

POLICY BRIEF

ANDESCROP: Competent Use Of High Value Andean Crops

Introduction

The ANDESCROP project aimed to identify sustainable solutions for Andean agriculture, through the appropriate use of local agro-biodiversity. One of the strategies proposed was to promote the use of high-value Andean crops to improve food security, through conducting research on genetic resources, agro-biodiversity, production and marketing to give priority to native food products of high nutritional value against imported products and low quality and reducing endemic malnutrition while indirectly safeguarding the ecologically fragile conditions of the Altiplano, already threatened by increasing demand of native crops such as quinoa in the Central and Southern Altiplano.

Background

Bolivia is one of the world's most important centres of plant domestication, where high value Andean crops have been used as a source of food security for centuries. However some of these crops are currently in risk of genetic erosion due to the introduction of foreign staple foods like rice and noodles and also due to the harsh climate conditions in the Altiplano. Therefore it is of high priority to study, develop and improve consumption of these crops to improve farmers' livelihoods and malnutrition.

We have proposed to carry on participatory research in the producing areas selecting the following themes: Social environment; food security and rural family economy, in order to increase the use and consumption in the family and improve the market access for Andean crops. Plant agro biodiversity and genetic richness; through the characterization of the diversity of Andean crops, current states of conservation and the knowledge associated with conservation and use. The systems of organic farming; production scenarios, a variety of natural products for the control of plant health, crop fertilization, soil quality and seeds, crop management, harvesting, farming, marketing of primary products, use and access to water resources. The themes have been structured in the following workpackages:

Workpackage 1: Agro-biodiversity richness: 1.1 Genetic resources and ethnobotany, 1.2 Seed

Workpackage 2: Organic farming systems: 2.1 Soil fertility, 2.2 Water resources, 2.3 Crop management, 2.4 Plant health management

Workpackage 3: Food security and economics: 3.1 From farm to fork, 3.2 Farm economics

Considering the research objectives, all the research was conducted under an experimental-descriptive exploratory qualitative-quantitative approach. The data collection methods have varied always considering the validity of the information obtained; thus, the main techniques used are: Participatory Assessment Workshops, Stakeholders Interviews, Case Studies, Observation, Surveys and Agricultural Experimental Research, supported by the review of secondary information. Throughout four years of work, the project has complied with the general milestones proposed at the beginning, through the implementation of activities coordinated between the partner institutions.

Results

Workpackage 1: Agro-biodiversity richness:

This workpackage collected information about traditional knowledge and its role in local management and conservation of genetic resources and the dynamics and of seeds flow.

1.1 Genetic resources and ethnobotany

During the first year of the project, planning activities were conducted. For the fourth year a catalog of agricultural biodiversity and traditional knowledge and in situ conservation strategy was developed, in addition to the delivery of the genetic material collected to germplasm banks.

With the participation of farmers the collection of 23 species and 192 local varieties of potatoes, quinoa, oca, isaño, papalisa ajipa and lupine has been completed. The agromorphological characterization in the same communities was also made. The inventory of traditional knowledge associated to agrobiodiversity conservation was completed including: local agro-ecosystems, festivities, rituals, bio-indicators and traditional and non-traditional uses of agricultural diversity in communities of the northern, central and southern Altiplano and inter-Andean valleys; with the identification of populations of wild quinoa, wild potatoes, wild lupine and wild cañahua. The seed collected was from 7 species and 49 wild populations of quinoa, potatoes and lupine.

1.2 Seeds

Studies on the flow of native potato seed, oca and lupine in Northern Altiplano, quinoa on the Central Altiplano and real quinoa in Southern Altiplano were made. These activities were conducted through interviews with key informants in the communities. Likewise, the collection of information was carried out through visits to community fairs. Prioritized seed multiplication of varieties of potatoes, quinoa, lupine and cañahua were made. The multiplication of varieties for the second year of the project consisted of seven varieties of quinoa on the Southern Altiplano (=3496 kg), one variety of cañahua "Illimani" (=110kg), one variety of native potatoes (=1024kg) and one of Oca (=1242 kg) for the Northern Altiplan. While, for the Central Altiplano Waycha potatoes seeds (=2300kg) were multiplied. The multiplication of this seed was conducted in farmers' fields in the project areas and this seed has joined the local flow of the communities through participatory workshops.

Workpackage 2: Organic farming systems

This component monitored soil fertility, performing experiments in quinoa production systems in the Altiplano. Also, local mechanisms and strategies to control pests such as the identification of natural enemies of pests and the use of bioindicators were compiled and tested. Bio-inputs (Biol, Vigortop and Nitrofoska) were also tested in their effects to restore soil fertility showing positive results in quinoa and potato, increasing growth in plant height and panicle in quinoa.

