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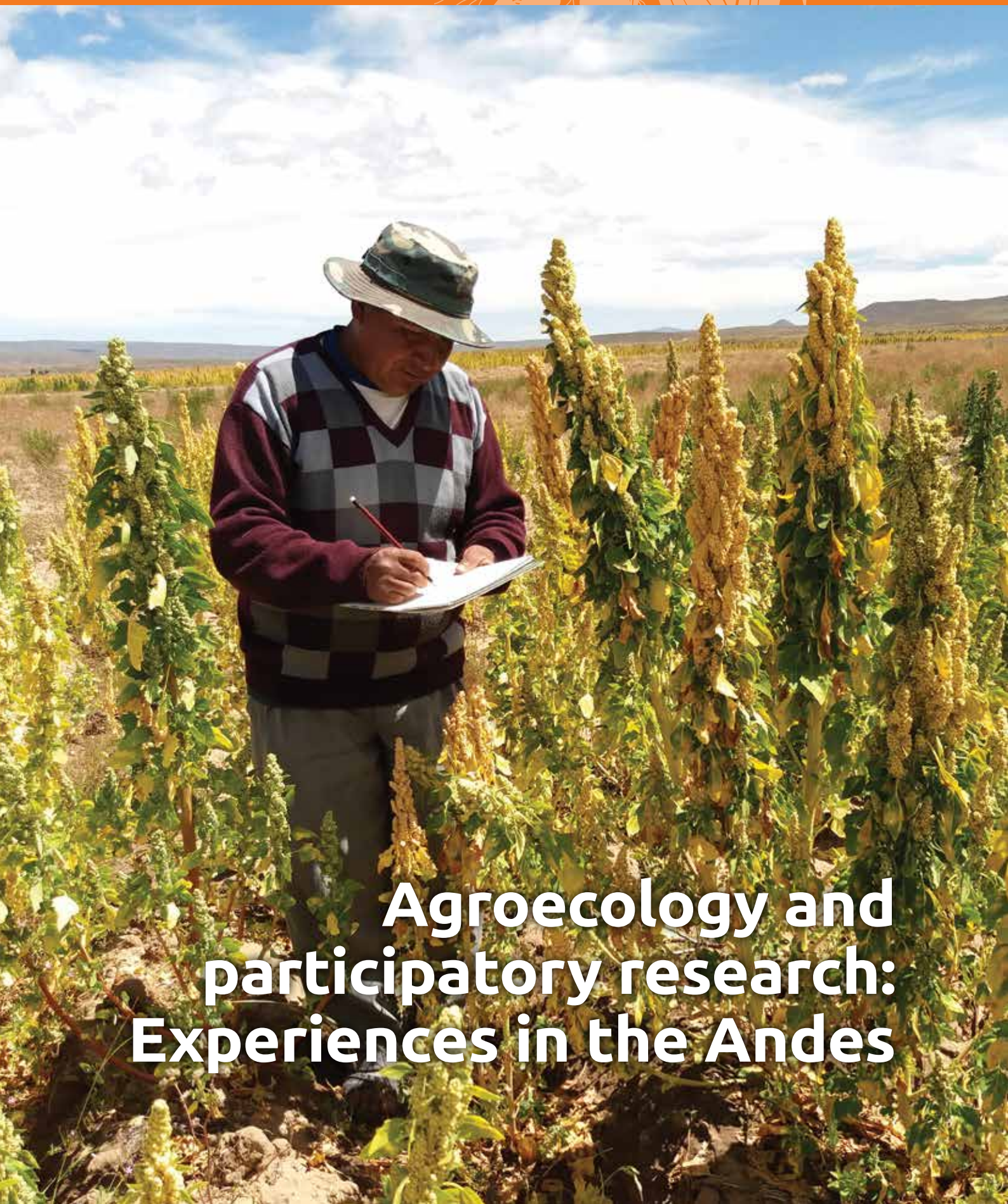

Agroecology and participatory research: Experiences in the Andes

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LEISA revista de agroecología is a member of **The AgriCultures Network**, which is comprised by four organizations that are responsible for publishing magazines about small-scale sustainable agriculture around the world:

- **LEISA revista de agroecología** (Latin America, in Spanish)
- **LEISA India** (in English, Kannada, Tamil, Hindi, Telugu and Oriya)
- **AGRIDAPE** (West Africa, in French)
- **AGRICULTURAS Experiencias en agroecología** (Brazil, in Portuguese)

In this number:

Dear readers:

LEISA 37-1, the first magazine of 2021, is a special edition dedicated to the presentation of the research experiences of the Community of Practice in the Andes (CoP) of the Collaborative Crop Research Program (CCRP), supported by The McKnight Foundation. This year's second number will also be dedicated to a special edition: the translation of the latest *Farming Matters* magazine, a publication edited and distributed by the AgriCultures Network. The network is conformed by the journals **LEISA revista de agroecología** (Latin America, in Spanish), **LEISA India** (in English, Kannada, Tamil, Hindi, Telugu and Oriya), **AGRIDAPE** (West Africa, in French) and **AgriCulturas, Experiencias en agroecología** (Brazil, in Portuguese). As these are the first two special edition magazines of 2021, we have not made calls for these issues.

In 2021 **LEISA revista de agroecología** for Latin America celebrates 25 years of uninterrupted publication and, as is already known to its readers, all the published issues since its beginnings can be accessed on its website (www.leisa-al.org). Currently, **LEISA** is no longer printed on paper and is only a digital publication, but the number of subscribers increases with each new issue. The subscriber's database is constantly reviewed and updated. We will publish the calls for the next normal editions of **LEISA** in due time, don't forget to subscribe to stay updated.

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Agroecology and participatory research: Experiences in the Andes

This issue compiles nine experiences of Andean farmers that are carried out in a participatory and objective manner on issues of strategic importance in the path to sustainable and agroecological agriculture. Likewise, the articles have in common that they are the result of research works supported by the Collaborative Crop Research Program (CCRP) of the McKnight Foundation in the Andean region.

The McKnight Foundation is a philanthropic organization based in the United States that supports the connection of experts, organizations and civil society movements through communities of practice where they interact and seek synergy through the exchange of evidence, learning and knowledge that results from projects with related themes in the same region. The final objective is to strengthen "geographic clusters" to promote the transformation of the agricultural and food system (agroecological transition processes) in the different regions where it is present: the Andes in South America, West Africa and East Africa.

In this sense, feedback between "the local" and "the global" is continuously pursued and is based, on one hand, on localized projects and processes that generate knowledge, as well as on learning methods that contribute to the discussion of global frameworks and theories of agroecology. On the other hand, it rests on global frameworks that are applied with the interest of knowing how processes occur, what changes are generated in people, the lessons learned from what works and what doesn't at a local level, etc. There is, therefore, a great interest and focus on the management options according to the contexts in order to understand the systems and identify real opportunities for change. To deepen our knowledge without losing this global perspective, the projects are thematically organized into groups such as pests and diseases, soils, seeds, local food systems, etc., from a vision of agroecology that is not only technical or practical, but holistic, and not necessarily covered from a single project but from all of them.

The different experiences are organized and presented through this operation logic. The first two articles on the organization for commercialization and consumption of small-scale production family farmers, offer a broad vision of the food system and support the importance of sustainable agriculture as well as the responsible consumption of agroecological food for the benefit of producers, consumers and society in general.

These articles are followed by several experiences on sustainable agricultural practices based on productive decision-making processes emanating from traditional knowledge about soils (Alavi et al., p. 16) and climatic phenomena (García et al., p. 20). This edition also includes an experience that is centered on peasant research and methodological learning approaches that challenge the structures of power in relation to knowledge and present them as transdisciplinary and agroecologial work tools of research farmers.

A second large block focuses on pest management; it documents experiences on the preparation of organic production inputs with farmers (Bentley, p. 29), and how to carry out disease control collectively from a case study (Navarrete et al., p. 31)

To finalize, two systematization experiences are presented: the first gathers and presents an experience implemented in the Huánuco region of Peru on the process developed for the incorporation and revaluation of traditional knowledge related to agrobiodiversity in rural schools. The second contributes some reflections on what are the key factors needed to boost agroecological transition processes, starting from the capitalization of the implementation experience of ecological production complexes in Bolivia.

This number, therefore, shows some principles and practical lessons that contribute, from the local and global levels, to the discussion on agroecology and sustainable agriculture and on how to achieve a scaling up effect of the transformation of the agricultural and food system.

Ana Dorrego
Guest Editor

A look at the **achievements and challenges** of **women's agroecological associations** in Cotopaxi, Ecuador

ROSS MARY BORJA, TRENT BLARE, PEDRO J. OYARZÚN, GUADALUPE PADILLA, SONIA ZAMBRANO

This article presents the experience of women's associations working with agroecology and that have achieved some relevance in their efforts to insert themselves differentially into urban markets. They are very small-scale producers, peasant women that are considered subsistence farmers with eventual interest in the association. Our hypothesis was that these small organizations –three of them with a greater trajectory and three more recent ones: Semilla y Vida, La Delicia, Chackras Comunitarias, Estrella del Amanecer, Espiga Dorada and Mujeres Solidarias, located in the parishes of Mulalillo and Cusubamba in Cotopaxi, Sierra Centro of Ecuador– are able to formulate or influence the rules of access to markets, of gaining territorial spaces, promoting the agroecological proposal and exerting influence on the food environment. We seek to share the perspectives of the associated women and their allies, the nature of the associations, their motivations for organizing themselves, what they value the most about their organization, the main changes in their efforts to place sustainably produced food on the market and the impact that this process has generated on each one of them, their families, their community, and the local environment.

Partners visit Mrs. Clara's orchard. Authors

The proposals related to the modernization of the food system and the industrialization of foodstuff have generated an ongoing increase in the distance between those who produce and those who consume (Lacroix et al., 2013), dramatically affecting the cultural and food systems of rural populations (Chamorro, 2012). One of the paradigms that has emerged from this modernizing concept is that the production of small producers is inefficient, incapable of generating effective forms of access to markets and of influencing the political, economic and social life in their territories.

In consequence, this type of agriculture has been denied by the official views and agricultural research. However, in Ecuador, family and community agriculture provides the majority of fresh food to the cities (between 50 and 70%, according to the Andean Community, 2011) only in 10 to 15% of the land in agricultural use. Thus, its efficiency, productivity (Chiriboga, 2012) and relevance doesn't need further discussion. Small traditional Andean agriculture, in its ancestral aspects, is considered a form of agroecology (Altieri, 2011).

The institutional forms of modern commercialization exclude peasants and ignore or undervalue their products. There is a dominant modernizing paradigm that privileges the individual character of peasant practices (Rebai, 2018). Small producers encounter barriers and inequities in commercialization: lack of market information (Ogutu et al., 2014), small volumes (Markelova et al., 2009), lack of access to credit (Marr *et al.*, 2016), low levels of organization and weak managerial and negotiation capacities (Blanc and Kledal, 2012). This is why they are inserted in unfavorable conditions in the food production chains, which are controlled by intermediaries, agribusiness and an increasingly monopolistic distribution with low and volatile prices (Chaveaeu et al., 2010).

The importance of smallholder agriculture and of women in agricultural production

Small-scale agriculture in Ecuador –in the Andean highlands in particular– is far from being homogeneous (Chiriboga, 1997). Typologies have been proposed to work more effectively in the areas of development and in the generation of public policies. Traditionally, agriculture in our country has been considered bimodal: small producers and industrial production (Schejtman, 2006). One of the central differences between these two categories lies in the production objective, which labels small agriculture as strongly linked to self-consumption and based on its own workforce, and, to a certain extent, to the market. Instead, the industrial objective focuses on maximizing the profits and relies on wage labor (Schejtman, 2006).

An important change in Andean small-scale production during the last 20 years is that women have assumed the management and production in the farms and that their participation is greater in more capitalized units (Chiriboga *et al.*, 1995). Migration, mainly male, was an important driver for this change. However, even when their contribution to agriculture has increased significantly, their level of empowerment in decision-making, and in the access to and control of productive and economic resources, is minimal (Twyman and others, 2015; Mosquera, 2018).

In addition, more women producers began to assume community roles and promote associative forms within their communities. By participating collectively, they seek to improve their negotiation power, reduce transaction costs in access to inputs and products, obtain information and take advantage of high-value markets and achieve economies of scale, among others (Markelova et al., 2009). That is why we postulate that they are key actors in a paradigm shift that seeks to create a food system aligned with agroecology, which is fairer with women producers and consumers, with a healthier diet, and that contributes to the protection of ecological systems.

Work methodology

To test our hypothesis, during the last 10 years we have facilitated a participatory action-research process in market access with associations of small agroecological woman producers. Through regular monitoring and ongoing planning, we document the organizational process, the internal changes and their relationships. This allows for the inclusion of opinions and visions of the producers as well as maintaining the focus on the process rather than on the effects or results obtained (Patton, 1980). In addition, as part of participant observation, we accompany the associations in their management activities with local actors.

To triangulate the collected information, we applied a semi structured survey to the leadership and to key people of the associations who know the process. Three historical women leaders were selected from each association. We inquired about the origin of the associations, their motivations to initiate agroecological processes, the factors involved in collective commercialization and their achievements and challenges. The impacts of the local recognition of their leadership, as well as the type and strength of the bonds they created beyond the productive and economic spaces, were emphasized as well. Furthermore, we complemented the obtained data with a literature review.

We also defined a list of people to interview from organizations, local governments, ministries, NGOs and institutes present in the territory or that were related to the associations. In addition, the "snowball" method was used to complete the preselection of actors, and a semi structured interview was developed for each type of actor. In total, we applied 52 interviews to 18 members, four political actors of both sexes, five NGO representatives, four from government organizations and one from the university and 20 community leaders.

Results

Cotopaxi is a territory with significant historic participation processes (Mosquera, 2018). Initially, people mobilized across the land, set up their organizations and were able to improve. Even though they worked, they were men's organizations, and therefore, generated disagreement and created common gender objectives. Almost across the entire territory, women groups began claiming their rights and started associating with larger organizations.

Although the associations come from a process of collective action, their genesis was also linked to the development of State interventions and other actors during the decades of 1990 and 2000. Even though one of their central concerns was the achievement of productive projects for the benefit of women through their management, they were proposed to access training, support in the fight against gender violence and, in general, to an improvement of the conditions of life for their families. It is thus explained that the associations have promoted a social and political agenda oriented to bring their problems to the foreground, gaining space in the political agenda and, particularly, to channel resources towards their proposals. Most acknowledge that in recent years there has been a greater concern about issues of market access and agroecological production and, at least in one case –that of La Delicia Association–, for achieving greater territorial associativity (Table 1).

On participation in the association and their role in the community

A central aspect in the continuity of an association lies in its pertinence and internal governance. An association offers

Table 1. **Origin, objectives and motivations of the women producer associations**

Association	Origin	Motivations	Changes in organizational objectives
Semilla y Vida	It derives from a group of women from the Compañía Baja community. Supports several founding woman members and had external support (FEPP).	Seeks projects for women, improve income, production skills and work with local authorities.	The original objectives are maintained, but with a greater focus on agroecological production and commercialization.
La Delicia	FEMICAN partners. It is part of a territorial organizational process with a strong gender component and demands for women's rights.	Positioning of women in the highest degree social organizations and mutual support (learning, sharing, speaking).	Influence in commercialization is extended to all the associations of the second-degree organization (FEMICAN).
Chakras Comunitarias	An initiative of spouses who are members of a savings and credit cooperative, and of some community leaders. There was an organizational experience on the making.	Manage projects for women, jointly market agricultural products and innovate in horticultural products; work in ventures.	The initial objectives are maintained with a greater focus on the commercialization of the members' products.
Estrella del Amanecer	It arises from a community group of women from Consolación that was renamed Estrella del Amanecer when it became legal.	Obtainment of projects, gender claims, benefits such as training, resources, etc.	The objectives are maintained with a greater focus on the commercialization of their products.
Espiga Dorada	It emerges motivated by claims of gender and violence. Collective action initiative to improve the position of women in the community. It received support from the church.	Positioning of women; access to training and generation of economic, health and educational options. Seeks projects for women.	Greater focus on the production and commercialization of agroecological products.
Mujeres Solidarias	Derived from the group of women of the Atocha community and the Women's Organization Nuevo Amanecer, previous organizational experience.	Create a space for women (learn, value, self-esteem, etc.); improve their agency capacity and contribute to household income.	The initial objectives are maintained.

Adapted from interviews with associations carried out by EkoRural in 2020.

a protected space with multiple purposes to women. The members acknowledge that they have managed to maintain themselves because their functioning does not come into tension with their available times, it allows them to talk and reflect and, in particular, it has been a hotbed of leaders for different community organizations of a higher degree. Their participation in spaces such as the Town Council and the Water Boards stand out. They emphasize that the demand for community issues (mingas, managerial positions) places a heavy burden on their activities and schedules. There are only a few woman leaders who have not played a role in community leadership. However, they point out that they rarely access the presidency or Town Council, so their participation in the community structure doesn't always occur from decision-making positions. They are sought mainly for their transparency in fund management.

Agroecology and market access: changes, achievements and lessons

In terms of the transition towards agroecology in the production and commercialization of food products, the producers recognize the influence of various external organizations, especially NGOs present in the territory. The mayority point out that the current agroecological production represents around 70% of their marketable production, an important change in an area where the monoculture of potatoes, corn and barley was dominant.

Regarding significant changes from agroecology, there are differences between the two groups of associations. The most advanced highlight the reduction of chemical inputs being used, learning to calculate production costs and the knowledge acquired on the relationships between health and agriculture. They all point out the introduction of horticulture, orchards and crop diversification as major innovations. Hence, the star agroecological products are vegetables; and to a lesser extent fruit trees, mellocos (*Ullucus tuberosus* Loz.) and corn. Experimentation and bio-inputs were widely mentioned.

The farms of women partners linked to markets are very diverse, and they are proud of it. Mrs. Rocío Quingaluisa, from La Delicia, indicates the following: "We try to produce as many types of vegetables as possible. We don't have to go to the supermarket because we grow all our food at home, in our own farm." Others said they grew different varieties of vegetables "to be able to control pests."

Agroecological production has been a key element in linking with local markets and a wide variety of mechanisms have been explored, mainly associated to the institutional environment, where good management has been achieved. Local government fairs; agreements with the ministries; sales in warehouses, farms, home deliveries, to restaurants or door to door; baskets, etc., stand out. This relationship, in turn, has generated a great deal of bonds and lessons.

In the most advanced associations, fair prices and production costs are central elements for a good negotiation in the market. This indicates that they have developed competencies in customer service, on how to build trust and have learned to dialogue with their consumers. They have noticed that there is a greater concern for health and that consumers demand products grown locally in a healthy way. However, they acknowledge that in the younger associations there is still a lot of work to be done.

This situation represents a great change from the environment experienced a decade ago. Mrs. Rosa, from La Delicia, mentioned: "Nobody wanted my products at the wholesaler and people offered very low prices. It was not worth it."

