Creating a shared vision and action plan for the future of quinoa beyond its origins

Dr. Didier BAZILE,

didier.bazile@cirad.fr

cirad
AGRICULTURAL RESEARCH FOR DEVELOPMENT

Quinoa was only in the Andes for over 7,000 years.
Potential of quinoa rediscovered during the second half of the twentieth century.
IYQ 2013, quinoa's biodiversity and high nutritional value can play a role in providing global food security.

1- Background
2- Quinoa expansion : trends and limits
3- Vision and objectives of the GCN-quinoa

Quinua
2013 Año Internacional
Un futuro sembrado hace miles de años

1-Background – What is Quinoa?

Chenopodium quinoa Willd.

- ✓ Member of the **Amaranthaceae** family
- ✓ Grown primarily for its achene
  seed like fruit with a hard coat
- ✓ Closely related to beets, spinach or common lambsquarters;
- ✓ Gynomoneocious both female and hermaphrodite flowers
- ✓ Facultative autogamous annual
  annual 10-16% outcrossing
- ✓ Allopolyploid;
  base chromosome number of x = 9, 2n = 4x =36
- ✓ Highly nutritious plant; complete protein

Quinoa and Crop Wild Relatives

C. berlandieri

C. berlandieri berlandieri (Weed in USA, Canada)

C. berlandieri nuttaliae (cultivated in Mexico)

C. album

Weed in Europe

Cultivated en Asia

Center of origin of the quinoa (H. Wilson)

C. quinoa

Domesticated,

Cultivated in the Andes (Colombia, Ecuador, Perú, Bolivia, Chile y Argentina)

C. hircinum

Weed

South America

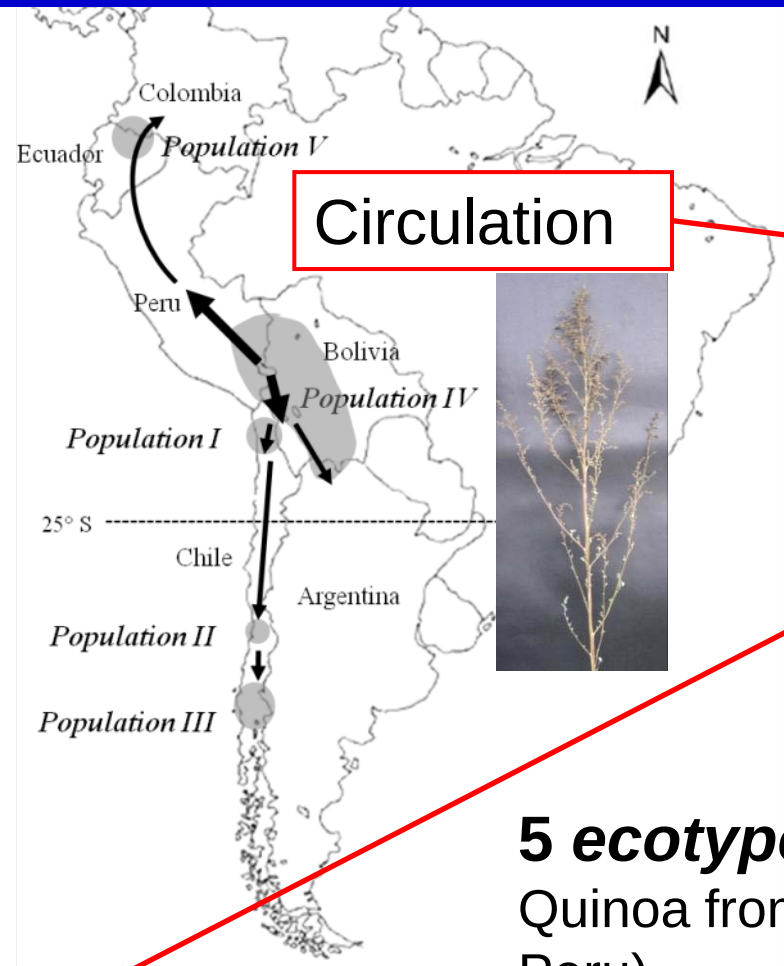
4 000 km

Content of essential amino acids (EAA) in quinoa in comparison to the values recommended by FAO (in grams per 100 grams of protein).