2.1 Soil fertility and 2.2 Water resources

Evaluation of soil fertility was developed in the communities of Villa Patarani (Central Altiplano) and Saitoco (Southern Altiplano). In order to identify and improve soil fertility, physical and chemical analyses were performed in soil plots where organic fertilization and deficit irrigation experiments were developed. Through a chemical characterization of soils it was determined that the total nitrogen concentration of these soils ranges from 0.03 to 0.09%, therefore one of the strategies to improve soil fertility is using biofertilizer and organic manure.

2.3 Crop management.

The work was carried out in the Northern Altiplano (Jutilaya, Chojasqui and Canllapampa), Central Altiplano (Villa Patarani, Romer Cota Catavi, Kolluhuma, Queseria and CulliCulli Bajo) and Southern Altiplano (Saitoco, Chacala). For systems and ways of managing natural resources, in the first year of the project according to information in the baseline. Information about traditional management practices used in each region was compiled. For the climate change issue, the work focused on the recovery of traditional practices to address adverse events and the use of bioindicators for the sowing seasons. About soil fertility, emphasis was given to the collection of information about traditional forms of crop management and organic fertilizer production. For the issue of soil fertility management, an evaluation of the loss of fertility by wind erosion in the South Altiplano in quinoa production system was conducted, being the largest movement of the particles observed in the first 15 cm of soil, implying that through using cover crops, the movement of the particles due to erosion could be avoided.

2.4 Plant health management

Several training activities were developed in the communities of Carabuco, Cariquina Grande Jutilaya, Chojasquia and San Pedro de Punama in the Northern Altiplano with the realization of training sessions on monitoring pest of potato crops, using the methodology of Farmer Field Schools (ECAs). The diagnosis of insect pests for oca crop was held in the Chojasquia, Jutilaya, Cariquina Grande and San Pedro de Punama communities, where two crop insect pests *Aristidius tuberculatus* (oca weevil) and *Systema sp.* (oca worm) were identified. Also in lupine crops *Anthonomus species sp.* and *Feltia sp.*, were the key crop pests in Carabuco. However, in ajipa, *Bemisiatabaco* y *Cariede sicamae* were listed as key crop insect pests in Anquioma communities. For the management of crop pests of quinoa, an Integrated Pest Management plan was developed, where it was established that the plots of quinoa at rest are the main sources of infection quinoa moths, followed by potato plots. The pheromone trap "funnel" type was the most efficient with 63.4% in the capture of adult ticonas compared to trap "container" type that presented 36.7%.

In Culli Culli Alto and Romer Cota the larval ticonas population has been regulated by the VPN entomopathogen *Helicover paarmigena* (58.7%). Instead, quinoa moth larvae is being controlled completely with five parasitoids (*Copidosoma sp.*, *Meteorus sp.*, *Deleboeae sp.*, *Venturia sp.* And *Phytomyptera sp.*) in the same way, it was determined that between adjacent weeds to quinoa crop species *Brassica rapa* (Mostacilla), *Malva sp.* (Malva) y *Bidensandicola* (Muni muni), due to beneficial insect fauna associated with them, could be promising for the development of biological control of pests in the cultivation of quinoa in Romer Cota.

Workpackage 3: Food security and economics

This workpackage carried out studies of the different value chains of the targeted crops and the potential linkage of small producers to formal markets, such as public procurement markets for school breakfasts. This component comprises two subcomponents: 1) food security, 2) socio-economic. The analysis of horizontal and vertical dimension of the lupine and quinoa productive chains was carried on. Two documents entitled "Diagnosis of quinoa producer associations in the municipality of Patacamaya" and "Diagnosis of tarwi producer associations in the municipality of Carabuco" were written. Also, research on livelihoods and the socioeconomics of quinoa and tarwi farming families was carried on, being the main result that education does influence the production of quinoa and tarwi.

Conclusions

One of the aims of the project was to enhance research capacity, focusing on some of the main problems of food production, consumption and commercialization in the Bolivian Altiplano, as well as to improve biodiversity conservation and consumption of high value Andean crops. The project has fulfilled its main

objectives through research in a cooperative way with the participation of both national and international scientist. Moreover the participation of several students has increased the impact of the project in terms of research capacity building also addressed to young professionals.

The results and knowledge generated by the project was disseminated at all levels, from policy makers and politicians to NGOs, farmers' associations, and the farmers and communities themselves. The information can hence be used for the appropriate design of policies, programs and specific action towards the improvement and conservation of high value Andean crops, towards increasing their consumption at local, national and international levels.