One of the most significant achievements in more advanced associations has been their contribution to making agroecology visible and facilitating political advocacy. Due to their actions, they feel like role-models for local governments and the Ministry of Agriculture. Based on their experience and knowledge, they have promoted trust systems for agroecological seals and participatory certification, among others. This participation stimulated and strengthened the leadership and, therefore, the members. Nevertheless, they state that their achievements are strongly linked to the recognition and appreciation of their agroecological products and the credibility of consumers; and that, in some cases,

this has meant greater transparency processes within their organizations.

They recognize that there are other achievements that go beyond market access. There is a change in the perception of themselves as agroecological women producers and in the expansion of their relationships and social networks. In addition, they also highlight the access to seeds and planting materials, smaller and larger animals, and the construction of reservoirs.

Effects of associativity in the partners and the community environment

Some of the effects recognized by all the associations are the capacity to speak and manage, the betterment of social relationships and receiving a greater appreciation at home (Table 2). They have also been able to influence the ways in which communities carry out agriculture, which are of community benefit. This can be seen in the live barriers implemented in the allotments, the incorporation of new species, new seed management techniques or sustainability mechanisms such as the chain pass management or 2 x 1 (all seeds that contribute to the bank for production purposes are returned by the community members in a 2 x 1 manner). Older associations have influenced the newer ones, involving more people from the community in learning tours, exchanges and replicas of gardens.

The reasons that motivate partners to stay in the association and sell collectively are related to the fact that it is a space that gives them a sense of belonging, allows the development of leadership and solidarity and helps to obtain support. They recognize that earning their own money, on which they can decide, brings a certain degree of empowerment and makes them a little more independent. For a large part of women producers, improving their skills to interact with diverse audiences and generate new social and business connections are important incentives to justify their access to the markets.

Acting as a group means overcoming barriers to commercialization: "Selling collectively is good because we are not alone. We are united and we can help each other" (Mrs. Victoria, La Delicia). Even though they have surmounted some of the challenges, participating in markets is not easy; partners have to cooperate, they need trust and commitment among all to fulfill their responsibilities.

Association and community leadership

Despite the multiple achievements and benefits, women partners feel that there is no recognition for their actions by the leadership of the community organization with respect to their activity schedule or the strengthening of their organizations. Therefore, they do not recognize a positive effect of the community organization on the association.

Associations are sensitive to the institutional environment where projects and opportunities move. When analyzing the current growth challenges, we highlight a common element that stands out: "the institutional environment is complicated". This is expressed in the lack of support and often in a hostile environment towards women. Faced with this institutional abandonment, it is difficult to keep them motivated and it requires a great effort. As a solution, they acknowledge that growth issues must be separated from the achievements –or not– of projects, in addition to improving the relationship between association and community authorities, generate initiatives for young people and establish their own sale points.

The associations from the perspective of community actors and the external institutional environment

Community associations carry out their activities in a complex internal and external organizational environment. In this environment, multiple community and public organizations and NGOs stand out because they have supported and promoted development interventions through the provision of support, information, technical assistance and capacity building. Those organizations related to water and to the Town Council are, in general, the most important regarding governance and community participation.

It should be noted that most of the interviewees think that women's associations have a very positive role in their communities. They are seen as very persistent, supportive and united organizations that know how to manage the support they receive. By influencing the formation and life

Table 2. **Associativity effects on partners and their community environment, and of the community on associations**

Association	Effects on members	Effects on the community environment	Community effect on the association
Semilla y Vida	Ability to speak, management skills, knowledge, self-esteem and confidence.	Greater participation of women in water boards and the community board; agroecological techniques (living barriers and new species such as uvillas, fruits, tree tomatoes, etc.)	There is interference, they cancel jobs, they do not take into account the activities of the association.
La Delicia	The fear or shyness is overcome; greater respect at home and, in addition, more social relationships; they handle their own money.	Inclusion of women in boards; better reputation in money administration; transparency.	Members recognize no effect of the community leadership or the community itself.
Chakras Comunitarias	Confidence, management skills, self-esteem, income generation, participation in the community.	More women in community organization boards; techniques (live barriers, maralfalfa, mallow); intercommunity seed exchange; new species (uvillas, fruits, tree tomato, etc.); homegardens.	The activities of the association must be subordinated to those of the community. Fines.
Estrella del Amanecer	Management capacity, leadership in the community, position in the home, knowledge.	More empowered women participate at a community level; greater community appreciation for leadership roles; seeds and varieties on the chain pass and 2 x 1 method.	The association's agenda subordinates to that of the community. It involves constant changes.
Espiga Dorada	Better self-esteem, credibility, cohesion; access to income; best social and customer network.	More participation of women in the community; the community has been involved in tours and exchanges.	Members recognize no effect from the community leadership or the community itself.
Mujeres Solidarias	Empowerment, greater self-confidence, more intentional participation, management skills.	More women generate opinion; greater access to seeds and varieties; orchards are replicated.	The community board imposes its agendas on the association. It involves changing activities and planning.

of their members, they allow coordinated work with the institutions and promote agroecology, technical assistance and knowledge transfer in their communities. Its greatest strength lies in its unity and organizational capacity, its agroecological productive identity and its ability to create benefits for the common good.

When analyzing weaknesses, the representatives of public institutions state that the associations fail to have a vision for the future –including a strategic plan with clear goals–, in communicating their activities and in doing more coordination work. MAGAP interviewees believe they do not have a cooperative business model nor commercialize in an associative manner. NGO interviewees, in turn, find that, due to their socioeconomic conditions, they lack the capacity to produce and distribute agroecological products on a bigger scale. There is also an immediacy regarding results between the members, while a slow process of aging and generational transition occurs. However, not only are there internal factors that limit their actions. There is an active disloyal competition by intermediaries in squares and markets and in traditional markets there are power structures that operate in detriment to the agroecological food proposals.

In general, the associations' leaders maintain a poor or regular level of contact with other community organizations. This is quite critical and generalized when it comes to the presidents of Town Councils in most communities. The transitory nature of these authorities and their political and religious affiliations probably explain the lack of enthusiasm of the associations in maintaining a closer contact and properly informing these authorities.

There is a consensus that associations should not manage support or resources for the community. In some cases, they recognize that their actions generate contacts and relations that are useful to the communities, however, Town Council organizations are the ones called ours to execute these management procedures.

The NGOs believe that in order to achieve a greater incidence and encouragement for the consumption of agroecological products, more articulation actions should be promoted between organizations that develop and foster agroecology; local authorities should generate effective support for its promotion and dissemination; more stimulation for policies of continuous training and the provision of exclusive spaces in markets. Improving the impact of associations would imply working on a more cooperative management model, upgrading internal governance and strategic planning processes and facilitating the development of capacities based on a portfolio that represents the interests of women.

Public institutions, in turn, think that, in the challenge for associations to achieve a greater impact on the food system, external institutions should improve the professional profile of those who assist them, facilitate the generation of alliances and strengthen or create networks between consumers and producers. The State must promote ordinances that improve their actions, identify specific budgets to strengthen the associations, generate confidence in agroecological processes and their traceability and support the dissemination in order to visibilize the links between agroecology and healthy food.

Final comments

Unlike what happens with the boards and Councils of the communities, who by law respond to organizational directives generated by the ministries, the associations represent a more stable and responsible establishment with the capacity to produce collective action. This is understood as the voluntary action of a group to seek common interests or social or economic objectives (Markelova et al., 2009) and long-term dreams.

It is better to sell here than at the wholesaler. People come because they know us. They value our products and that they are organic.

Doña Malvina,
Semilla y Vida Association,
on sales at fairs

In the present case, the collective action of women participating in mechanisms for direct access to agroecological markets has been shaping the Alternative Food Networks (RAA). Through these spaces, they have defined the local food system. The authorities and other local actors recognize the role that these associations play in the transition towards a more sustainable agriculture.

Due to the fact that the associations are made up of women of very low incomes, it is understandable to doubt whether this human group could promote important changes in agriculture and new ways of understanding food consumption. The elements shown from their experiences and points of view, as well as those from relevant actors in their environment, lead us to think that this sector not only has "a little something to gain," but much more than just "something" to deliver. They also seem to indicate that the size of the farm is not the determining criterion to measure the success or influence capacity of small producers in the local food system.

To assess their actions and permanence, it is important to understand what these associations are and what are their genesis, objectives and current views on these goals. Thus, the members' commitment to the association appears important, but not stable. It depends on how associations perceive their environment, their strengths and weaknesses at any given time.

The associations have generated impacts far beyond economic issues and have influenced the way communities conceive and carry out production. However, community life demands a tremendous effort from the most active women in the territory. It also requires a constant balance of interests between the personal, the family and the community, even if this can be a source of tension.

The results show that, regardless of whether the producers come together for agricultural issues, the organization allows them to discuss women's issues and, to a certain extent, achieve other ends. The social issues around the organization were of greater importance. In this process, the members have had to face organizational, management, quality control and training challenges. Not all producers have the same social skills or participate with the same degree of responsibility in these mechanisms. The distribution of benefits is a critical point since it affects the necessary cohesion of the organization and the commitment to making their presence sustainable in the managed spaces.

Currently, the associations market locally, but they are not nor were born as organizations for commercialization. Associations can be strong in the market because they appropriate experiences from agroecological production, but they are not and should not be seen as peasant enterprises. From the point of view of their objectives, they are complex and they endure due to their low operating and managerial costs, but maturing competencies is a process that occurs slowly in practice.

Economically, the methods of market entry generated for agroecological products have been very beneficial. But their concerns are not only in market access, which is much broader than the sale of products, but there is also a market of affections, money and relationships involved. The market place becomes an interactive and social learning space that gives rise to multiple negotiations and exchanges, and where social relationships become closer and deeper. Hence, we talk about Alternative Food Networks.

The availability of leaders at different levels, accompanied by an adequate flow of information and accountability (Parrado and others, 2014), is a decisive factor in maintaining the unity and continuity of the processes, especially in the face of frequent changes in the organization leadership and the local authorities.

Leadership, identity and empowerment are important elements for social participation or effective associativity and can become elements of recognition. The internal rules and respect for agreements generate tensions and significant changes in behavior, even in relatively small organizations with generally transparent relationships of friendship and management.

The participation of associations in local governments constitutes a political opportunity to incorporate new issues and new production and consumption perspectives on the public agenda. However, winning these spaces or influencing them has been a challenge conditioned not only by the group's capacity for collective action, but also by the ability to support the development of instruments and policies that are more adjusted to the reality of the territories.

On the other hand, with accord to specialized literature, the participation of women in local power spaces is very far from parity. In rural parishes, the majority occupies the spokesperson roles, but few women serve as board presidents or vice presidents. Commonly, the participation of women in local spaces has been understood as "management" of social services and "voluntary" contribution to the wellbeing of family and community, which has led to the naturalization of gender roles (Mosquera, 2018).

This example of associations in Cotopaxi, Ecuador, demonstrates the possibilities for agroecology to break the commercial links that favor agribusiness and to promote a fairer system for producers and consumers. The next task is not how we will improve these new dynamics, but how we can take them to scale, and women's associations have the potential to broaden the acceptance of agroecology.

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Supply, differentiation, consumption and demand of **fresh ecological food**

The experience of four popular fairs in Cochabamba

MARIANA ALEM ZABALAGA

This article summarizes the changes between the baseline (2017) and the final line (2019), and the interventions made by the EcoConsumo project during 2018 to increase the supply and demand of ecological food in Cochabamba, Bolivia.

The diagnosis had two phases: the first included 115 semi structured interviews in a "snowball" sample of actors involved in the production or commercialization of ecological food at a departmental level, to estimate the amount of food available in relation to the departmental production; and the second included 213 qualitative and exploratory interviews carried out in four popular fairs, in which information on supply, differentiation and demand for organic food was collected. The intervention consisted of several initiatives to improve the visibility and differentiation of ecological food at fairs and on the dissemination of messages for consumers on radio, television, almanacs and posters. The final line consisted of surveys for 100% of the producers and suppliers and of a sample of around 100 consumers in each of the four popular fairs.

The results show that in 2017, at the department level, ecological food production represented 2.1% of the total in Cochabamba, of which only 0.02% was certified. This production came from almost 6,200 families (98.9% from the rural area), who generated an estimated 26,050 metric tons in 9,855 hectares (2017 campaign), and displayed a variety of 140 different products (Alem et al., 2018).

In the four popular fairs, less than 20% of the interviewees in 2017 (between producers and consumers) understood what an ecological product is (mostly called "natural" or "irrigated with clean water.") Also, less than 7% of consumers were specifically looking for ecological products (searching for food with definitions such as: healthy, nutritious, uncontaminated and of high durability) and could not easily identify which of the stalls at the fairs offered ecological food. Additionally, the main reason of purchase was to search for cheap foods that looked fresh and had a nice appearance, that is, large, colorful, without black spots or damaged parts.

Sale strategies for ecological food at fairs were improved and made easier and more attractive for buyers through the dissemination of effective messages targeted towards the consumer through radio and television regarding the importance of ecological products and the locations and schedules where these could be found. The knowledge and demand for these was increased.

The conclusions show that the knowledge about ecological food is increasing, but there are still confusions between the producers who declare themselves ecological and the consumers. Likewise, the demand for ecological food has expanded but at a much slower pace than the acquisition of knowledge. And there is still resistance to the differentiation between ecological food and the conventional one.

This article consists of three parts: first, in the presentation of the topic, a brief summary is included regarding the problems faced by ecological producers at popular fairs and by consumers from the middle to lower socioeconomic strata who attend these venues to stock up on food. Secondly, the design and research method, where the population and the methodology are described. And finally, the results achieved by the EcoConsumo project with the actions implemented in popular fairs and the comparison between the base line and the final line.

Presentation

For the Agrecol Andes Foundation, the EcoConsumo project is a strategy aligned with the axis of "Promotion of economic enterprises with a social solidarity approach" of its Institutional Strategic Plan (2018-2022). The project works by bringing ecological producers closer to consumers in short commercialization circuits to improve their family income. The foundation has previous experience supporting producers in the commercialization of specialized fairs (EcoFairs), promotional fairs, public sales (school breakfast), sales with home baskets (BolSaludables) and at popular fairs. However, this represents the first experience of research and awareness-raising processes for consumers who attend popular fairs.

For this article, "popular fair" is understood as a classification of the Cercado Municipal Autonomous Government, and has been adapted using the definition of Oromendía et al. (2013) and Peñaloza et al. (2015). The criteria are as follows: a) fairs located in peripheral areas of the city in neighborhoods classified with medium to low human development indexes; b) fairs that take place one or two days a week on the streets adjacent to fixed markets, and c) fairs where there is a diverse offer of peri-urban and rural producers, and depending on the size, the sale can take place

at dawn for wholesalers and later, for the consumer. At these fairs, ecological food is usually sold at a similar or lower price than conventionally produced food.

The term "organic producers" is used to describe people who practice agriculture as a means of agricultural, forestry, fishing, pastoral and aquaculture organizational production, which is managed and operated by a family and is based mainly on the use of family labor, both masculine and feminine. The family and the agricultural productive unit are integrated, coevolve and combine economic, environmental, social and cultural functions (FAO, 2014). Their systems base production on unpaid family labor and the maximization of profit is not a main objective of the productive unit. The "family capital",

Sacaba's products. Author

its patrimony, serves the peasant family to earn a living and its use corresponds to the strategies of each productive unit in the short and long terms (Van der Ploeg, 2016).

It is important to understand that this concept can be expanded to include urban and peri-urban producers who may or may not have agriculture as their main source of income (Cárdenas, 2015).

Through the production of different crops, family farming alters natural ecosystems through their conversion in agroecosystems. These alterations are generated by conventional agriculture and agroecology. The difference lies in that the first seeks a higher net production with the use of energy sources and external inputs (machinery, fertilizers, pesticides, etc.), while the second seeks to develop models of production and sustainable use by promoting the vital cycles of nature (Restrepo et al., 2000).

The 3525 Law for the regulation and promotion of ecological agricultural and non-timber forestry production, defines the "ecological producer" as one who arrives at popular fairs provided with a certificate guarantee (PGS) regulated by the same Law and normally obtained with the support of an NGO. Nevertheless, the producer can also declare himself ecologic without offering formal guarantees, and develops different sale strategies to gain the credibility of his/her customers.

This self-declared ecologic producer can also be traditional, as one that produces with a very low incorporation of external inputs, with "natural" production and using only manure (*wanu* in Quechua) for the production of his food (Chambilla and Lizarazu, 2013).

Finally, the term "popular fair consumers" is used for people from a medium to low socioeconomic level who live in areas of the city classified with a low human development index. They are the buyers who attend the popular fairs that operate once or twice a week on the streets of the area surrounding the markets.

The work in popular fairs involves the support of small ecologic producers who have difficulty accessing sale spaces in markets managed by associations of intermediaries and merchants (Salazar, 2016). On the one hand, when they manage to access stalls, it is usually thanks to the support of NGOs in specialized, protected and certified fairs, which serve a high-class consumer, a non-majority group of the population. Therefore, by selling at popular fairs located in the outskirts of the market or as street vendors, they risk paying high fines or having their products confiscated by the municipal administration. On the other hand, when they get a fixed stall they have to supply it year round, but because they don't have enough production for the entire year, they find themselves forced to play a role of intermediation and resale at certain times of the year and they normally don't differentiate their ecological offer (Pinto, 2002).

There is little research on consumers who attend popular fairs; they normally do not demand ecological food because their priorities of purchase are focused on getting cheap food (price is prioritized over quality) in large amounts and with a good appearance, the latter is associated with having a good durability (Deconinck, 2008).

The Agrecol Andes Foundation is committed to exploring strategies to increase the supply and demand of ecological food in popular fairs because most consumers in Cochabamba, as in many countries of Latin America and the global South, prefer to buy their food in these types of fairs due to its wide variety, schedules and accessible prices, and not in supermarkets as in Northern countries (Borja et al., 2018). Likewise, it is an opportunity to work with popular consumers, as very little has been done with them so far. It is believed that they could have a solid bond with the countryside (due to recent migration), and their consumption and eating habits include a wide variety of carbohydrates and fried foods (salt, sugar and saturated fat), and very few vegetables and fruits (Monteiro et al., 2013).

In this way, the EcoConsumo project worked during the first phase (2017-2019) with producers who sell at popular fairs and consumers who regularly attend them.

Research design and method

Description of the population

The population that the EcoConsumo project worked with is made up of producers and consumers who attend four popular fairs: Quillacollo Fair, Producer to Consumer Fair (Las Rieles), 24 de Julio de Villa Obrajes Agroecological Fair (Sacaba) and 1ro de Mayo Fair. These fairs were selected based on the criteria of size (from the largest to the smallest), location (they are within the metropolitan region of Cochabamba), classification assigned to them by the Cercado Municipal Autonomous Government (typology adapted by the project) and the diversity of the characteristics among them, such as time of existence, how they were originated and whether or not producers participate in their boards, among others.

