Multidisciplinary research to improve global food security of the native Andean communities

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Introduction

A comprehensive project involving potato breeding, genomics, metabolomics, biochemistry, human nutrition, gender studies and agricultural education through participative research is in progress to improve the food security of indigenous communities in Colombia. The indigenous populations of Nariño province in Colombia are the second highest undernourished people in Colombia. The project seeks to impact on improved potato cultivars with high yield and nutritional qualities to improve daily diet, to make visible women's roles as axes of the family, adopt improved nutritional habits, develop participatory research on Good Agricultural and Postharvest Practices, develop nutritional value criteria in breeding processes and select potato genotypes with high resistance to "late blight" to mitigate potential risks of climate change.

Objective

To improve food security of indigenous communities by developing potato cultivars with higher yield and nutritional qualities to improve families' income and diet, to empower women as food security axes, to adopt nutritional habits, to develop participatory research on Good Agricultural and Postharvest Practices, and to introduce new molecular technologies in potato breeding to anticipate global warming.

The approach

This project considers that the Food Security and Nutrition (FSN) is a complex issue that requires different experimental approaches to resolve:

➢ Potato is a staple food of the Indigenous communities of the Nariño province, and the production of a cultivar with better nutritional quality of potato may have a significant impact on food security and nutrition.

➢Potato breeding programs in Colombia have never considered nutritional quality criteria for selecting new cultivars. This project builds the technological bases to do it: research in potato genetics, recovering genetic biodiversity, measuring the variability on nutritional quality of potato tubers, introducing new genotypes selected for their high iron content and other compounds.

➢New cultivars should be perceived by producers as a new opportunity to improve their income and their nutritional status to be successfully adopted. The new cultivars should present higher resistance to late blight to reduce production costs, they should be environmentally friendly and present other agronomical traits such as nutritional quality, yield, shapes and colors.

➢Current potato production presents problems referred to environmental management. Production techniques should consider Good Agricultural Practices and environmental protection.

➢The Colombian FSN policies do not consider that women and men perform different roles. Basic research on family roles with focus on women and on ethnical differentiation is carried out to support policies. To have a sustainable impact we are working together with local and regional authorities as well as indigenous autonomous authorities.

The scheme shows the interacting project components

Figure 3. Participatory research in potato breeding program. smallholders select and decide about new cultivars according their needs.

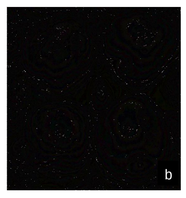

Figure 4. Potato (*Solanum phureja*) in Colombia. a) Biodiversity of the Colombian Core Collection. b) Advanced clones of the breeding program of the National University of Colombia.

1. Food consumption and diet
Characterize food intake of native potato production communities in Nariño. Contribute to the improvement of food quality and nutritional security of potato growers in five municipalities (fig. 1, 2)

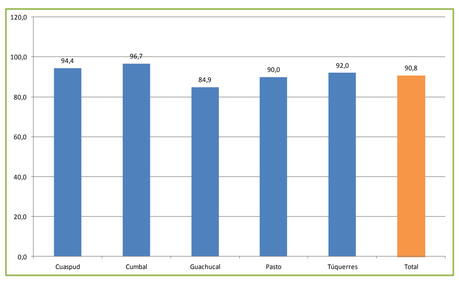

Figure 1. Population study on perception of food insecurity in the household for the five municipalities under study.

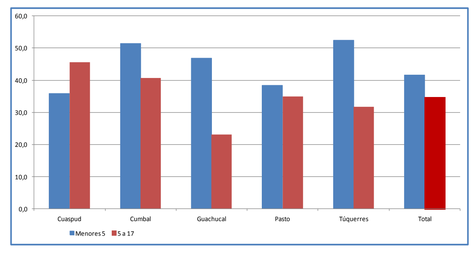

Figure 2. Nutritional situation for children under five years old and school age in population study for five municipalities. Data show delay in size in percentages.

Information about dietary habits

2. Potato breeding
Select potato cultivars with high yield, late blight resistance, improved processing quality, better nutrient content and community acceptance, for immediate release through indigenous community participatory research (fig. 3). and preserving germplasm (fig. 4)

Potato genotypes for consumption with higher nutritional micronutrients

Information about potato genotypes with improved nutritional quality

6. Family roles and gender
Identify sustainable strategies to empower Nariño´s indigenous women as axes for the achievement of Food Security and Nutrition (FSN) for their families and their communities (fig. 7).

Figure 7. Women engaged different roles as member of the family. a) woman loading a potato sack on her back. b) women cooking in traditional rural kitchen . c) women and men are harvesting and selecting new cultivars.

Training women leaders in FSN involvement of local and regional agencies

Potato genotypes for biochemical characterization

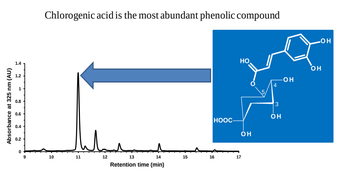

Figure 5. Phenolic compounds profile in potato tuber. Arrow indicates chlorogenic acid , which is present in highest concentration

3. Nutritional quality value
Select potato genotypes based on concentration of micronutrients (Fe, K, Zn), nutrients (carotenoids, ascorbic acid) and functional food components (phenolics) (fig. 5 , 6).

Good Agricultural Practices and participative research for new potato cultivars

5. Educational Program – ECA
Develop an ECA for the indigenous and poor smallholders in Nariño to introduce good agricultural and postharvest practices, including sustainable agricultural practices (fig. 8).

Figure 8. Field School for Smallholders (ECA).

New tools to improve plant breeding program

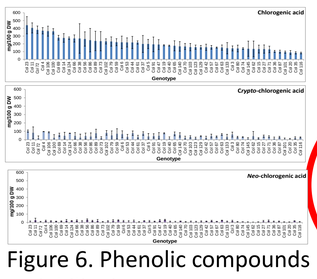

Figure 6. Phenolic compounds variability in potatoes genotypes in CCC. Analysis done in cooked tubers

7. Establish public advocacy strategies for the incorporation of the results of the project
Involvement of local and regional agencies. Participation in agreements on FSN.

4. Genomics and metabolomics
Apply genomics and metabolomics technologies to develop markers for selection and breeding of improved potato varieties with improved nutritional quality, resistance to late blight and adaptability to climate change (fig. 9).

Figure 9 Responses of potato genotypes to *Phytophthora infestans* infection (late blight). (A, B) Potato genotypes displaying stem resistance. (C, D) Potato genotypes displaying foliage resistance.

→ Interactions among project components.
→ Contribution to public policies

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