
3. **Créer des centres de compostage communautaires** pour approvisionner zaï/demi-lunes.
4. **Reporter ces cas pratiques sur la plateforme MRV** pour capitaliser les données (ha, rendement, emplois).
5. **Former et certifier les acteurs locaux** (production biopesticides, entretien haies, suivi MRV).
6. **Standardiser & valider** les recettes de biopesticides en laboratoire (sécurité/efficacité).

Annex: Tableau synthétique des méthodes (extrait)

Pratique	Principales étapes	Intrants	Coût indicatif	Rendement/effet attendu
Bocage (périmètre)	Étude site - pépinière - diguettes - haies + clôtures - suivi	Plantes locaux, grillage, main-d'œuvre	600–800 EUR/ha (financé par Terre Verte à travers la collecte de dons et de subvention)	Rendements sorgho augmentent 2–3× en 3–4 ans
Zaï	Creuser alvéoles - apporter compost - semis	Compost, outils manuels	Main-d'œuvre élevée	Récolte même en pluies faibles
Demi-lune	Tranchée cuvette - plantation arbres/semis	Outillage, plantes	Variable	Rétention ruissellement, régénération végétale
APPICHI / Kogle	Mélange ingrédients locaux - fermentation - dilution pulvérisation	Piment, ail, alcool, neem, savon	Très faible (ingrédients locaux)	Réduction ravageurs, substitution pesticides

Ressources clés:

- Yarbanga N., 2024. Wégoubri
- Baudin F. 2017. Wégoubri. Un bocage au Sahel. Entretiens avec Henri Girard. Editions Culture-Environnement-Médias. https://www.cemfrance.eu/produit/wegoubri-un-bocage-au-sahel-2
- Terre Verte. 2021. Rapport annuel 2020 de la Ferme pilote de Filly. https://eauterreverdure.org/publications/documents

Cette étude de cas a été réalisée par l'Association Jeunesse pour l'Environnement et le Développement Durable (AJEDD) en collaboration avec PAN International. Elle fait partie d'une série d'études PAN menées à travers le monde présentant les avantages et les contributions de l'agroécologie à la résilience climatique, à la sécurité alimentaire, à la santé et à la protection de la biodiversité. Cette série est produite par les membres du groupe de travail sur l'agroécologie de PAN International. Le financement nécessaire à l'élaboration de cette étude de cas a été fourni par Global Greengrants Fund.

Réseau d'action contre les pesticides -PAN selon son acronyme anglais - est une coalition mondiale regroupant plus de 600 organisations non gouvernementales, institutions et particuliers dans 90 pays, qui œuvrent pour remplacer les pesticides dangereux par des alternatives écologiques et socialement justes.

Web: pan-international.org
Facebook: PesticideActionNetworkInternational
BlueSky: @pesticideaction.bsky.social

Association Jeunesse pour l'Environnement et le Développement Durable (AJEDD)

Créée en 2017, AJEDD est une organisation burkinabè de la société civile engagée dans la protection de l'environnement, la promotion de l'agriculture durable et la mobilisation de la jeunesse pour un développement inclusif et respectueux des écosystèmes.

Localisation : Ouagadougou, Burkina Faso
Tel : +226 76680425
Courriel : ajedd.fburkina@gmail.com
Facebook: @AJEDD.Burkina

See the full series in a number of languages via the QR code

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.

Web: pan-international.org

Bluesky: paninternational.bsky.social

Facebook: PesticideActionNetworkInternational

Linkedin: Pesticide Action Network International

La Red de Acción Internacional contra los Pesticidas (PAN, por sus siglas en inglés) es una coalición mundial de más de 600 organizaciones no gubernamentales e instituciones participantes en 90 países, que trabaja para sustituir los plaguicidas peligrosos por alternativas ecológicas y socialmente justas.

Réseau d'action contre les pesticides - PAN selon son acronyme anglais - est une coalition mondiale regroupant plus de 600 organisations non gouvernementales, institutions et particuliers dans 90 pays, qui œuvrent pour remplacer les pesticides dangereux par des alternatives écologiques et socialement justes.