The largest is the Quillacollo Fair, classified as a provincial fair where producers and merchants arrive from all over the province. It works three times a week and covers an area of approximately three kilometers in radius. The access for producers is restricted, as it is comprised of three federations of more than 100 associations of merchants, retailers, unions, artisans and homeowners.

The second in size is the Producer to Consumer Fair, known as the Las Rieles Fair because it was settled in the old train rails during its first year of existence. The attendees of this fair are producers from the municipalities of the

Table 1. **Estimation of the Human Development Index, according to planning districts**

District	CAR	ALR	Life expectancy	Median years education			Adjusted average anual income			HDI		
	%	%	years	man	woman	total	man	woman	total	man	woman	total
8	65	90	66	8	6	7	2,522	2,565	2,543	0.69	0.64	0.66
9	67	89	59	7	5	6	3,421	3,345	3,381	0.66	0.60	0.63
Sacaba	66	89	65	9	7	8	3,684	3,679	3,676	0.71	0.65	0.68
Quillacollo	65	91	66	10	8	9	3,160	3,076	3,116	0.71	0.67	0.69

CAR: Combined attendance rate: population from 6 to 24 years old; ALR: Adult literacy rate of the population aged 15 and over; adjusted average annual income: gross domestic product at purchasing power parity; HDI: human development index.
Adapted from Ledo and Agost (2012).

Commonwealth of the Southern Cone that don't have fixed positions and settle in order of arrival in the designated place of their municipality. It is open on Wednesdays and Saturdays and at its peak time can reach up to a kilometer in size. The organization of the fair is in charge of a board made up of the representatives of each municipality who elect a president and collaborate with the strict control of entry and placement of producers only. However, despite the efforts, when the producers finish selling they leave their positions open where resellers and traders begin to settle.

The 1ro de Mayo Fair (District 9 of the southern area) is a Sunday neighborhood fair that sits around the Bartolina Sisa sectional market and is part of the 9th district of the southern area, it covers less than a kilometer in space. Most of the stalls are for merchants; however, any producer can settle with their goods in the peripheries of the fair. An association of organic producers called Nueva Esperanza obtained three to five permanent positions at this fair and they now participate permanently.

Finally, the smallest one, the 24 de Julio de Villa Obrajes Agroecological Fair, known as the "Fair Price Fair," operates every Friday and sits on the north side of the main square of Villa Obrajes, in Sacaba. It is a fair that began with the support of two institutions that work with ecologic producers, including the Agrecol Andes Foundation. Later on it joined the Bartolina Sisa women's union and expanded its offer to a variety of non-organic and non-edible products.

The four fairs are located in the metropolitan region of Cochabamba and as seen in Table 1 and in Figure 1, they are in areas with the lowest human development indexes.

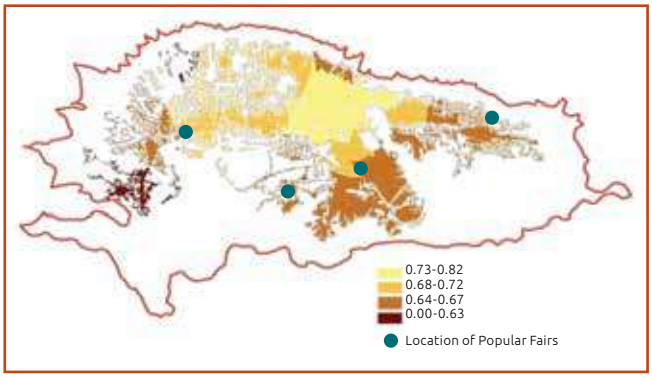
Methodology used

The EcoConsumo project began with a baseline diagnosis that took place in 2017, using snowball sampling and applied 115 semi structured surveys. It initially estimated the traceable ecologic production of the department of Cochabamba and the first sale destination where the production arrived. Subsequently, it delved into four case studies on the supply and demand conditions of organic products using 213 open interviews of five to ten minutes applied to producers, consumers, retailers and wholesalers, transporters and market authorities. Additionally, 99 open surveys were conducted with key actors to further explore the history of markets, power relations, access to fairs, etc., these surveys took between 30 and 45 minutes. The investigation was also complemented with six consumer focus groups of retired teachers and a mothers' club, and with participatory observation from the arrival of the first members to the fair until the closing.

The qualitative data from the open interviews was transcribed into 340 sheets and analyzed with Atlas TI text analysis software program. It generated 358 codes that enabled and established relationship frequencies, quotation extraction and graphics.

With the results of the diagnosis, workshops of socialization and participative construction took place with the leadership,

Figure 1. **Map of the human development index, according to municipal districts and location areas of the popular fairs with which the project works**



Created by C. Ledo, 2012.

fair authorities and ecologic producers and consumers. During these workshops the results of the diagnosis of each fair were socialized and an open invitation to action was conducted in order to revert the situation of lack of visibility of ecological foods and the low knowledge and demand by consumers. Together with the participants, indicators were prioritized and the implementation of schedules and responsible agents, etc., were created and established. The process lasted between one and two months, and after that came the implementation and provision of equipment for each fair.

The final line of the project was collected in May of 2019, and given the experience of the 2017 diagnosis, other instruments were included to make the data collection and analysis more efficient. In this manner, two questionnaires were developed in the Survey123 software –one for consumers and another for producers-sellers–; their duration was between five and seven minutes. In total, 598 surveys were carried out (215 to producers-sellers and 383 to consumers). The producer-seller surveys were applied as a census, meaning that the total number of stalls present on the day of the survey were taken into account (this occurred for three of the four fairs; in the case of Quillacollo, only the stalls of ecological products and 5% of stalls of conventional products that were selected with random numbers were interviewed). For the consumer surveys, an attempt was made to interview one of every ten, considering those who expressed willingness to provide answers.

The final line was complemented with participant observation and 26 open interviews that were carried out exclusively with ecologic producers (producers-leaders) with the objective of deepening in the perception of the implementations that were executed at fairs, the market access strategies, the sale and marketing of organic food and the family strategies to overcome the difficulties of access and supply of the stalls throughout the year.

Data analysis was performed using SPSS and Excel and maps were designed on the ArcGis Online platform.

1o. de Mayo. Author

Results

Actions of implementation

The strategy directed towards the general population was the creation of radio spots with key messages that clarified what ecological food is and why its consumption is important, hence, breaking the myth that it is more expensive than conventional food. These messages also informed where ecological products could be found, at what times, and also shared the addresses of the four popular fairs that collaborated with the project. The information was provided by two characters (man and woman) in an informal conversation using popular speech, including the typical idioms of Cochabamba. They were also broadcasted in the two stations with the highest audience in popular neighborhoods, in Spanish and Quechua, for approximately six months.

The actions implemented in each of the four fairs were different due to the choices and preferences of the leaders and authorities in of them. For example, in some, they only chose to have training workshops focused on teaching the differences between ecologic and conventional foods and the effects of agrochemical residue ingestion. While in others, actions were chosen to make the fair, stalls or food more visible with the use of awnings, aprons, tablecloths, signs, blackboards, television propaganda or almanacs with didactic and educational information on feeding with ecological products. Additionally, a "graphic personality" was created for each fair with logos that were used in all the produced material.

Comparative results of the baseline and the final line

When comparing the baseline established in 2017 with the final line of the 2019 project, we find that the knowledge about what is ecological increased from 20% to 55%. The definitions used by both producers and consumers went from "natural, irrigated with clean water" to include words such as "ecological" and "without agrochemicals."

During the baseline, a maximum of three stalls with ecological food products per fair were identified. However, in the final line, 63 stalls with some offers of organic food, corresponding to 29% of the total stalls (215) of all the fairs, were pinpointed. The majority of these stalls in the final line were mixed (with an offer of ecologic and conventional food) and one could find from one product (such as organic spinach that the producer would bring from his own garden or from the surplus of his family consumption to complement their conventional commercial products or resale crops) to all the ecological food produced by themselves together with some resale crops to complement their offer. An average of 60% of ecological food in offer was calculated for the 63 stalls throughout the year, having its highest peaks in May and December, dry season food harvest and rainy season, respectively.

Of the 63 stalls, the project managed to visibilize and instruct 47% of those involved in the training; this corresponds to the percentage of women producers that claim to have "good strategies," which is why further work on training, differentiation and visibility of ecological food is still required. However, it is curious to note at this point that another 28% of the producers mention that they do not promote or differentiate their food because they already have a built a reputation with their customers and do not need to change or acquire new sale strategies. This may be due to the fact that if they promote their products more, they might not have enough supply for a growing demand.

In the baseline, no consumer explicitly mentioned that they searched for ecological food at the four fairs; while 46% said they did in the final line. Furthermore, the explicit purchase and demand ratio rose from 7% to 15.3% (consumers who stated that the type of food purchased should be ecologic, without agrochemicals, natural, with optimal durability –a characteristic associated with organic food– and good for nutrition and health benefits). This entails an interesting result: the purchase intention does not necessarily translate into an acquisition due to other factors that influence purchase and consumption behavior. Likewise, only 5% of the consumers recognized or differentiated who sold ecological food in the baseline; while in the final line this value increased to 64%. In any case, that 64% did not necessarily translate into a purchase of ecological food because 13% of them were skeptical and didn't trust that this food was truly ecologic. This lack of trust may be due to the low level of certification, since only 8% of the bidders have PGS. On the other hand, 17% of the consumers interviewed mentioned that they fully and blindly trust their familiar woman vendors regarding that the food they sell is completely ecologic, either because of the properties and characteristics of the food itself or because they came to know their orchards and production in a visit to their plots promoted by other projects.

However, not all changes can be attributed to project actions because the differences may be due to the different methodology used in the base and final lines. Additionally, different implementations had their weaknesses; for example, the signs at the stands of Villa Obrajes (Sacaba) were used occasionally but without showing the offer of the season. The producers said that they usually had no markers available. Another example occurred at the Producer to Consumer Fair (Las Rieles), where the slates were not rewritten according to the season either. Moreover, in some of them they preferred to use permanent marker to avoid having to rewrite the signs every week. Others used them only to delimit the section of their municipality without using them to play the envisioned role, which was to inform the consumer of the available offer of agrochemical-free food.

Thus, when consumers were asked in the final line if they noticed changes in the fairs, only 8% explicitly mentioned some element attributable to the project. When they were asked directly if they had noticed the signs, awnings, tablecloths, etc., or if they had seen the information broadcasted on television and radio, 57% of them answered affirmatively. Particularly in Villa Obrajes, the smallest fair, this value was greater than 70%.

Conclusions and implications of the research findings

The results show that in the department only 2% of the production is ecologic, only 0.2% is certified, and most of the ecologic production that reaches these markets is not differentiated. There is still much to do in this field, such as increasing its volume and identifying the destinations of this

organic production to differentiate it. In the same way, the largest volume consists of few dry farming foods (tubers and cereals) and, therefore, work still needs to be done to increase production in the rest of crops, such as vegetables and fruits.

Despite the fact that the implementation of actions at the four fairs was quite short –six months–, it was possible to improve the information and visibility of ecological foods to make them easier and more attractive to buy; in this way, the knowledge and demand for these products increased. However, at the close of the project´s first phase, only a little more than half of the buyers knew what ecological products were and despite explicitly looking for them, did not buy them. There is some skepticism and they state that there is little offer and a lack of differentiation. Therefore, the purchase reasons for ecological foods remain low (15.3%). That is why knowing the factors that determine the purchase of ecological food and its consumption by consumers would allow for the generation of more accurate information, awareness and advocacy strategies, according to the factors that influence different types of consumers the most.

On the other hand, at the end of the project, a little less than half of the producer-sellers stated that they had the sale and visibility strategies needed to promote their ecologic food. Even though there is another 28% of them who mention they do not need to do anything because they already know and have loyal customers, there are still around 25% of female producers that need to improve their promotion and differentiation strategies in these four fairs. It remains open the question whether the self-declaration of being ecologic is supported by sufficient knowledge, productive practices and motivations of organic producers, as described by Law 3525.

The use of signs and whiteboards without being exploited to the 100% of their possibilities indicate a possible aversion towards differentiation and, therefore, it is necessary to deepen the investigation to better understand this rejection and how to overcome it. Some hypotheses lean towards fair and market structures, which do not consider differentiated spaces for ecologic producers; or perhaps it is due to the implicit social norms between producers-sellers who don't want to develop advantages over their fair companions to avoid winning enemies (aversion to inequality).

The low certification rate is also striking: there is a need to understand better how the trust between self-declared ecologic producers and consumers who buy ecological food is built and maintained. In addition, how can this be handled when there is a majority of stalls with a mixed offer (ecologic and conventional); and how can differentiation be achieved despite these limitations, allowing the consumer to better recognize organic food and increase its demand through campaigns of information and awareness.

Challenges remain ahead for ecologic producers in new fairs in order to continue showing ecological food in more sale spaces, informing and creating awareness in consumers while influencing public policy at the same time.

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Productive decisions made by farmers who are influenced by global changes and their impact on soil management

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Agricultural activity and its constant evolution are closely linked to changes of a climatic, socioeconomic and cultural nature that have accelerated their processes in recent decades, thus tending to break natural balances of resources such as soil and water. Soil is a main productive factor, but has been scarcely studied in the Andes where soils are considered geologically young, poor in organic matter content and with low moisture retention capacity (García et al., 2014). Despite these conditions, the Andean region is a great center of agricultural production and has been sustainable for centuries. This sustainability is largely due to land use and management practices appropriate for the particular characteristics of the territory. However, these sustainable practices are at risk of being lost due to the great pressures of current production systems to which they are subjected. This study discusses the influence of climatic, socioeconomic and cultural changes on the decisions of small farmers and, consequently, on soils.

The decision of changing the productive systems and its determining factors was analyzed in two communities of the Bolivian Andes: Chojñapata (at 4,200 m.a.s.l.) and Calahuancani (at 4,000 m.a.s.l.), located in the Huanquisco basin, circumlacustrine of the Northern Altiplano of Bolivia (Figure 1). Both communities have an agricultural calling and their main crop is potatoes. Chojñapata is located in the upper part of the basin and has soils with a high content of organic matter (OM). This richness is explained by the low temperatures which slow down the decomposition process, giving the soils a greater capacity to retain moisture, which in turn favors agricultural activity. Calahuancani is located in the middle part of the basin; it has soils with a lower OM content, so they present limitations in terms of their ability to retain moisture. The thermal amplitude is also higher and precipitation is relatively lower in the middle basin than in the upper one.

Local knowledge of soils

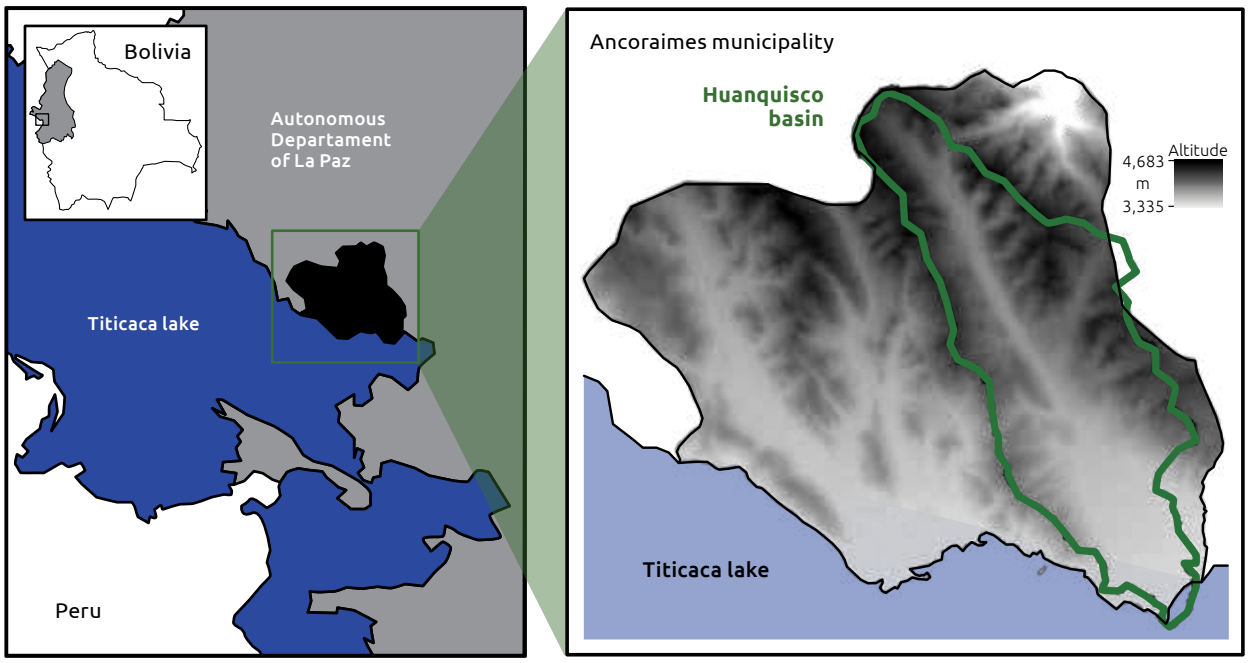
Local knowledge of soils in these communities, as in various ancient cultures, has been developed and transferred from generation to generation in an iterative process of trial and error (Hatt and others, 2016). However, this knowledge is scarce or undocumented, and is not integrated in contemporary soil studies. Zimmerer (1994) and Sandor and Furbee (1996) have categorized local descriptors in some Andean Quechua-speaking communities; under this structure were developed local descriptors in both communities in their local language, Aymara (Table 1). Rescuing, systematising and integrating rich local knowledge to current soil science (edaphology) will allow to obtain more complete and adequate conclusions regarding the use, management, conservation and recovery of soils, avoiding generalization.

Change in the productive systems of high Andean small agriculture

In both communities, farmers recognize changes in their production systems. The transformations are linked to changes such as global warming, market pressure and the availability of labor. The combination of these factors results in changes in the productive vision that, consequently, will affect the fragile balance of Andean soils.

In the particular case of potato cultivation (the main crop in both communities), Taboada and others (2014) identified

Figure 1. **Huanquisco basin, Ancoraimes minucipality, Bolivia**



Adapted from: Alavi-Murillo et al., 2021.

the change taking year 1985 as reference. The production of sweet potato, known locally as *waycha* (*Solanum tuberosum* L. ssp. *andigena*), increased to the detriment of the *luk'i* or bitter potato (*Solanum juzepczukii*). The bitter potato is a species adapted to recurring frost events in the area, an attribute that the sweet potato doesn't share, but is instead favored by consumer preference. The authors mention that the thermal increase and the lower frequency of frosts are the main factors. For 2019, farmers ratify this change, but they also cite new crops: turnip (*Brassica rapa* subsp. *rapa*), onion (*Allium cepa*) and broad bean (*Vicia faba*). These species were not cultivated before the year 2000 and some even before 1990. From a very general look, these crop choices could mean an improvement in agrobiodiversity. However, it must be noted that these are species that have been introduced into the Andean ecosystems in addition to the fact that their nutritional requirements are higher than what these soils can satisfy. As a long –or even short–term- result, the cultivation of these species would lead to the impoverishment of soils.