	FAO recommendations	**Quinoa**
Isoleucine	3.0	**4.9**
Leucine	6.1	**6.6**
Lysine	4.8	**6.0**
Methionine	2.3	**5.3**
Phenylalanine	4.1	**6.9**
Threonine	2.5	**3.7**
Tryptophan	0.66	**0.9**
Valine	4.0	**4.5**

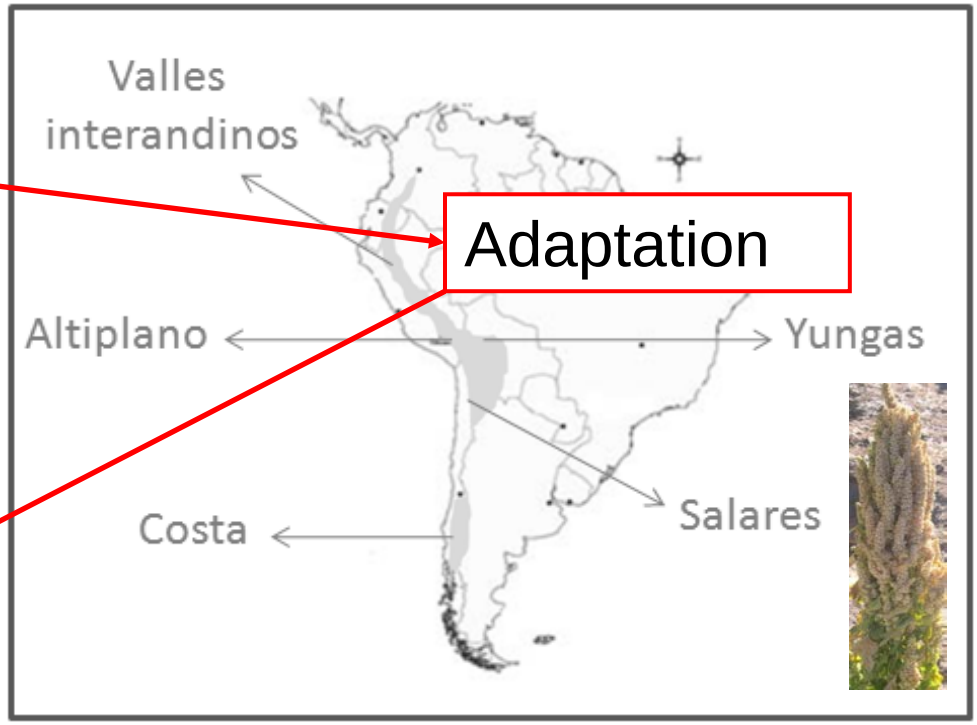
Adapted from Koziol, 1992.

Quinoa: a single domesticated species but five major ecotypes
– *but little known outside the Andes* –