In addition to climatic factors, the improvement in sweet potato prices and the lower availability of land for cultivation also had an important influence (although to a lesser extent) (Taboada and others, 2014). Our interviews confirmed that the cultivation of the *waycha* potato has increased since the 1980s and shows an increasing trend towards 2019, contrary to the bitter potato, whose production is negligible or null.

Table 1. **Soil descriptors in the Andean region (English, Aymara and Quechua)**

Clasification		Descriptor in English	Local descriptor in Aymara	Local descriptor in Quechua
Level 1	1	Soil	Callpa	Hallp'a
	2	Cultivation soil	Yapu callpa	Chakra hallp'a
	3	Pastures	Pasto jarkarata	Pasto hallp'a
	4	Wetland	Jok'o	
Level 2	5	Sandy (sand)	Pinaya (ch'alla)	Chaqa
	6	Clayey	Llink'i	Llank'i / Quilli / Llink'i
	7	Loam	Llamp'u	Llamp'u
	8	Silty	Kink'u	Lama
Level 3	9	Red soil	Wila laq'a	Puka
	10	Black soil	Ch'iara laq'a	Yana
	11	Light brown-yellow soil	Q'ellu	K'ellu
	12	Gray soil	Chik'u	Ushpa
	13	Ashen soil	K'ellari	

Adapted from Sandor and Furbee (1996) and Zimmerer (1994) for Quechua terms, and from Alavi-Murillo et al. (2021) for Aymara descriptors.

Soils workshop in the Chojñapata community. Authors

Finally, Alavi-Murillo et al. (2021) indicate that the migration –both temporary and permanent– of the population from these communities towards urban areas has had an impact on the age distribution of the population, with a direct influence over the availability of labor for agricultural activity. For example, soil preparation was done manually or with animal traction before 1990, but after that year the use of tractors has increased and that trend is growing. Farmers have also mentioned that chemical fertilizer (urea) is being used in the communities since the 2010s. They mention that its use is simpler (and effective in the cultivation of *waycha* potatoes) because it is applied at the time of planting; instead, the manure must be incorporated into the soil, which demands more work. Nevertheless, the use of a tractor has negative impacts: it tends to destroy the structure of soil as it compacts it and generates less moisture retention. If the increase in chemical fertilization is added to this, soils become increasingly vulnerable, lose their fragile quality and ultimately degrade. Another interesting aspect mentioned by farmers is that there is a tendency to augment sheep farming due to its rapid economic return and its ease of handling, which makes it a suitable activity for the elderly and the women, since camelids, due to their larger size, require more strength. The increasing trend in using this type of livestock has been introduced and not adapted to the characteristics of the Andean ecosystems and must be monitored. A study carried out by CONICET (2012) in the Argentine Patagonia concludes that sheep directly influence vegetation. This study identified the disappearance of species preferred by sheep, such as grasses and shrubs, and the subsequent exposure of soils to environmental factors.

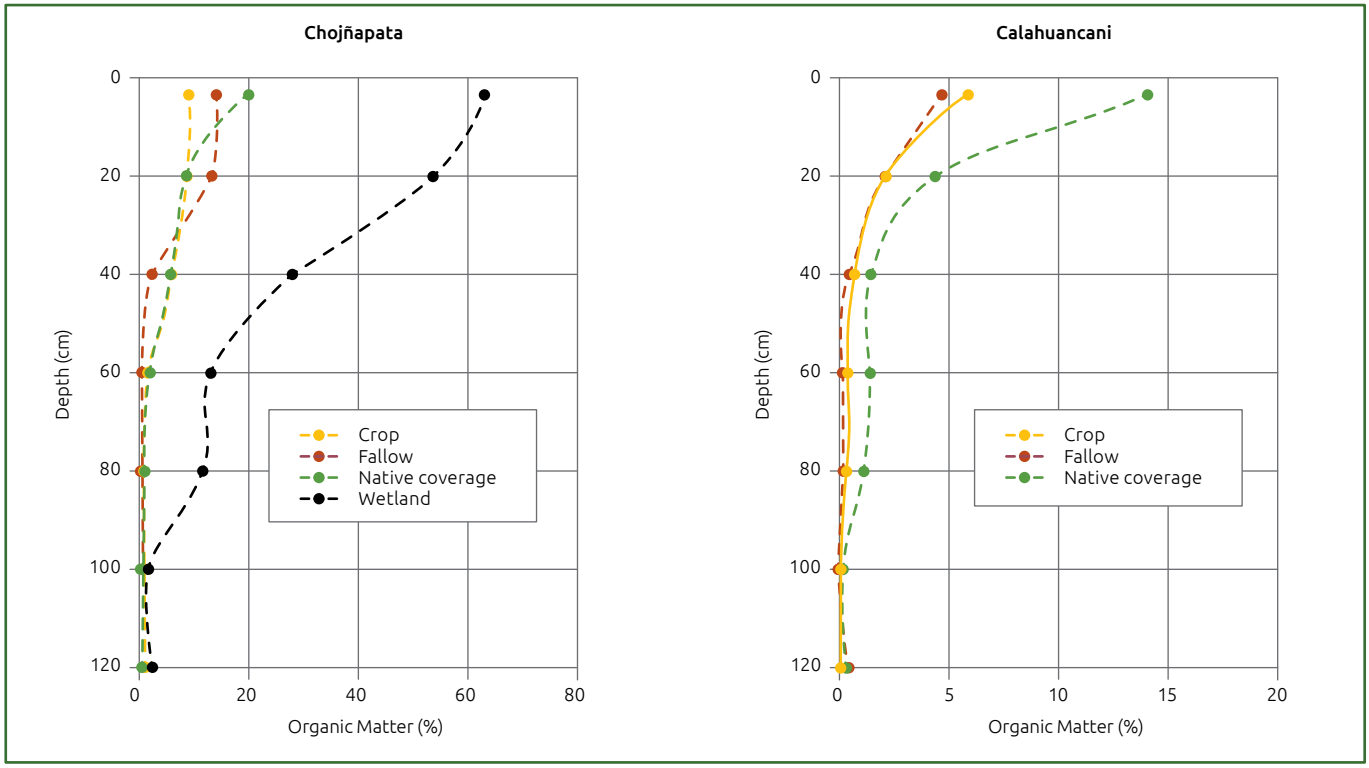
The combination of these factors is clearly expressed in the particular case of the *waycha* potato: it responds better to chemical fertilization (Gilles et al., 2013), it develops quite well in frost-free areas (apparent temperatures increase in the area) and it is a product of preference by end consumers (market pressure). However, the trend towards chemical and non-organic fertilization, the invariable probability of extreme climatic events such as frosts (although temperatures have increased, the frosts have not disappeared) and the reduction in the diversity of the potato crop (only growing *waycha* potato) can lead to nutrient depletion and soil degradation in these and other communities in the Andes.

Soils use and management and its effect on the soil

Figure 2 shows the effect of the use and management of these soils on the OM content. Cultivated soils have a lower OM content than those that have regained their native cover. The difference is clearer in the first 20 cm, in addition to highlighting that the rest period of up to two years does not manage to restore the fertility of the soil to its initial levels.

Changes in the productive systems of high Andean small agriculture may have direct or indirect repercussions on soils. Global warming has allowed the introduction of new species of high economic value, but these crops are known for their high nutrient extraction, which would lead these soils with low nutrient content to a degradation process if the outflows are not compensated through sustainable practices. Market preferences force a reduction in agrobiodiversity, an unsustainable practice for these soils. Finally, the workforce reduction has promoted the use of tractors that compact soils with little OM content, and the use of urea discourages the development of edaphic microbiology, the main actors in the process of conserving and improving or restoring the quality of these soils.

Figure 2. **Organic matter content in soil's profile in representative plots of the Chojñapata and Calahuancani communities**



Although the literature on adaptation actions to climate change and its influence on the agroecosystem in the Andes is extensive, soil has been very tangentially studied without being integrated to the flow of nutrients that guarantee the sustainability of the agroecosystem. The presented data is a sign of similar problems that affect Andean soils and that should be studied in a unified way with the agroecosystem, given that its quality influences the vulnerability of farmers and their capacity to face the impacts of climate change, either as mitigation or adaptation strategies.

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Innovative responses of farmers in the Bolivian highlands in environments of changing climate risk

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For more than 3,000 years, producers in the high tropical zones of Bolivia have established themselves at altitudes above 3,700 m.a.s.l., facing adverse climatic characteristics such as frost, hail, drought, winds and snowfall in a recurrent and erratic way. These events challenge the productive capacity of the area and demonstrate the high adaptive capacity and productive flexibility of farmers. The frequent meteorological extremes are produced by the unique combination of tropical latitudes with significant altitudes, which blends a lot of energy with atmospheric transparency. In a global warming context, this singularity could determine specific behaviors that diverge from what is expected on a warming planet.

Bolivian highlands productive system

The long tradition of complementation of farmers with a rugged environment has given way to a unique production system, inconceivable in other latitudes. Despite being located in the tropics, due to its altitude, the area is not productive in winter because frosts occur almost on a daily basis. So even with available irrigation, open-air agriculture is practically impossible in that season. Agricultural production is then restricted to the summer months (the rainy season) and marks a complementarity that translates into a very strict cultivation period that goes approximately from the end of October to mid-April (Figure 1). In this harsh environment, farmers have developed alternatives and relatively successful production strategies. For example, thanks to the observation of natural indicators for future climate, they make productive decisions in advance and with a high probability of accomplishing what is forecasted (Orlove et al., 2000; García et al., 2019). However, in the last decades, traditional indicators show little or erratic expressions and there are very few indicators for short-term events. Another strategy is the cultivation of rustic and frost-resistant species and varieties, but they have low yields, which has forced farmers to seek new strategies, leaving behind the traditional agricultural approach of the area.

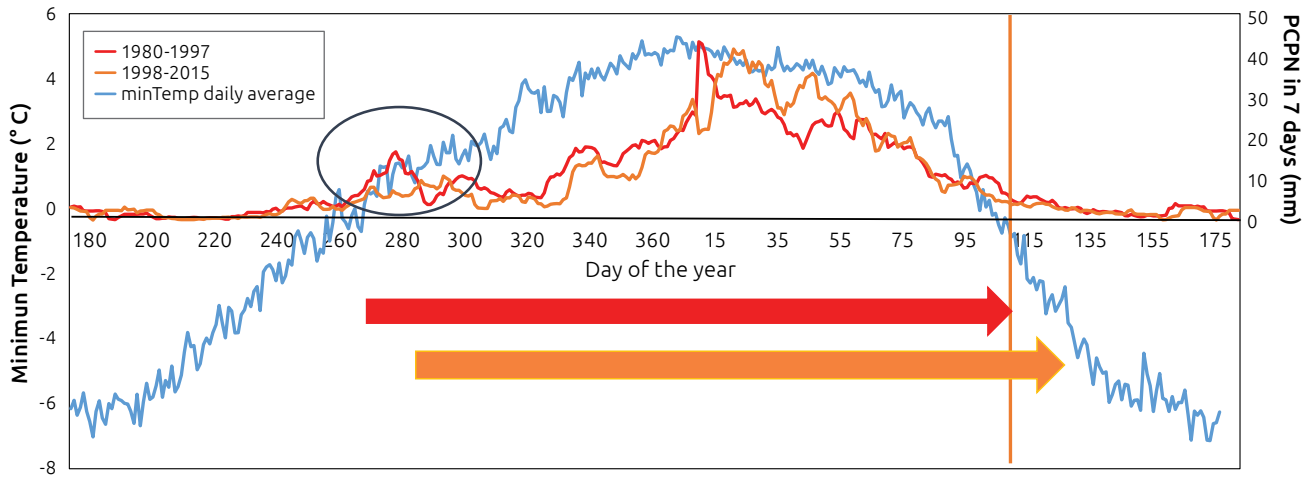
Due to the fact that highland agriculture is developed to a large extent with rainwater (the area does not have sufficient water sources to establish irrigation systems), farmers depend on the beginning of the rainy season to proceed with the sowing and this determines the success of the annual production. The presence of rain is decisive because its combination together with the frost-free period determines the occurrence of a narrow cultivation window (red arrow in Figure 1). It is clear that a delay in the rainy season will cause the entire crop cycle to be stalled, which would expose it to damage near harvest or during ripening due to the almost certain occurrence of autumn frosts (orange arrow in Figure 1).

The impact of a changing planet

Despite its altitude and the relative physical isolation of the Bolivian highlands, like the rest of the planet, it is influenced by an increase in greenhouse gases (GHG). For approximately three decades, farmers have reported modifications and variations in the thermal and rainfall environment as it is shown in Box 1 (page 21). Based on this reality, they have reacted promptly to these changes by modifying their production system through the replacement of varieties of the same species (Taboada et al., 2017), as is the case of the change of potato varieties for those that are more productive. However, even though farmers demonstrate a broad adaptability that has been inherited through generations, the speed of change could reduce the efficiency of the measures taken.

Researchers such as Valdivia et al. (2010) and Taboada et al. (2017) showed a clear trend towards the change of the high plateau production system, generally introducing new varieties; but, inversely, the risk of frost and seasonal dynamics of precipitation, as well as their influence on productive decision making, have been hardly studied. The present article aims to describe the autonomous actions assumed by innovative farmers in the study areas and how they are influenced by the behavior of the most limiting meteorological variable for highland agriculture (low environmental temperatures, frosts and precipitation); and to propose a small discussion on a potential increase of their vulnerability.

Figure 1. **Outline of the productive window determined by the frost-free period combined with the rainy season**



The **vertical orange line** shows the average deadline for the development of crops without damage, as it marks the average start of the frost period. The **red line** shows the average daily precipitation between 1980 and 1997, while the **orange line** shows the same, but for 1998-2015, with a perceived delay in the initial rain peak. Consequently, the **red arrow** shows the typical growing season until the end of the previous century, while the **orange arrow** shows how the delay in the sowing season will lead to an increased risk of frost damage, since the crops would not be able to cover their productive cycle before the occurrence of autumn and winter frosts.

Methodology

The information for this work comes from three sources: a) historical data of daily and monthly minimum temperature (minTemp) and precipitation (PCPN) (1980-2016) of the Patacamaya Station, located adjacent to one of our study areas and whose data is reliable and will be used to evaluate the average rate of change of minTemp, frosts and distribution of the precipitation throughout the year; b) participatory workshops with farmers from the aforementioned communities, held between the periods of 2009-2015 and 2019-2020, and related to their production system of which only the sowing date decided is considered; and c) observation and conversation with innovative farmers within communities who are usually leaders and agents of change.

Results

Innovations in the production system

The recurrent erratic behavior of the atmospheric variables in the Bolivian highlands has forced farmers to develop a permanent attitude of observation to early signs of rainy season behavior and make productive decisions accordingly. This capacity has probably exacerbated under the new conditions gradually established since 1980, approximately. In participatory surveys on changes in production systems (from 2009 to 2015), farmers refer especially and repeatedly to a notorious delay in the onset of the rainy season and to rising temperatures (Garcia and others, 2011; Taboada, 2017). In the first case, they mention that if rain delay is severe, they are forced to change their initial crop choice towards fodder crops or lower productivity species, as these would be able to resist April's frosts. In the second case, and almost intuitively, farmers establish varieties of their traditional crops (potatoes, quinoa, etc.) that are less resistant to frost; but on the other hand, they are more productive because as air temperature rises their cycle finishes rapidly, even though this would mean that productive risks would increase. However, the observations taken in the last productive cycles (2019-2020) and the testimonies of some of the innovating farmers, show that beyond the change in varieties of the same or similar species (for example, from bitter potato to sweet potato) and in sight that the zones face higher temperatures and an apparent "lower frost risk", the decisions have turned towards new and more productive crops, even though they are less resistant (Box 2, page 20) and are atypical in the area, as occurs with

B1 *In the dry season the heat is so strong that it burns us, but this only happens for a few moments because in the afternoon, starting at 3 o'clock, the cold starts from the upper part of the basin. Before, 20 years ago, frosts were very strong. We could only plant bitter potatoes, quinoa and cañahua, that is why the members of the community had to go to the valleys. We left at 4 in the morning to arrive at 9. Afterwards, we realized that climate had changed and it was possible to plant sweet potatoes, turnips, barley and other crops, because it is not so cold anymore and the potatoes grow well because it rains...*

Farmer interviewed in Chojñapata (Source: Yucra surveys, 2009).

B2 Testimonies from innovative farmers exploring the introduction of new, less frost-resistant crops or previously unused agricultural support techniques

I have inquired about the benefits of tarwi by consulting fellow producers from the north and Cochabamba. In this place, due to the climate and sand, we only produce potatoes and quinoa, but [this year] we decided to sow tarwi on 1,250 m² to test if it could be produced because we are interested in its soil fertilization properties with nitrogen, and, if it does not provide grain, then mix the plant to the ground. I have produced pods loaded with grain and they have a good price in Cochabamba. I have also learned that it is important to prepare the soil well twice in the rainy season and sow in September, because the yield could be much better...

Innovative farmer of Iñacamaya (62 years old)

New carrot fields in Sabilani, Umala's municipality. Yucra, field record, 2019

I have seen that our Ancoraimes brothers have a sprinkler irrigation system. Seeing how it works, I have adapted one with plumbing materials and bolts to resemble the same form of irrigation here in Umala. I have helped myself in the sowing season because the rain gets lost, and also when it is in bloom in February because the soil dries quickly. This method is effective and, in a way, the production is better.

Innovative farmer of Iñacamaya (65 years old)

Farmer exhibits tarwi seeds obtained from the introduction of this new species in the communities studied in the central Bolivian highlands. Yucra, field record, 2019

Weather problems in potato production were added to the fall of the price and milk market. So we decided to plant three hectares of carrots following the advice of fellow producers from Viscachani [a nearby community]. The production has yielded well and we are now in the commercialization process. We have verified that this carrot adapts to our soils, it seems to tolerate frost and can be preserved for several months for the market and we can produce it together with the potato...

Innovative farmer of Sabilani, Umala (62 years old)

Sprinkler irrigation systems installed by farmers in Iñacamaya, Umala. Yucra, field record, 2019

Figure 2. **Linear trends of the average monthly records of minimum temperature**

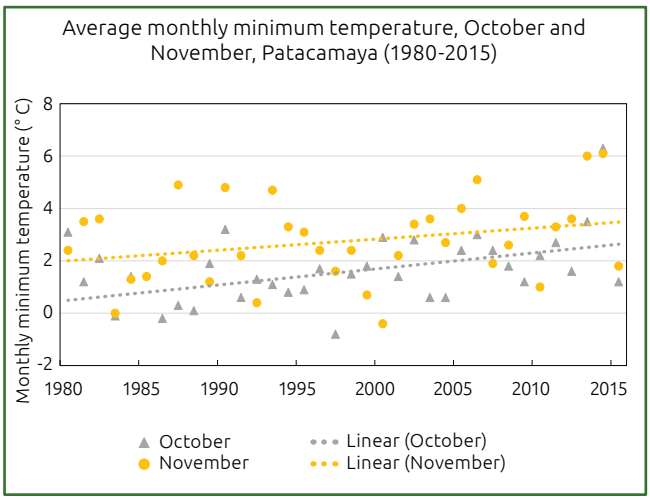
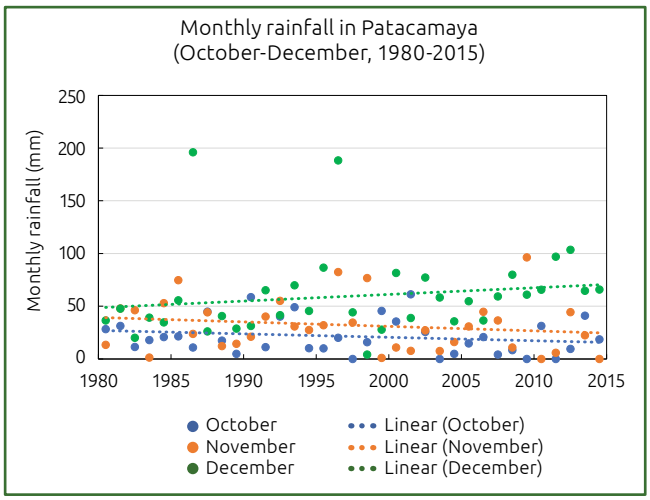


Figure 3. **Linear trends of the average monthly precipitation records**



tarwi and carrots. A decision that stands out is the inclusion of assistive technologies that were previously absent, such as the implementation of both drip and sprinkler irrigation systems. Some farmers that are well-known for being innovative and trying new production strategies, when successful, are quickly imitated by other farmers.

Risk of frost and occurrence of rain

The above-mentioned production decisions are based on the farmers' perceptions of the increase in the minimum temperature (assumed as a lower probability of frost, which is not necessarily true) and the scarcity of rainfall in the sowing season. The trends of the monthly average minimum temperatures in the area where the Patacamaya Meteorological Station is located, show an increase in the months of October and November (Figure 2). While the precipitation shows variable trends with slight decreases in October and November, and an ascent in December (Figure 3).

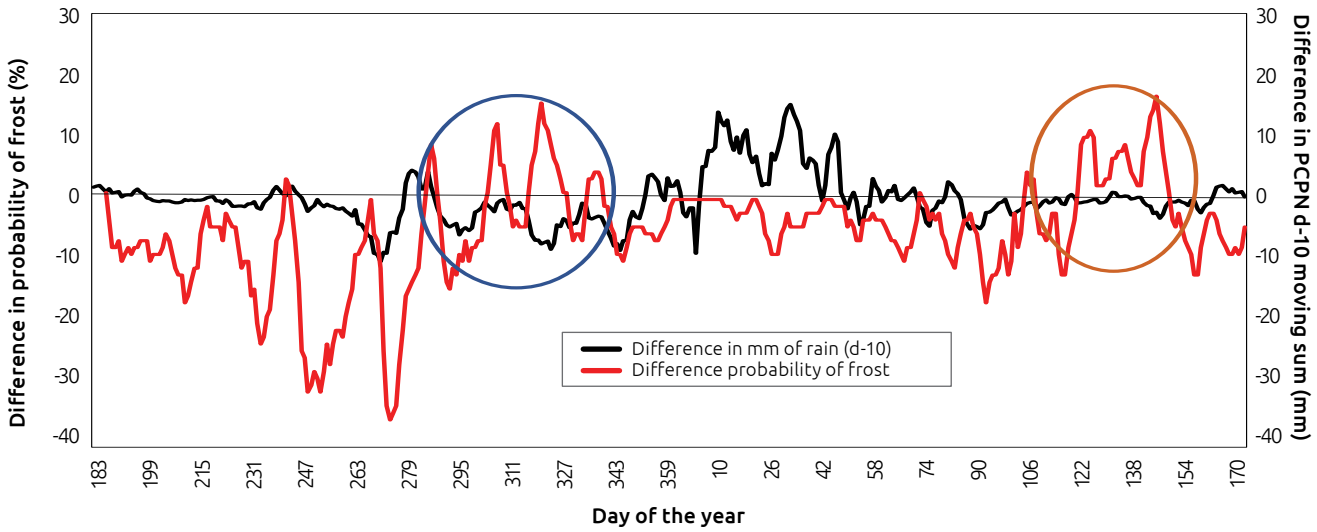
Although figures 2 and 3 would suggest an improvement in productive conditions due to the rise in minTemp and a small change of trend in rainfall during the sowing months, these monthly averages could hide the daily variations that particularly damage crops and constitute the process known as frost. Similarly, the amount of rain accumulated in between the periods of seven to 10 days is more important for the crop than the total amount of rain that falls in a month. In order to evaluate comparatively these factors between the previous century situation and that of the present, the registry was divided into two parts (1980-1998 and 1999-2016). The following analysis was carried out with both parts: a) to evaluate the probability of frost, each day of the year was accounted for the number of occasions in which the minimum temperature dropped below zero in the historical record and, the probability of frost was evaluated for each day; b) to evaluate the occurrence of rain, the mobile sums approach was used, adding the amount of accumulated rainfall for each date in the 10 previous days, consecuently obtaining the daily average for each part of the record. Subsequently, the difference between the data for every day in both periods was calculated for each case, which would should show the change in the frequency of frosts and in the timing of precipitation.

Figure 4 integrates the difference in the probability of frosts and the amount of rain fallen in 10 days, from July 1 to June 30 of the following year, according to the agricultural calendar of the area between the periods mentioned above. It is perceived that in the months of July to September, the probability of the occurrence of frost has been significantly reduced, but it increases precisely in the traditional sowing period (October and November); this shows that there is a greater risk of frost since 1999. Inversely, since 1999, the accumulated amount of rain in 10 days significantly reduces between October and November and clearly increases between the end of December and February.

Discussion

Since the last decades of the previous century, highland farmers have shown an ample flexibility of reaction in their decisions and ability to adapt rapidly to productive environments that change gradually, but steadily, following the global rhythm. It is noteworthy that a large part of the literature that reports the autonomous adaptive actions of farmers arises from 2010, despite the fact that the adaptive actions began as early as the 1980s, which shows the reduced monitoring of the highland agricultural systems. Currently, the sustained thermal increase provides more perceptual information to producers, who integrate it with market requirements and explore the innovative introduction of new non-traditional crops for the areas where they produce, going beyond the change of varieties applied until the beginning of the present decade. However, the evaluation of the change in the probability of frost and the accumulation of precipitation in 10 days, shows that the adaptive decision towards less frost resistant crops (although more productive and commercial) could escalate the vulnerability of producers due to significant declines or even total losses in case of the occurrence of an extreme event. Unfortunately, the probability of heavy frosts during the sowing season still exists and, combined with a clear delay in the start of the rainy season, could significantly affect the overall production of the areas, since the introduced crops are less resistant to drought and frosts because they come from benign areas, climatically speaking. On the other hand, if the decision to delay the sowing to reduce the exposure to frost (late sowing) is taken, the probability that crops will meet their thermal requirements before the onset of the autumn frosts is low, when in addition the risk of frost increases. Thus, the productive window for farmers, although more benign, is shorter, inviting them to rethink innovative but risky productive strategies. The introduction of supplementary irrigation by water-saving techniques, as carried out by some

Figure 4. **Probability of frost occurrence (red %) and amount of accumulated precipitation in 10 days**



The **red line** is the probability of frost occurrence (%); the **black one** of the precipitation amount (mm, moving sum), expressed as the difference between the 1999-2016 records minus 1980-1998 for Patacamaya. If the values are less than zero, they denote less risk of frost or less amount of accumulated rain in the 1999-2016 period compared to the 1980-1998 period; and if they are greater than zero, the inverse. **The blue circle** shows the sowing season in the highlands; **the orange circle**, the harvest time. Observe the greatest risk of frost in these periods since 1998 and the lower accumulation of rain in the sowing season. The day of the year begins on July 1 (day 182).

innovative producers, appears successful in the face of new climate and market environment, but it must be supported.

Conclusions

Although production decisions cannot be imposed by norms external to the reality of the Bolivian highlands, it is also evident that farmers require external support to guide or facilitate the process of adaptation to climate change through short-term forecasts that denote risks to which the system will be exposed in case of taking a certain decision. The wisdom of producers in a normally harsh environment, but even more so under the conditions of climate change, could require more information and aid with decision support structures and infrastructures. The implementation of irrigation systems could be enhanced with local systems to combat frost already established in other latitudes with good results, such as stoves, fans or thermal protectors that are adapted to the local reality. This requires intensive complementation of farmers with the state or municipal extension systems that must be considered in the future.

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Experiment design with small farmers

A methodological tool for **farmer research networks**

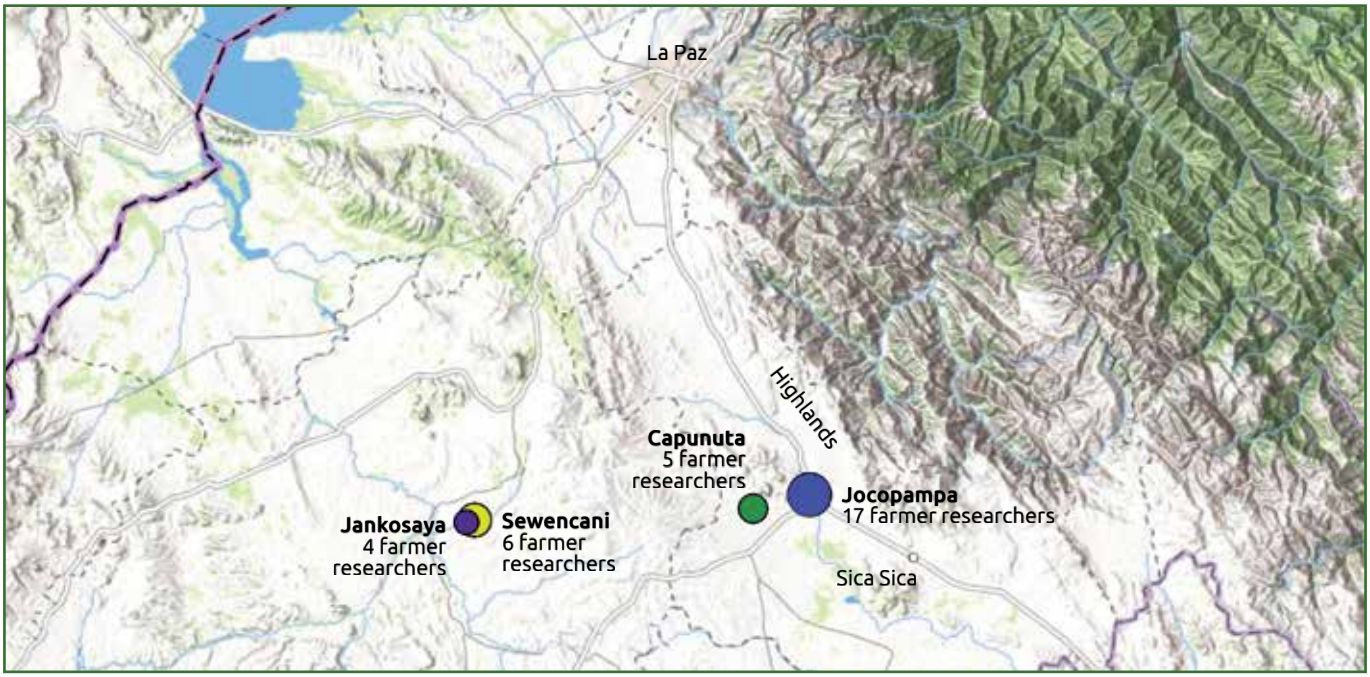
ELISEO MAMANI ÁLVAREZ, WILFREDO ROJAS, CARLOS BARAHONA

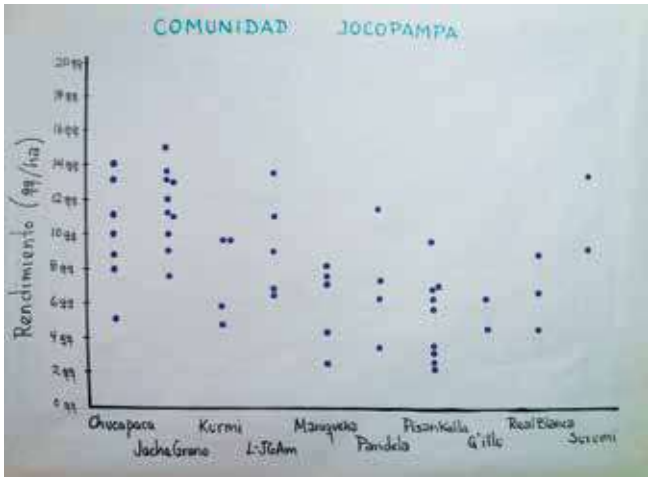
The experience demonstrates how to design experiments with small-scale farmers. This process, together with farmer researchers, consists in the identification of problems; the adoption of agreements on how, when and where to investigate; and the development of tools to collect data and their implementation in the field, along with its processing and analysis, all executed with scientific rigor and in response to specific biophysical and social contexts.

When talking about research with farmers the following question arises: "Why is it important for the farmer to conduct research on his farm?" Various aspects point to the importance of this type of research for the benefit of the farmers themselves (Ponce et al., 2011), because it responds to their personal and family interests with the use of local resources and according to their economic possibilities (Gupta, 2000). In addition, the conditions of the farms have their own particularities and are very diverse; and the results of the experiment stations do not always work (Ponce et al., 2011).

Although different approaches, techniques and participatory methodologies have been implemented –participatory action research, farmer field schools (FFSs), local agricultural research committees (LARCs), among others–, they do not usually include experimental design. The Collaborative Crop Research Program (CCRP), supported by the McKnight Foundation, proposes the Farmer Research Network (FRN) approach, guided by three principles: 1) farmers who represent the social and biophysical diversity of their communities participate in the entire research process; 2) the research is rigorous, democratized and useful, providing practical benefits for farmers as well as insights into biophysical and social variation; and 3) the networks foster collaboration and opportunities for learning and knowledge

Figure 1. **Location map of the communities where the research was conducted**





Graphic representation of quinoa grain yield data. PROINPA

sharing. The first two principles seek farmers participation in research with scientific rigor, being collective on a large scale. This is a systematic learning process that enables the acquisition of knowledge of the interactions of options by context and seeks to improve farmers' access to new and old alternatives in a scalable way, sharing information and data (Nelson et al, 2016).

Considering that Andean agroecosystems are diverse within the same community, with variations in the type of soil, climate, pest population and crop disease; and that farmers have generated knowledge that allows them to understand their territorial space, the incorporation of experimental designs in participatory research is essential for farmers to investigate according to their needs and interests, responding to the biophysical and social contexts in which they live.

The experiment developed

To generate evidence of the application of the FRN approach within the framework of the project "Agroecological alternatives to contribute to the sustainable production of quinoa in Bolivia" (2018-2021), we have worked with farmers from four communities in the central highlands of Bolivia (Capunuta, Jocopampa, Jankosaya and Sewencani, department of La Paz). The population that resides in this region is of Aymara indigenous origin.

In order to incorporate the experimental designs in the participatory research with small quinoa farmers, local authorities from communities were contacted, and through them, the families were summoned to a meeting to discuss participatory research. These meetings were attended by more than 50% of the families living in the communities (men and women; the elderly, adults and youth). During the dialogue, the researchers helped the participants recall that farmers have been conducting research for thousands of years, helping them understand that research is not a novelty. Currently, co-creation and knowledge exchange between farmers and researchers is being sought to obtain better results that are applicable to their contexts. Thus, a new way of doing research with and for farmers was proposed, one where everyone has the opportunity to participate in the entire process. To ensure that the research maintained a rigorous character, it was proposed to design experiments where the treatments were different technologies and practices that they wanted to explore with accord to their interests and needs. The experimental units would be the plots that they usually sow each year, and the lessons could be shared with other farmers and communities.

Conformation of farmer researchers

In the meetings it was highlighted that the research would be joint between farmers and technicians, in order to co-create knowledge. It was also proposed that the researchers contributed with seeds, biofertilizers and bioinsecticides, while farmers would provide land, seeds, time, tools and agricultural machinery service, depending on the research topic. It was clarified that not all research has favorable results, because there is a risk for farmers and technicians. However, if the research results are negative, it is still a valuable part of the learning process.

Based on these considerations, the farmers decided whether or not they wanted to participate in the research. Those who decided not to participate mentioned that they lacked time and also had other occupations besides agriculture, others explained that they didn't have extra land. For others, research carried a risk because it didn't always turn out as expected or they simple didn't want to try risky things; instead, they prefered to receive proven recommendations. Those who decided to participate were farmers that were curious to experiment for themselves, in search of new alternatives to improve the productivity of their crops. Some farmers decided to be part of the process not because they were interested in the research, but because they were motivated by the possibility of receiving inputs and technical training.

As a result of the dialogues, 32 farmers (20 men and 12 women) showed interest out of a total of 125 participants in the meetings. These farmers are known as "farmer researchers." Then, four groups of them were formed, one per community: 17 farmers in Jocopampa, six in Sewencani, five in Capunuta and four in Jankosaya. The age of the women ranged from 27 to 73 years; that of the men was between 29 and 78 years old.

Problem identification

Problems with the cultivation of quinoa were identified through workshops with farmer researchers in a participatory manner. Such problems were the low productivity caused by drought and frost, and the loss of sweet varieties and frequent changes in the demand for grain at rural fairs. The problems identified provided a base for the research options. The ideas revolved around the use of the genetic diversity of quinoa, which led to the evaluation of varieties of this crop in the four communities. Then the objective of the investigation was defined by means of the following question: "What do we want to discover about the varieties of quinoa?" After several ideas, it was agreed to identify the varieties of quinoa that had adapted better to different agroecological, biophysical and social contexts of the central highlands of Bolivia.

Agreements on how, when and where to investigate

In order to create the experiment design, the object of study was the varieties; based on the characteristics desired by the farmers, 12 varieties were chosen. For the experimental units, the participants discussed where to investigate and eventually decided that the research would take place in the farmers' plots. In addition, it was concurred to standardize the size of the plots to 1,000 m^2 and the amount of seed to 800 grams.

The next questions were "How to investigate?" and "Does everyone want to plant the 12 varieties?" No one wanted to plant all 12 varieties, so each farmer chose the ones they wanted to investigate. This allowed the farmers to select between one and eight varieties. Each farmer picked different varieties and in order to ensure three experimental replications (treatment-variety), it was verified that a variety was chosen by at least three farmers in each community. The exercise allowed planning 112 experimental units (plots) with 12 treatments (varieties). To accomplish the research, 112

Farmers of different ages with an interest in participatory research are involved in the entire research process. They jointly prioritize investigations according to their common problems and interests, the experiment objectives and the study method. The farmers decide when, where and how to implement the research plot and are autonomous in managing the tests, as long as the agreed objectives remain unmodified. Additionally, the commitments agreed by the farmers and the technicians who are part of the research are explicitly established.