Circulation

Adaptation



Utilization

5 *ecotypes* as *diversity sub-centers:*

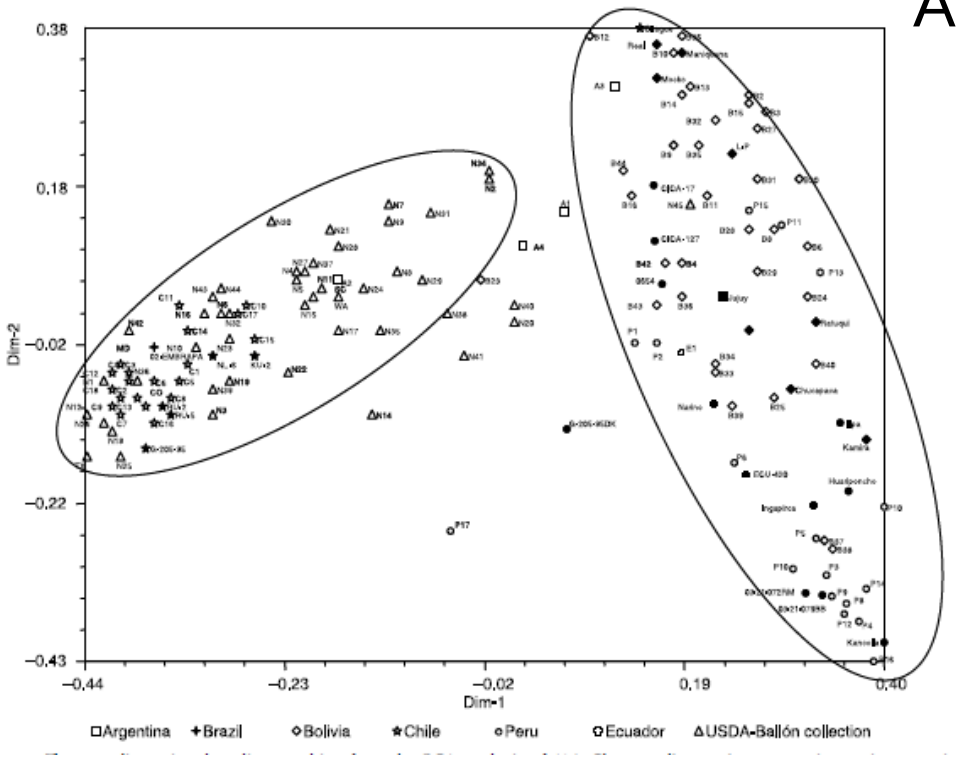
Quinoa from Inter Andean Valleys (Colombia, Ecuador y Peru)

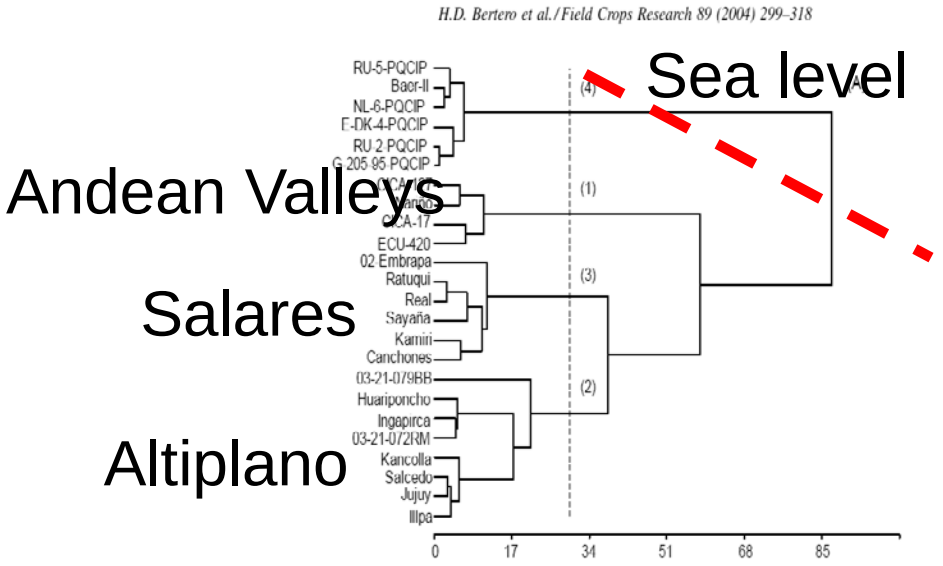
Quinoa from the Highlands (Peru y Bolivia)

Quinoa from the Y*ungas* (Bolivia)

Quinoa de los *Salares* (Bolivia, Chile y Argentina) Quinoa from Sea level (Chile)

What can be grown in temperate environments outside the Andes?





Christensen et al. 2007. Plant Genet. Res.
Bertero et al, 2004. Field Crop Research

2- Quinoa expansion : *trends and limits*

- Different steps for a global spread:

- Many local initiatives to adapt quinoa to new environments from the 40’ to the 80’
- FAO, first global initiative : “American and European Test of Quinoa” (1996-98) with field trials in several countries such as Sweden, Poland, Czech Republic, Austria, Germany, Italy and Greece.
- Nowadays, quinoa is present in more than 100 countries.