The small farmers' plot is constituted in a space for the research (experimental unit) according to the distribution, spatial and temporary rotation of traditional systems of land management. The methodology makes it easier for farmers to allocate time for participatory research, especially to record data after agreeing on common variables between all farmers and the technical research team.

Once the research has started, farmers have the possibility to dialogue with their peers and adjust the tests during the process, if necessary. This promotes continuous communication between them to share findings, which allow collective learning and the generation of a research network among farmers.

In addition, the methodology allows technical researchers to learn about the preferences of farmers in their context. The process also makes it possible to carry out a joint analysis between farmers and technicians based on data collected in the field by farmers during the experiment. The analysis allowed to explain the patterns and factors of variability and contributed to the farmers' decision-making process, based on the evidence generated.

seed bags were delivered, duly identified with names for each experimental unit.

Then there was a discussion about what to measure or observe. Each farmer indicated different criteria; a list was prepared containing variables such as yield, plant height, panicle length, productive cycle, flavor and grain size, constituted as evaluation variables. Likewise, the need to record other data such as sowing date, harvested plot size, frost damage, drought, hail, and others was explained to help elucidate the variability. This set of criteria made up the covariables.

The discussion then turned to the manner in which to record the variables and covariables. Farmers tend to evaluate by observing and not measuring. Therefore, it was necessary to negotiate and agree with them, explaining that analyses with data (numbers) enable the comparison between varieties. The farmers understood the importance and agreed to measure the most important variables, while others would be evaluated by observation.

Research tool development

A "Quinoa variety evaluation card" was designed to facilitate data recording for farmer researchers. The card included the name of the investigating farmer, the name of the community and all the variables and covariables, accompanied by images for a better understanding. The card was printed on both sides of a cardboard sheet and given to the farmers (one for each experimental unit).

Field research

The farmer researchers sowed the seeds; the plots were spatially distributed in different sites, where farmers' provided land for research. The data recording on the card began with sowing and ended with postharvest. Some older women farmers requested assistance with the data recording process, which was achieved jointly. During the experimentation process there were meetings and visits to the plots where dialogue, lessons about the methodology and varieties of quinoa were promoted. It was not necessary to adjust the research design, but 22 of the total of 112 experimental units (plots) were lost: two research farmers did not get to plant 10 plots due to lack of time; five plots were lost due to the intense drought; and seven more due to the intense frosts during the ripening of the grains. These losses, however, did not affect the design; and the number of repetitions was simply reduced.

Data processing

Farmers attended the workshops held in each community with their scorecards and the data was reviewed. Measurements were found in different units, for example, arrobas, kilograms, pounds and quintals were used interchangeably to measure grain production. To standardize the data, the farmers were trained in unit conversion. Then, conversations were carried out for each variable. Calculations were generated for some using variables and covariables; for example, the yield was calculated with the data of production and harvested area, while for the productive cycle the number of days from the sowing date to the maturity of the plants was counted.

Data analysis

Data analysis with farmers

The data was analyzed with the farmers in the workshops held in each community with the use of a flip chart on the wall for every variable. A two-line graph was drawn on the flip charts: one horizontal (x-axis, varieties) and another vertical (y-axis, variables). The farmers marked points for each variable according to their cards. The point was the evaluation value and, in this way, graphs with several points were obtained and allowed the visualization of the behavior of the varieties with respect to each variable. The data for each variable was

A farmer researcher from Jocopampa analizes yield data of quinoa varieties. PROINPA

interpreted by observing the graphs with high, medium and low values. In the case of most variables, varieties with high values were preferred, with the exception of the productive cycle, where they looked for low values because short-cycle varieties were favored.

The farmers were suggested to identify the existing correlations between the variables in order to explore them. They identified, for example, that short-cycle varieties have low yields. In the joint analysis of the variables there was a lot of dialogue and learning between research farmers. Their preferences were very diverse and specific. Men and women prefer different varieties for cultivation, as well as for food preparation and market sale.

Joint data analysis

The team from the Foundation for the Promotion and Research of Andean Products (PROINPA, by its acronym in Spanish) that participated in the experience explored the variability of the data collected by all farmers during the first year of the experiment. Important components of variability were found in relation to the communities: the duration of the vegetative cycle, the availability of water and the varieties. These results are not surprising because these communities have different conditions and that was known beforehand; we know that the performance of short-cycle and long-cycle varieties is unalike and that the severity of the drought affects the crops correspondingly. These starting points are corroborated by the data. Furthermore, the selected varieties have different characteristics and, therefore, were expected to contribute significantly to the variability in the results.

An interesting result of the local analysis of the farmers, corroborated by the joint data analysis, is that when varieties that that are considered to have a long-cycle in a particular ecosystem are moved, they behaved like short-cycle varieties.

The most interesting finding from the joint analysis of the data is that varieties behave differently in different communities; there is evidence of interaction between varieties and locality. This affirms the decision to carry out the research in networks. The main learning is that the tendency to make uniform recommendations is dangerous; under real conditions, the performance of varieties is strongly influenced by the biophysical and social context in which they are grown. This reinforces the need to involve farmers in the evaluation of productive options within their own context. As a consequence of the farmer research network approach, the role of researchers and the institutions they work for changes from "giving recommendations and promoting their adoption" to sharing promising options, evaluating them together with farmers and systematizing learning in order to explain the variability that can be expected.

Consequently, our work as researchers becomes a task of sharing elements of information or technology that are not available to the farmers. That is, sharing and, evaluating with them the options and reasons why these options are useful for each context. This way, farmers can be empowered to make informed decisions and generate better skills to deal with the risks inherent to agricultural production.

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Friendly microbes

JEFF BENTLEY

At a congress in Cochabamba in March 2020 just before Bolivia went into quarantine due to the coronavirus, I had the rare opportunity of being part of a small group that witnessed how to make inputs or products for agroecological agriculture.

The organizers (the NGO Agroecología y Fe) were well prepared with written recipes for natural fertilizers and pesticides, with an expert for each input to explain what every product did and showed the practical steps. They also had their materials properly prepared in advance.

In a grass field we had plenty of space to build bonfires, mix materials like cow dung with dirt and water, observe and chat. Engineer Freddy Vargas began by preparing *bocashi*, whose preparation has been demonstrated by extension workers many times in Latin America over several decades, especially among environmentally sensitive organizations. Bocashi is sometimes described as a fertilizer, but it is actually more than just organic compost; it is also a source of minerals and microorganisms for the soil. Freddy explained that he has been making bocashi for the past 25 years, since he was in college. He uses it on his own farm and teaches this to farmers who want to bring life back to their soil.

Freddy mixes the leaf litter with soil that he collects from under the trees (known as *sach'a wanu*, in Quechua, "tree manure.") Tree manure contains natural bacteria and fungi that break down organic matter, give life to the soil, and control plant diseases. Freddy adds a few packets of bread yeast just in case. He includes bran and rice husk as a culture medium, but but any other organic product could be used. He also adds minerals: rock fluor (ground stone) and phosphite (rock flour and bone flour burned over low heat); incorporates chancaca (cane sugar) dissolved in water as food for microbes; and then removes all the ingredients with a shovel and covers it with a tarp to let it ferment. More or less every day, the bocashi is heated by the fermentation and the mixture has to be stirred again. It would be ready in about two weeks, depending on the

Engineers Freddy Vargas and Marcelina Alarcón add ingredients to make *bocashi*. Author

environment temperature. It is a demanding and very laborious procedure, but Freddy explained that he adds bocashi to the surface of the soil on his farm to release microorganisms that, over the years, help improve the soil so that it can retain more moisture. "Previously we had to water our apple trees every two days, but now we only have to water once a week," he explained. His enthusiasm and the clear evidence of benefits helped me reevaluate my skeptical opinion of bocashi.

Next, engineer Basilio Caspa showed how to prepare *biol*, a liquid culture of friendly microbes. In a bucket, he mixed fresh cow manure, *chancaca* (unrefined brown sugar) and water, explaining that when he shows farmers how to mix the biol, they oppose. "How is it that an educated man like you can mix cow manure with his hands?" they say. But Basilio likes to do things with his hands and is soon up to his elbows in the mix before pouring it into a 200 liter barrel and filling it with water.

Basilio puts an airtight lid on the barrel to keep the air away and installs a valve that he bought for 2 Bolivian pesos at the hardware store to let out the methane that the biol will release when fermenting. In a month, the biol will be ready to spray crops as foliar fertilizer and to prevent disease (because beneficial microorganisms control pathogens). Basilio actually wrote his dissertation on biol. He found that he could mix from half a liter of biol to two liters in a 20 liter backpack pump and that the more biol he puts in, the stronger the plants become. Based on that, he recommends using a minimum of two liters of biol for a 20 liter pump. We also learned how to prepare a mixture of sulfur and lime (calcium sulphide broth), an ancient pesticide. It is easy to prepare with lime and sulfur boiled in water.

But, do farmers really use these products?

María Omonte, an agronomist with deep field experience shared a doubt. With the help of Agroecology and Fe, she had taught farmers in Sik'imira, Cochabamba, to manufacture these inputs and then helped the communities test them on their farms. "In Sik'imira, only one farmer has made bocashi, but many made biol." This experienced group agreed: and so it was. Farmers tended to accept biol more than bocashi, but they were more interested in broths that look more like chemicals, such as the calcium sulphide broth, the Bordeaux mixture (a cupric fungicide) and the ash broth (boiled ash with soap).

The group animatedly discussed the low adoption of these preparations by producers in general. According to them, there are several reasons: one is that mixtures with microbes are not always correctly made, so the results are not optimal and the producers do not want to prepare the mix again. Another reason is that the peasants want immediate results and when they do not see them, they instantly distrust and stop its use. In addition, making biol and bocashi requires more time and effort in preparation than agrochemicals, and that discourages farmers.

Bocashi and biol do improve the soil; otherwise, engineers like Freddy would not continue to use them in their own farm. But perhaps farmers demand inputs that are easier to prepare. The next step is to conduct a study to find out which inputs are accepted by farmers and which are not. Why do they adopt some household inputs and resist using others? Agroecological technology, no matter how healthy, has to respond to user demands, such as being low cost and easy to prepare. This topic also deserves formal studies on the effects of minerals, organic matter, and microbes on soil fertility and structure.

Engineer Basilio Caspa mixes *biol*. Author

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Potato purple top:

How to manage this "disease" in Ecuador?

ISRAEL NAVARRETE, CONNY ALMEKINDERS, XUANYU YUE, KLEVER QUIMBIULCO, NANCY PANCHI, JORGE ANDRADE-PIEDRA, PAUL C. STRUIK

This study contributes to the discussion of how we should respond to epidemics of diseases and pests that affect crops. The article focuses on the purple top epidemic that is affecting potato producers in Ecuador.

The potato purple top "disease" is affecting potato farmers in Ecuador (Photo 1). We write "disease" with quotation marks because its causes are actually unknown; it became an epidemic in Ecuador while spreading rapidly from the North to the South of the country. It started approximately in 2012-2013 in Carchi, a province in the North of Ecuador. Since then, there have been two other outbreaks, in 2015-2016 and, recently, in the 2018-2019 period. The purple top has caused losses in potato production; forced farmers to plant at higher altitudes, contributing to the advancement of the agricultural frontier; and caused an increase in pesticide use. There is also evidence that the purple top is present in other crops (although we don't know its impact) such as *uvilla* (*Physalis peruviana*, also known as Peruvian groundcherry, *aguaymanto* or *chilto*), pepper (*Capsicum annum*) and tree tomato (*Solanum betaceum*, also known as *tamarillo*) (Caicedo et al., 2020).

However, little is known about the purple top in Ecuador. What we do know is that several agents can cause it: a) two types of phytoplasmas; b) an insect called potato

Photo 1. Researchers visiting a potato field infected with purple top, Pichincha province. Carmen Castillo

Photo 2. Purple top symptoms on the apices of plants, Cotopaxi province. Israel Navarrete

psyllid (*Bactericera cockerelli*, Hemiptera); locally known as *paratrioza*, and c) the bacterium *Candidatus Liberibacter solanacearum* (which also causes the disease known as zebra chip). All these agents have the ability to induce the following symptoms in the plant: a) the apices turn purple (Photo 2), b) the leaves of the upper part of the plants become erect and curl, c) aerial tubercles appear, d) the axillary buds proliferate more than normal, e) the stems branch out profusely forming what is known as "witch's broom", and f) there is a reduction in crop yield (Photo 3). Current recommendations are to use good seeds, monitor the potato psyllid, remove infected plants and rotate with other crops such as corn (Cuesta et al., 2018). However, strategies to control purple top during the growing cycle are still being developed.

It is not possible to leave potato farmers at the mercy of the disease until technical solutions are available. It is necessary to reflect on how this disease has been managed and what we can do about it. The answer is that we have to prepare in a collective manner to respond efficiently (Damtew et al., 2020). With this idea in mind, meetings and workshops have been held such as the "International workshop on preventing the spread of the main potato pests and diseases in the Andean region: purple top, potato psyllid and internal potato spotting," organized by the International Potato Center (CIP, by its acronym in Spanish) (Pérez et al., 2020). These meetings evidenced the need to learn how different actors have or have not responded to other diseases and pests around the world. For example, it has been observed that collaboration between actors is vital to establish monitoring systems. The meetings also clarified that not all the actors are going to intervene at the same time to handle the purple top; some will support at all times, while others will aid mainly at the peak of the "illness." This context makes it necessary to understand when and who you can count on to manage the disease

Following the needs identified in the meetings and workshops, CIP, together with the Roots, Tubers and Bananas program (RTB) of the Consultative Group for International Agricultural Research (CGIAR), the University of Wageningen and the Technical University of Cotopaxi, joined forces to identify the lessons learned from other epidemics that can be applied to the purple top epidemic, and to understand the moments in which the actors are willing to implement interventions. We hope that this article will lead to a discussion on how to prepare for epidemics of diseases and pests that affect crops.

Study 1: General lessons from other epidemics

In response to our first objective, a literature review was conducted to identify lessons that we can learn from other epidemics in humans, animals and plants. For example, we analyzed lessons learned from human epidemics such as ebola and zika; in animals, foot-and-mouth disease; and in plants, rusts in cereals. In total, 108 articles related to epidemic management were analyzed, each one was studied and the lessons were labeled using qualitative data analysis software. After identifying all the lessons, they were grouped into seven categories that we called "epidemics management areas." This review was conducted between October and November, 2019.

Study 2: Moments of an epidemic and the actors' disposition to carry out interventions

In the second study, nine interviews were conducted with different key actors that were selected for their ability to intervene in the purple top epidemic. The actors are part of farmers' organizations, governmental and non-governmental organizations, and international organizations.

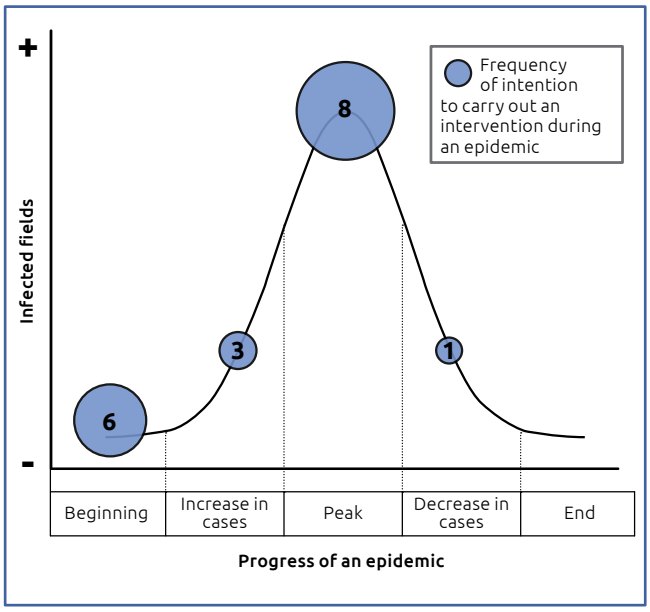
Each of the interviewees was shown the theoretical progress curve of an epidemic, in this case of purple top (Figure 1), divided into five moments: 1) start of an epidemic (with a few farmers affected), 2) increase in cases (more farmers affected), 3) peak (maximum number of farmers affected), 4) decrease in cases, and 5) end of the epidemic (there are no farmers affected). Then they were asked to decide at what point in the epidemic they would intend to carry out an intervention and their reasons for doing so. When answering, the interviewees were free to select more than one option. These interviews were conducted during November and December, 2019.

Lessons learned from other epidemics

During the literature review, we identified seven lessons that can be implemented in future epidemics of purple top or other epidemics in plants. They are described below according to the "epidemic management areas."

Photo 3. Yield of a plant that is infected with purple top, Cotopaxi province. Veronika Vogel

Figure 1. **When do different actors intend to intervene during epidemics of diseases and pests that affect crops?**



Collaboration and coordination lessons

The first general lesson is the need for collaboration and coordination between the different actors. This implies identifying a leader who facilitates the collaboration of activities with other actors. It is also necessary to involve and motivate actors to mitigate the impact of the epidemic, this is where producer organizations, NGOs and universities come in.

Producer organizations in particular should be actively involved in the decision-making and implementation processes to ensure that the management activities of purple top or other epidemics respond to the real needs of farmers. In this collaboration, it is essential to generate a negotiation process because different actors will have diverse motivations to collaborate.

Communication and awareness lessons about the epidemic

Improving communication between the actors was the second lesson that the literature review gave us. Providing clear and timely messages can contribute to the management of the epidemic and minimize its impacts. It is critical to generate an awareness process of the epidemic with the most affected actors; that is, the farmers who grow potatoes in Ecuador. As well, it is important not only to deliver a clear message, but also to translate the information into local languages and transmit them through communication channels that the actors, especially farmers, use the most (such as Facebook or WhatsApp). Raising awareness among farmers about the impact of purple top can be an important tool to contribute to the response against the epidemic.

Lessons on designing and implementing interventions

Designing and implementing efficient intervention strategies has been critical to manage epidemics throughout history. We have learned from past epidemics that interventions must include different agroecological principles; for example, interventions should seek the reduction of external inputs and the reduction of gender, generational, social and political inequality gaps. Due to the impact of epidemics, these interventions need to be designed as soon as the epidemic appears and all existing information must be considered. Examples of existing information for the case of purple top in Ecuador are the risk maps generated by ILCYM, a software that allows analyzing the risk for plants (in the validation phase under the Ecuatorian conditions), and maps of the presence of potato cultivation or of a diversity of Solanaceae (since other Solanaceae are being affected). Although this is not part of the design and implementation of interventions, lessons from other epidemics highlight the importance of ongoing evaluations to strengthen preparedness and contingency plans.

Lessons on financing

All these coordination, communication and intervention design activities need to be funded. In the case of other epidemics, access to funding was a relevant limitation to mitigate the impact on farmers' lives. From those other epidemics, we learned that financing must be available in times of emergency, as well as in the medium and long term. Funding can be used for multiple purposes, such as conducting awareness campaigns about the epidemic, strengthening local capacities and supporting the diagnosis of the causal agents of diseases.

Lessons on policies and regulations

The literature review showed that policies and regulations need to be improved to facilitate epidemic management processes. In the reviewed case, Ecuador is not only experiencing problems with the potato purple top, but also those of the Covid-19. Past epidemics have suggested that regulations and policies enable the management of simultaneous epidemics, requiring more trained personnel and funding. Furthermore, past experiences suggest that it is important to strengthen regulations in order to be prepared for future epidemics.

Health surveillance lessons

Strengthening health surveillance has proven to be one of the most salient lessons that has come out of the management of other epidemics. Strengthening early warnings using laboratory diagnostics, for example, is particularly vital. Similarly, health surveillance strategies have to consider events that allow a greater spread of diseases. In the case of the purple top, these events may occur at the time of purchasing the seed from unreliable sources in local markets because it

could transmit some of the possible causative agents of the "disease". Past epidemics suggest that sanitary surveillance should be complemented with reports from farmers in order to understand the impact that epidemics are having.

Research lessons

In the case of other epidemics, it has also been observed that strengthening research is a critical aspect. Participatory research with and for farmers has been essential. Farmer field schools and farmer research networks are some of the approaches that can be used to define management strategies and adapt them to local contexts. On the other hand, past epidemics show that research should not only focus on identifying the causal agents of these diseases or developing management strategies, but also on understanding the social and economic impacts caused by epidemics.

Despite not being explicit in the literature, we realized that it is necessary to consider the lessons while thinking about all the areas of epidemic management. For example, if collaboration between actors is not strengthened, there may be obstacles to generate changes in policies and regulations, or to obtain funds to implement interventions. In a similar way, if there is no research on purple top, there will be problems in sanitary surveillance, in the training of farmers, and in the design and application of policies. Preparing for future epidemics of purple top or other plants pests and diseases will require us to implement these lessons simultaneously.

When do different actors intend to mitigate future purple top epidemics?

The results of the interviews indicated that all the actors are willing to mitigate the impacts of the purple top and want to implement interventions at the beginning, during the increase of cases, at the peak of the epidemic and during the decrease of cases. The moments with higher intentions of intervention were at the peak (eight of nine interviewees) and at the beginning of the epidemic (six of nine interviewees). None of the actors mentioned the end of the epidemic as a time to take action (Figure 1).

The reasons for becoming involved in those moments of the epidemic were related to the roles of each of the institutions. Some interviewees mentioned that their role is to warn other actors when a purple top epidemic begins. Others mentioned that their role was to control the epidemic at all times, since the economic incomes of various social groups, especially farmers, depend on that. Similarly, additional actors mentioned that their role was at the beginning, during the increase of cases and at the peak, because it was necessary to build capacities for farmers to handle the epidemic.

Key messages from these investigations to prepare for future purple top epidemics

The literature review and expert interviews allow us to define two key messages. The first is that the lessons we have identified are helpful in preparing for the purple top and other epidemics of plant pests and diseases. The impacts of future purple top epidemics can be mitigated if we learn to collaborate between different actors communicate and rethink interventions. As well, if all the actors involved jointly seek funding or contribute to improve regulations and policies, support the development of the sanitary vigilance systems and participate in the investigation – in the end, we all conduct the research. Learning from the past will allow us to be better prepared to face future epidemics by supporting farmers with interventions that are applicable and efficient under different social and ecological conditions.

The second key message from these investigations is that it is important to involve different actors in mitigating the impacts of epidemics. As we saw in the interviews, each actor plays an important role at a certain point in the progress of the epidemic. Some will be more inclined to implement actions at the beginning, while others would at all times. Knowing who you can count on is valuable in order to manage epidemics collaboratively. The authors of this article believe that joining forces to face the impacts of an epidemic is everyone's responsibility.

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The school. Authors

Schools and seeds: spaces for a dialogue with traditional knowledge in the Peruvian Andes

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The article describes the experience of the educational institution N° 32677, 3 de Mayo, of Huayllacayán, which integrates traditional knowledge in the regular curriculum and demonstrates some of the potentialities of intercultural education, especially around the linkage of the national educational system with the ancestral and traditional knowledge of the communities. It also illustrates how much our intercultural educational models are missing to be able to develop in context and at a distance from the dictates of urban centers, which are usually out of touch with the agrarian problem.

In the Peruvian Andean region, farmers traditionally and historically conserve and manage a great diversity of crops and varieties along an altitudinal gradient, a crucial strategy to adapt to the great environmental variability and the typical climatic uncertainty of the mountains. These local production systems are part of family farming, of worldwide importance for its traditional risk management knowledge and techniques that can contribute to the adaptation to climate change, in addition to being vital for food safety.

Unfortunately, there are global processes that are affecting food security systems, whose multiple expressions, such as industrialization, poverty and the loss of local knowledge and techniques, are risking the future of global food production. In this context, we have the challenge of identifying the role of certain key institutions, such as the formal school.

Within the various cultural contexts, the school plays a fundamental role in the dissemination of knowledge for new generations. However, it does not always consider the

Seeds farm. Authors

social, cultural and linguistic particularities of an important sector of Peruvian girls and boys because these are not taken into account as a central dimension within educational programs. The discontinuity of educational programs with an intercultural approach promoted and supported by the State must also be added because it constitutes a critical point in the search for respect and continuity of the traditional and local knowledge that is part of the Andean ways of life.

The Schools and Seeds project: a dialogue between two cultures in the Andes of Huánuco

The project "Agrobiodiversity and traditional knowledge: linking seeds with schools for adaptation to climate change in Andean communities of Peru," of the Arid Zones Research Center in La Molina National Agrarian University (CIZA-UNALM, by its acronym in Spanish) and the Collaborative Crop Research Program of The McKnight Foundation, was implemented between 2016 and 2019. It had the support of NGOs from three regions of the Peruvian Andes: the José María Arguedas Andean Center for Education and Promotion (CADEP, by its acronym in Spanish), from Apurímac (South); the Development and Environment Institute (IDMA, by its acronym in Spanish), in Huánuco (Center); and the Services Central of Peru (CEPESER, by its acronym in Spanish), from Piura (North).

The project sought to help understand the relationships between teachers and farmers who are mothers and fathers in the rural Andean school scenario, and whether these bonds allowed for the continuity of the transmission of local knowledge on native Andean crops, its use and management, and the passing on of this information through dialogues and contextualization of educative contents with an intercultural approach.

The project began its activities in 2016 with IDMA in the district of Quisqui, province of Huánuco, in the central highlands of the country, where this organization and CIZA-UNALM have been collaborating for more than 10 years. Quisqui is particularly important for possessing a great wealth of native crops and varieties, as well as farmers who conserve and guard them, distributed over the Mito river basin, a tributary of the great Huallaga river. With these efforts, the creation of an Agrobiodiversity Zone was supported by Regional Ordinance N° 097-2014-CR-GRH, on December 26, 2014.

In 2017 the project reached the 3 de Mayo community in Huayllacayán. It was presented to teachers, students, parents and the management team. This generated great expectations among the teachers of the Educational Institution N° 32677, who considered it interesting and novel to learn more about traditional knowledge on native crops, and because it sought to promote a more active relationship with parents, only that this time the school and students would learn from them. Hereunder, we will share the experience of the Huayllacayán school within the framework of the project.

Educational institution N° 32677, 3 de Mayo, of Huayllacayán: promoting intercultural knowledge dialogues

This school is located at 3,200 m.a.s.l. in the town of the same name, which is part of the district of Quisqui, in the Huánuco province. It is a regular basic education institution created 47 years ago. Furthermore, it is a multigrade school with kinder, primary and high school levels, and has capacity for a population of 85 students and eight teachers: one in kinder, two in primary and five in high school. It is important to mention that this school has received significant support for its creation from the 3 de Mayo community of Huayllacayán and the Quisqui District Municipality which, in the latter case, provided support with teaching contracts. This occurred even before the school was under the jurisdiction of the Local Educational Management Unit (UGEL, by its acronymin Spanish) of Huánuco.

In 2017, the school began joint work with IDMA-Huánuco by developing the first conversations for the implementation of the project, thus initiating the alliance with this institution and with CIZA-UNALM.

The course: Andean mountains, climates and crops

As part of the project, a blended training course for teachers was carried out mainly with primary school educators. It was called "The mountains, the climates and the Andean crops: science and traditional knowledge," which sought to place the school curriculum in an intercultural approach context, especially the area of Science and Techonology.

The course –of three to four months in duration- took place in two occasions, in 2018 and 2019. It consisted of four modules that were equipped with learning materials such as pedagogical folders (with concepts, activities and learning sessions) and notebooks with reference bibliographies systematized by modules. The course modules were the following: a) ecosystems, Andean mountain ecosystems, reflections on "our Andean people," b) native agrobiodiversity

and crop breeding from the Andean culture, c) food security and sovereignty, and d) worldview, climate and local knowledge of the Andean culture.

Each module presented activities that allowed the teachers to re-elaborate concepts, adapt the topics to the age groups of their students and expand the content, among other aspects. These activities enabled the generation of ideas and thematic and didactic resources for face-to-face classes, such as texts, caricatures and stories of local knowledge on the use and management of native crops. The teachers were particularly encouraged to get closer to local knowledge by asking them to solve activities through interviews with farmers (who were student parents) on the topic of native crop seeds.

One of the final products of these activities was to develop learning sessions with innovative and locally contextualized topics based on the course content. In some cases, they were incorporated into face-to-face classes where materials were generated with the students. The teachers who finished the course with a passing grade –which, in the case of Huayllacayán, were three at the kinder and primary level– received a certification from the Faculty of Sciences of the UNALM.

In this way, the inclusion of topics on Andean ways of life related to the use and management of native crops and local foods of the Andes began, while teachers were trained in the use of concepts and the theoretical framework generated from scientific knowledge on these same issues.

Innovation and creation of new educational spaces

Various experiences of the school community were carried out through activities that were added to the academic practice. What is narrated here is based on the results and memory of an important nucleus of people within the school: the principal and two teachers. Even though it's a small number, they successfully took on the task of working cooperatively and responsibly during the process of the project.

Different ideas and initiatives emerged from the framework of the course and project, such as the possibility of organizing agrobiodiveristy fairs of native products, as well as the implementation of the *Muru huasi* (Seeds Hall), directly from the school's native potato and seed farm and garden.

Finally, as part of a process of systematization and dissemination of the academic work developed within the framework of the project, the school generated a *Revista escolar* (school magazine) where all the described activities were published.

These innovations contributed to the strengthening of the educative practices in live spaces where direct interaction of children with knowledge and local practices are prioritized. The activities also boosted a greater and stronger participation by fathers, mothers and other family farmers in the school space. Both of these are important first steps to recognize that they are the possessors of the knowledge presented.

The Agrobiodiversity Fair

This fair is an activity organized by the school and began in 2018. From that year on, it has been scheduled for every May 3rd, the day when the creation of the community is celebrated. The students are accompanied and guided by their farmer mothers and fathers, and present their knowledge about native varieties of potatoes, ocas (*Oxalis tuberosa*), mashua (*Tropaeolum tuberosum*), ollucos (*Ullucus tuberosus*) and medicinal plants at the fair. Their expositions include sharing the local names, exhibiting the crops and tasting the traditional dishes.

The children displayed models of crops, technologies and local agricultural practices made with their parents. For example, they created ceramics of native potato varieties, diverse crops and animals based on clay, as well as models on the origin of the native potato and its journey to the town of Huayllacayán and the city of Huánuco. In other cases, they prepared scale models with straw baskets and local materials such as mud and wild plants; for example, a *tambo*: a hut that peasants build to store agricultural products after harvest that also serves as a refuge and shelter for animals when there is bad weather.

Both boys and girls and also young adults presented poems, songs, drawings and paintings alluding to biodiversity. Their creations showed their skills, feelings, emotions and artistic expressions regarding local agrobiodiversity, and also strengthened their identity as part of the community. At the end of the fair a jury evaluates the works and gives a prize of radio equipment and materials for drawing and painting to the winners.

The school considers that these activities are very important because through the performance of collaborative and active teamwork, the educational community of Huayllacayán gains a feeling of direct involvement with the project.

Likewise, it has been a key space for interaction between teachers, students and their families, mainly dedicated to agriculture. This is a first step to visibilize the importance of promoting the participation of farmers in a school environment and to incorporate key issues about their ways of life.

The Seeds Hall: Muru huasi

In conjunction with the school and parents, the project supports the establishment of the Muru huasi, a classroom destined to the permanent dissemination of diversity and the importance of active discussion on native Andean crops and seeds through the exhibition of infographics and reference bibliography by both teachers and students. The classroom includes a model of the Mito basin, which houses the Rangracancha micro-basin, where the 3 de Mayo community of Huayllacayán is located. This room is usually decorated with visual works created by the students and teachers, as well as those generated in the formative course. It is intended to be a living and dynamic space, open to the entire educational community.

We expect that in the near future the Muru huasi will become an even more open and connected space to the community of 3 de Mayo of Huayllacayán, where materials, resources or products directly generated or in collaboration with the farmer fathers and mothers can be received and housed, taking advantage of their local knowledge on agrobiodiversity and native seeds of Andean crops.

The Muru huasi was inaugurated in 2019 with guests such as the mayor of the Quisqui district, as well as representatives of NGOs like IDMA-Huánuco and Peace Islands. UNALM specialists and the entire educational community, made up of teachers, boys and girls, young adults and fathers and mothers who are mostly farmers, also participated. The inauguration coincided with the second Agrobiodiversity Fair, which is why the students' works became part of the permanent exhibition of the Muru huasi. Acrostics, poems, drawings and models were among the most prominent materials included.

The Seeds Farm for the conservation of native potatoes

The Seed Farm is perhaps one of the most important new educational spaces due to its direct link between school and community and because it contributes to teaching and learning outside of classrooms but within educational practice. It was conceived as an open space provided by the community –by the students' fathers and mothers who are farmers– to contribute to the valorization and strengthening of traditional knowledge and practices of native Andean crops and its local use and management, mainly in terms of

the conservation of native potato seeds and the recovery of the high altitude sowing or *chiwi*. This is how this significant setting came to existence; it is a place for teaching traditional knowledge where farmer parents, teachers and students converge and where everyone can participate collectively.

The farm was established between 2018 and 2019 and began with seeds of five potato varieties (two to three kg per family, 80 kg in total) and sheep manure provided by the families. Eventually the seed farm reached 40 varieties. Close to 30 parents carried on the cultural work together with the support of three teachers and 10 primary school students.

When the farm was harvested, the families sold the crops to cover their children's expenses, yet they always set aside money for the seed, of which a portion remains in custody of the school. In addition, another fraction of the harvest was given to the Qali Warma school feeding program.

It is important to mention that it is a somewhat unexpected achievement that the school is gradually inserting itself into the local seed system, not only because it has a farm of native potatoes for educational practice, but also because it has become the guardian of a portion of seeds. This could contribute to the integration of this educational institution with the community as another node of the local network of seed exchange that develops between different family units.

The organic garden

A lettuce garden was installed in the school in 2017, it helped improve students' diet and also became a space for integral learning about healthy habits by sowing and cultivating vegetables.

Parents collaborated in the preparation of the land and subdivision by school degrees, the organic garden was established on a 60 by eight meters area. The furrows were made by the 3rd, 4th, 5th and 6th degree students under the direction of Professor Serafín Calderón Minaya. The seedling was donated by a parent, Jesús Robles Daza, and the students were in charge of the transplantation onto the prepared plots. The lifting of the organic garden's fence was carried out with the support of each student and using meshes donated by IDMA.

The School Magazine

The magazine was proposed and designed by Professor Hugo Villar Domingues (a teacher hired by the municipal management for the secondary level of the school) as a means to communicate information from the Agrobiodiversity Fair and for the products developed by the students on a yearly basis. The magazine circulated in the educational communities with about 50 copies during the Achievement Fairs (programmed every two months in the communal calendar of the educational institution and in the Annual Work Plan) of 2019.

Challenges and achievements: an initial balance

When the Schools and Seeds project began, teachers were not aware or were unfamiliar with this other type of local knowledge, despite maintaining constant communication with parents. They did not realize that they were farmers that possessed a broad knowledge and experience of native agrobiodiversity

Therefore, the great challenge was to open the doors of the school to this knowledge and to those who preserve and practice it: families. That was achieved with the formative course and the educational spaces generated and they began to take this knowledge into account. The opening of the school and the role of the director and teachers were key in this process, as well as the coordinated work based on the relationship of trust with the community, IDMA-Huánuco and UNALM.

It is important to mention that these important educational innovations have began to be included and formalized in the school's Annual Work Plan and with the official educational entity, the UGEL. It is expected that in the future, these activities will be considered in the development of the Institutional Educational Project (PEI, by its acronym in Spanish), which is prepared every three or four years in a participatory manner with teachers, students, fathers and mothers.

School N° 32677 is constantly setting new challenges and goals for itself, such as sharing and replicating the experience with the Rural Educational Networks, these are schools that exchange pedagogical experiences and are recognized by the UGEL. The teachers, as well as the members of the project alliance, are motivated to participate by communicating and sharing what they have learned so far.

Finally, even though a process of educational innovations with an intercultural approach was triggered, it is important to carry on an in-depth reflection on why and how to develop an intercultural education proposal that would contribute to incorporate and emphasize the importance of this local agroecological knowledge and education practice in a permanent manner. This is the great challenge for teachers, who will now have to promote a schooling that, although classified as regular basic education, has the great opportunity to provide children from Andean communities with a culturally relevant education.

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We want to dedicate this article to the Engr. Wilmar León Plasencia, who was the director of IDMA-Huánuco and a crucial actor for the development and success of the Schools and Seeds project in Quisqui. Wilmar shared with us his experience, affection and commitment to working with Andean communities and with the agroecological movement for many years. Goodbye, dear friend.

The ecological production complex

A potential strategy to promote an **agroecological transition** in Bolivia

ANA DORREGO CARLÓN

From field practice, in the fabric of networks, to the broader level of state planning for production, what place does agroecology occupy? The systematization of the Bolivian experience in the context of "production complexes" allows us to take a glance at the dimensions of the task of carrying out agroecological transition processes.

The text raises some reflections about the ecological productive complex potentialities in the debate on the promotion of agroecology in Bolivia, based on the results of the systematization and capitalization process of the "We Produce to Live Well: Program of inclusion and development of the ecological production complex in Bolivia," funded by the European Union, and executed by the Association of Organizations of Ecological Producers of Bolivia (AOPEB, for its Spanish acronym) and Practical Action (Soluciones Prácticas) from December 20, 2016, to December 20, 2020. This program was implemented in 15 municipalities from seven departments of Bolivia: Camargo (Chuquisaca); Achocalla, Caranavi, Sica Sica, Palos Blancos, Alto Beni and Coroico (La Paz); Salinas de Garci Mendoza (Oruro); San Pedro de Buena Vista and Tupiza (Potosí); San Ignacio de Velasco and Yapacani (Santa Cruz); Padcaya and San Lorenzo (Tarija); and Rurrenabaque (Beni).

The systematization, understood as a critical interpretation of the process carried out by the project, had the objective of learning, improving and generating transformative knowledge, as well as expanding information on the advances and challenges of ecological production in Bolivia from the analytical framework of the productive complexes and the agroecological approach.

The methodological approach consisted of a practical method for describing and analyzing experiences in order to achieve a complete documentation or capitalization with accord to the "learning by doing" methodology (Chávez-Tafur, 2006). In this sense, the tools designed to collect information from the experience made it possible to describe what happened and what was achieved, including difficulties and unexpected results. In addition, the data collection and analysis matrices contain a series of parameters defined in relation to the project's objectives and strategies and the analysis framework, which were the general guide. Each of the parameters contains a set of indicators that help to specify the most relevant aspects that have (positively or negatively) influenced or that were, are or will be related to the activities and results of the entire process (Chávez-Tafur, 2006).

With the intention of contributing to the debate on the promotion of agroecology based on lessons learned and practical experience on the relationship between actions, actors and different territorial contexts in the implementation of the ecological production complex in Bolivia, a series of questions are posed that guided the systematization process of the project.

Ecological producer of San Lorenzo, Tarija. Lubert Chirinos, Practical Action

- What are the characteristics of an ecological production complex in Bolivia?
- What factors/conditions must exist for an ecological production complex to develop in Bolivia?
- What is the role and participation of the AOPEB and the ecologic producer organizations (OPE, for its acronym in Spanish) in the ecological production complex in Bolivia?

Theoretical framework: productive complexes and agroecology in Bolivia

"Plural economy" has been defined by the Plurinational State of Bolivia as the path to Living Well (see box on page 40). In it, the production complexes are the cornerstone, the base from where the actors find the paths for innovation, growth and development. The Economic and Social Development Plan (PDES, by its acronym in Spanish) explicitly recognizes the role of production complexes in "Pillar 4, Scientific and technological sovereignty with its own identity," and in "Pillar 6, Productive sovereignty with diversification."

In a specific territorial area, the productive processes by category and product seek to articulate with each other to constitute territorial productive networks for the achievement

Living Well, as assumed in the principles, values and purposes of the Political Constitution of the Bolivian State, proposes an ethical vision of the economy and of the relations of exchange, an objective where the individual relationships of people are not predominant. Instead, it prioritizes a complex relationship, based on the exchange, balance, reciprocity, respect and spirituality principles, between humanity and nature, to guarantee future life.

(B. Elías, 2013).

Table 1. **Human Development Index estimation according to planning districts**

Parámeters	Indicators
Articulation of actors, participation	- Participation of women and youth. - Role of AOPEB: leadership as a dynamic agent and facilitator of spaces for dialogue. - Networking, collaboration between actors. - Associative culture. - Inclusive communication.
Sociocultural impact	- Capacity building and knowledge sharing. - Revaluation of knowledge and cultural dynamics. - Incorporation of innovations. - Empowerment of women and youth. - Consumption trends.
Economic impact	- Income. - Strategies for the creation of added value. - Markets and commercialization channels.
Environmental impact	- Resilience and adaptation for climate change. - Diversity. - Localization of production and resources.

of economic development according to the different macro-regions and regions of the country. They also invigorate each other and create productive networks with different connected actors. In this context, a production complex requires basic conditions for its full development, such as the strengthening of intermediate cities, infrastructure for production and the constitution of an articulating nucleus that facilitates the connections between the productive actors and the necessary services for its consolidation (technology, financial and basic services) (PDES, 2015).

The productive complexes have the priority of strengthening the potential and productive capacities of producers and social organizations, cooperatives, associations and productive communities of the country with technical assistance, training and the provision of inputs and services necessary for production and transformation. This permits a territorial production complex (CPT, by its acronym in Spanish) to be much more than a production chain. It is a systemic concept in which the actors, resources and interconnections take place and land the goals and objectives for which they are articulated (AIRAD/GIZ, 2019).

The networks are, therefore, the natural spaces of the CPTs and the context where they develop actions and establish links and relationships that drive the different actors involved. Without the establishment of networks, which can be platforms or other articulation mechanisms, the sustainability of the processes become difficult (AIRAD/GIZ, 2019).

Taking into account the aforementioned, CPTs are synthesized and conceptualized as systems or sets of interrelated elements that seek a common goal and whose dynamization is achieved through the construction of networks. In this sense and in conjunction with the analysis of the agroecological framework, the different axes and dimensions of analysis were organized and defined to capitalize the experience of the project.

Agroecology –or agroecologies, as some authors refer– present a polysemic notion. As a science, as a social movement and as an agricultural practice, its characterization also depends on the scale of the approach: plot, agroecosystem and food system. Here we consider agroecology as an approach that integrates the science of ecology with other scientific disciplines and different kinds of knowledge to guide research and actions towards a more sustainable and fair agrifood system (Méndez, 2019).

This conceptualization dialogues with the way in which agroecology is understood and practiced in Latin America, and specifically in Bolivia through the AOPEB, an organization that promotes ecologic production and has worked to encourage agriculture based on agroecological principles. The AOPEB also considers that this type of production, according to the definition of Via Campesina, goes beyond the ecological-productive principles because it incorporates other social, cultural and political principles and goals (Rosset and Martínez-Torres, 2013).

The project sought to contribute to the implementation of the PDES 2016-2020 with active participation of the ecological productive complex at a national, regional and municipal level. Work was done on four components: strengthening the capacities of organizations to encourage organic production; strengthening AOPEB and the ecologic producer organizations through the services provided by AOPEB; promoting the articulation between actors who work on norms and regulations related to organic production, as well as capacity development and leadership training within AOPEB; and promoting inquiry processes of effective and alternative communication mechanisms through a communication-action that accompanies the advocacy process and enables to position the proposals at the municipal and national level.

Main results and discussion

Some of the main accomplishments that the main actors of the project mention is the protagonism that the organizations of ecological production (OEP) acquire at a local level. The OEP manages to build policies that promote the ecological production from local spaces of concertation and/or planning that are not necessarily related only to the ecological sector, and materialized in plans of promotion and reactivation (the latter one, after the pandemic covid-19 crisis) that are susceptible to compromise resources. In addition, we must also take into account the creation of new platforms that bring together different actors in the agroecology of Bolivia, like the case of the recently launched Agroecological Movement (MAB, by its acronym in Spanish) and the use of a territorial and community work approach.

In addition to the covid-19 pandemic, the main difficulties to have a clear view of the productive complex are also the political crises. Since it was a project linked to decision makers, the participation of actors who do not prioritize

ecologic production, as well as the organizational weakness of ecologic producer associations, hindered its posible impact.

The analysis of the experience was carried out based on the opinions, criticisms and judgments of the participants which were collected through 32 interviews with producers, national and local authorities, technical teams (national and local) and other actors (11 women and 21 men), beside from four focus groups with 20 female producers and 8 male producers. The parameters and indicators used are shown in Table 1.

As lessons learned, the different stakeholders highlight, first and foremost, the methodologies used. Work methodologies that respect the contexts and "what is there", as well as validated, enriched and recognized leadership training methodologies (through the schools of leaders). It is important to understand that the Municipal Economic Productive Councils (COMEP, by its acronym in Spanish) are spaces that are "more big" than "the ecological", as it is key to involve the greatest number of actors in order to generate interactions and promote institutionality in these spaces while working on their governance.

The confluence of public and private resources also becomes a fundamental element for appropriation and sustainability, while the alliances between governments and producer organizations generate exchanges that enable the guide to better interventions.

The experience of Bolivia shows that in order to develop a productive complex it is important to have interest and prior relationships of trust in the territories, as well as having an agent that can boost the processes. But it is necessary to strengthen producer organizations by improving the capacities of advocacy with a gender and generational approach, through transdisciplinary methodologies, so that they take ownership of the advocacy processes. Likewise, interconnecting the different sectors and agents of agroecology is fundamental, and not only the production sector. This implies involving consumption and public authorities. There is also a need for greater clarity in the production and development models, and a better correlation between the different levels of government (national and subnational). Furthermore, laws and policies with a bottom-up approach that "listen" to the needs of producers in terms of access to credits, investments, technologies, training, markets, tax differentiations, etc., are necessary, just as those of the rest of actors (mainly consumers).

Interventions must be articulated and alliances between public and private actors, and betwixt private ones, should be promoted. In the same line, the transfer of experience and knowledge generated by organizations that are present in the territories (such as the Federation of Associations of Municipalities of Bolivia) should also be expanded to scale up the impact.

The AOPEB is recognized as a representative institution of ecologic production in Bolivia. It is conformed of primary producer organizations, which is why it has a leadership role as a dynamic agent in the development process of the productive complex in the country. The organizational structures of the OEPs are still weak (hierarchical, patriarchal), so a key and basic element in the promotion of production complexes is to strengthen their capacities so that a greater presence of women in smallholder agroecological agriculture is recognized. As a consequence of demographic dynamics, there is a lack of young people that must be acknowledged and sought to involve and give them a voice. Likewise, advocacy processes should be driven in order to establish the foundations for the promotion and incentive of agroecological production, according to the local needs for appropriate technologies and innovations, access to credit, land, water, differentiated markets, tax differentials, etc.

Bolivia's National Summit for Promotion and Strengthtening of Ecological Production. Practical Action archives.

Finally, on the basis of these reflections, we must highlight the potential that ecological production complexes represent as strategies to promote the agroecological transition and its contribution to the current debate in academic institutions and development organizations on the model of agroecological agriculture and the impact of agricultural research and policies in general. The objective of this recognition is to expand its scale, either by wide adoption in large areas and by many producers (scaling out), or by institutionalizing support policies for successful experiences and alternatives (scaling up) (Rosset and Martínez Torres, 2013).

In this sense, the roles played by the various levels of government and their differences are recognized: the role of extension services and technical assistance; the role of local and regional governments; and how to involve the State in supporting the processes but, at the same time, maintain the independence of civil society and its organizations.

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You can download "We produce to Live Well: a look at ecological production in Bolivia from civil society", a complete publication on this experience, from: https://infohub.practicalaction.org/handle/11283/622750

Production, marketing and consumption

Mujeres en resistencia y territorios agroecológicos (*Women Resistance and Agroecological Territories*)
Narcisa Requelme (Coord.). 2019. Universidad Politécnica Salesiana/SEDAL Foundation. Quito, Ecuador.
https://dspace.ups.edu.ec/bitstream/123456789/18645/4/Mujeres%20en%20resistencia%20y%20territorios%20agroecologicos.pdf

Review of the participatory construction process of the Ordinance for the use of public space for the commercialization of healthy products in agroecological fairs in the Cayambe canton, in order to promote its correct implementation and become a reference for other groups of producers with similar problems.

Circuitos cortos de comercialización agroecológica en el Ecuador (*Short Circuits for agroecological marketing in Ecuador*)
Jackeline Contreras, Myriam Paredes, Sandra Turbay. 2017. *IDESIA (Chile) 35*(3)
https://scielo.conicyt.cl/pdf/idesia/v35n3/0718-3429-idesia-00302.pdf
This study analyzes the factors that promote the sustainability of the short marketing circuits of the Union of Agroecological Production Organizations and Associative Marketing of Tungurahua, in Ecuador. The authors propose that the viability of this economic strategy depends on the strength of informal institutions supported by social organization, which allows the reduction of transaction costs, thus improving economic efficiency

Sustainable agriculture

Una agroecología con raíz campesina (*A Peasant Rooted Agroecology*)
GRAIN. 2019. ***Biodiversidad, Sustento y Culturas***, 101.
https://www.grain.org/system/categories/pdfs/000/000/560/original/Definitiva-Biodiversidad%20101%20WEB.pdf
This edition of *Biodiversidad, Sustento y Culturas* vindicates agroecology and circulates peasant dialogues, as well as organizational proposals of agroecology from Brazil, Paraguay, Argentina, Chile, Ecuador, Costa Rica and Mexico, with testimonies, voices and peasant reflections against the free trade agreements, taxation policies, and devastation and poisoning of water, air and spirit.

Pest management

Guía de manejo de la punta morada de la papa (*Potato Purple Top Management Guide*)
Xavier Cuesta, José Velásquez, Diego Peñaherrera, Marcelo Racines, Carmen Castillo. 2021. Instituto Nacional de Investigaciones Agropecuarias. Quito, Ecuador.
https://repositorio.iniap.gob.ec/handle/41000/5345

A management guide for the potato purple top, one of the main problems that affect the potato crop and the cause of losses of up to 100%. It presents a description of its causative agents, the insect vector, management strategy and recommendations for the design of control strategies.

Manejo de plagas de la papa en la región andina del Perú (*Potato Pest Managemet in the Peruvian Andes*)
Jürgen Kroschel, Verónica Cañedo, Jesús Alcázar, Thomas Miethbauer. 2012. CIP.
http://cipotato.org/wp-content/uploads/2014/08/005830.pdf

A training guide that improves the understanding of potato pests' biology and ecology for a correct and more effective application of control strategies. This guide is based on a close connection between theory and practice, with field demonstrations and costing exercises.

Willay - Midiendo el tiempo sin instrumentos (*Willay - Measuring Time without Instruments*)
Juan Torres Guevara (2017). Servicio Nacional de Meteorología e Hidrología del Perú (SENAMHI).
http://repositorio.senamhi.gob.pe/handle/20.500.12542/252
This publication collects some samples of the ancestral knowledge developed by wise men and women of local cultures –*arariwa*, *misayoc*, *kamayoc*, *yachachichi*, today known as "curious" or "sorcerers" in different areas of Peru– through the observation of nature and climate. In it, some of the many signs, the most used warnings or indicators, the *willay*, which allow to measure time without instruments are presented.

Conocimientos ancestrales y adaptación al cambio climático en comunidades altoandinas de la Región de Huancavelica (Ancestral Knowledge and Adaptation to Climate Change in Highland Communities of the Andes in Huancavelica Region)
Gobierno Regional de Huancavelica (2015), Peru.
http://www.regionhuancavelica.gob.pe/descargas/upload/DOCUMENTOS%20DE%20GESTION/ESTRATEGIAS%20REGIONALES/2526782_Conocimientos_Ancestrales_y_CC-Silvano_Ninfa.pdf
Collection, analysis and comparison of bibliographic information with practices, testimonies and beliefs of cattle ranchers and farmers to predict extreme weather variations.

Access Agriculture
https://www.accessagriculture.org/es

Access Agriculture is a non-profit organization that broadcasts agricultural training videos in local languages. Its website allows to filter searches by product and language, and it offers the option to download material of interest. Material on good microbes for plants and soils can also be accessed in English and Spanish.

EcoConsumo Project
https://ecoconsumo.agrecolandes.org/

EcoConsumo investigates the circulation spaces for fresh organic products in Cochabamba, and builds and implements participatory strategies to strengthen them. Through its website, it is possible to access a map that shows the location of organic producers in Cochabamba, explains the organizational structure and collects the testimonies of producers that are part of this network.

PROINPA Foundation
https://www.proinpa.org/

PROINPA promotes the conservation and sustainable management of genetic resources in agrobiodiversity centers of Bolivia. It has an Integrated Crop Management (MIC, by its acronym in Spanish) program, which develops technologies for the integrated management of crops with an agroecological approach and with Bolivian agrifood systems resilience. Its website offers access to material produced by PROINPA that can be downloaded free of charge.

Practical Action
http://practicalaction.org.bo/publicaciones/

Practical Solutions works hand in hand with communities to generate ingenious, sustainable and appropriate solutions in agriculture, water issues, climate resilience and renewable energy. After 10 years of work in Bolivia, this website shares the voices of the people involved, beside access to a virtual library, news of interest, audio records and audiovisual material.

Bosques Andinos Program
http://www.bosquesandinos.org/

Regional initiative that helps the Andean population living in and around Andean forests to reduce their vulnerability to climate change and receive social, economic and environmental benefits from the conservation of woodlands. For this, information is generated and disseminated through applied research in these forests to detect, validate and share the existing good practices. Its website provides access to news, publications on Andean forests and research grants.

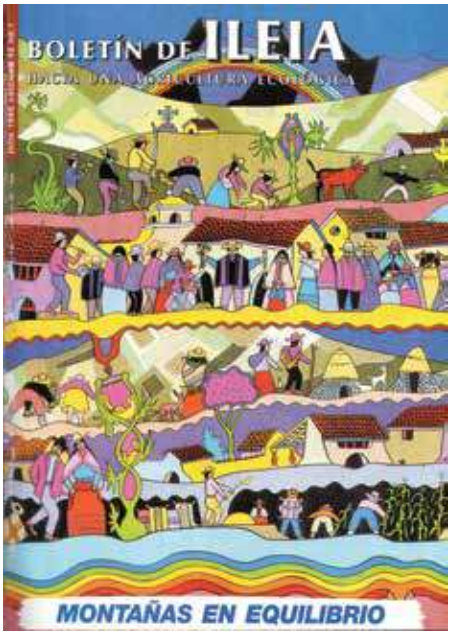
Instituto para el Desarrollo Rural de Sudamérica (*South American Rural Developement Institute*)

https://www.sudamericarural.org/
A civil society initiative born in 2009 to promote links, synergies and rural development actions with an indigenous peasant base in the South American region. IPDRS executes projects, conducts consultancies and evaluations, and manages services to strengthen capacities for rural development in South America through the lines of research-action, communication and interlearning.

LEISA 25 YEARS

revista de **AGROECOLOGÍA**

From *Boletín de ILEIA* (*ILEIA's Bulletin*) to *LEISA revista de agroecología* on-line



25 years ago, in July 1996, the first issue of our magazine appeared as *ILEIA's Bulletin*. It was basically a translation into Spanish of the magazine published originally in English by ILEIA (Center for Research and Information Exchange on Ecological Agriculture), a Dutch organization that pioneered globally the promotion of sustainable agriculture and agroecology, based on small holders and peasants facing poverty in the Global South, and in a deep dialogue between science and traditional knowledges.

Soon, the *Bulletin* would transcend the mere translation and began to search and publish practical experiences from Latin America which would be more friendly and useful to a permanently growing audience. The name of the magazine would change simultaneously in the Dutch version and in the new Peruvian-based Latin American and the Indian editions, to *LEISA*, acronym for "low external imput sustainable agriculture".

Thanks to the wise guidance of senior editor Teresa Gianella, head of the magazine for these 25 years, from the begginig and until her very last breath last May, 2021, *LEISA revista de agroecología* is a basic reference for everyone –farmers, field technicians, agronomists, activists, academics, politicians– involved in sustainable developement with social justice, plurality, diversity and inclusion. We are proud to say that, thanks to Teresa and all the people and authors involved in the magazine during a quarter of a century, we reach every three months tens of thousands of readers, even when we are no longer printing a paper version and all access is digital.

Although *LEISA* is not an academic, indexed or peer-reviewed publication, it is an obliged reference when assessing the model of sustainable agriculture that more and more international organizations and national governments are adopting as a resilient way out of the global climate crisis.