- Problematic for expansion:

- High genetic diversity with 5 ecotypes
- Resistant to abiotic stresses (drought and salt)
- Optimal source of proteins with all essentials amino acids

NORTH AMERICA

EUROPE

ASIA

AFRICA

SOUTH AMERICA

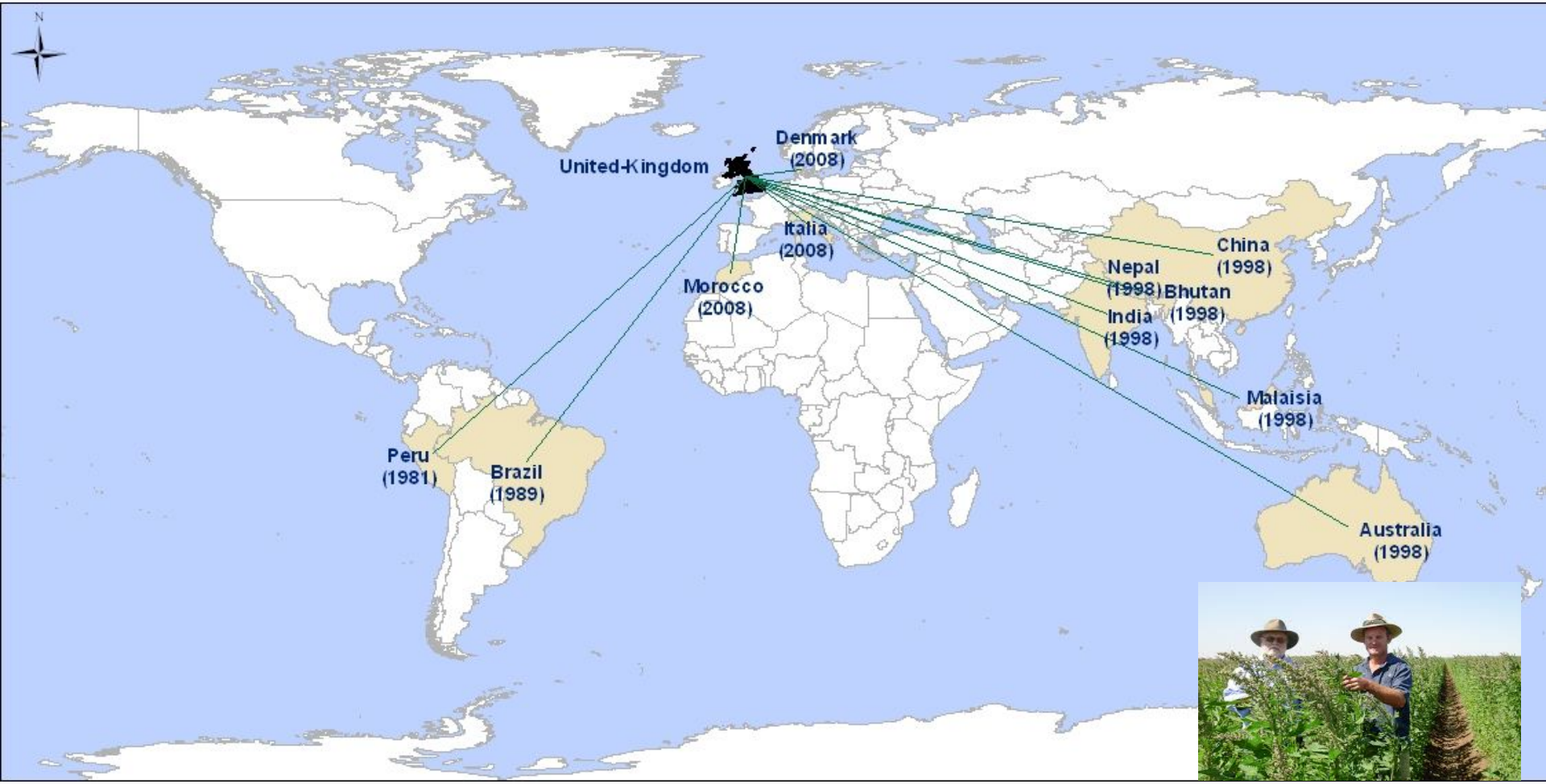
Lake Titicaca

AUSTRALIA

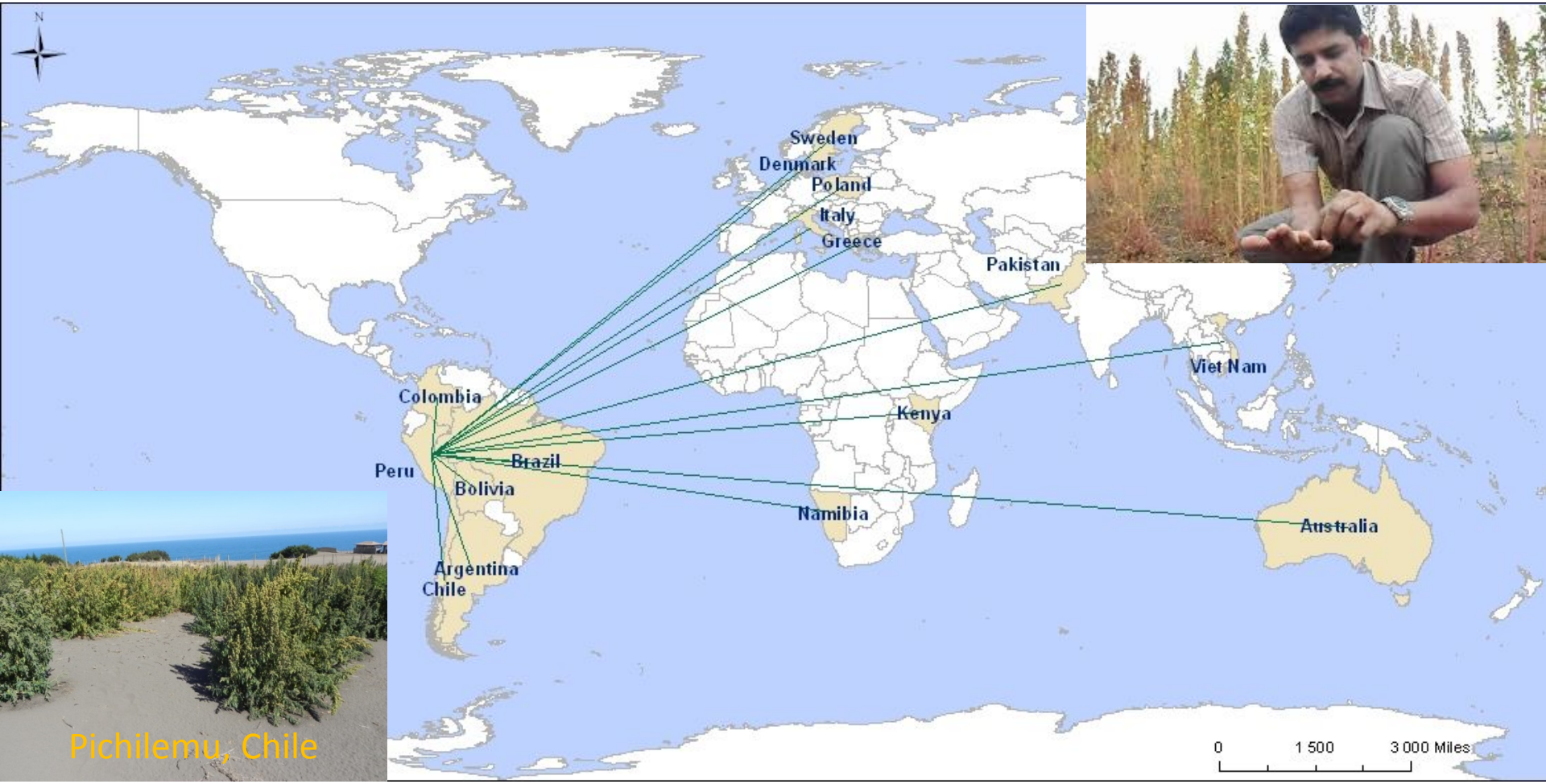
Quinoa introduction

- Before 1975
- 1975-2000
- After 2000
- Native

SOURCE: DIDIER BAZILE, CIRAD, FRANCE



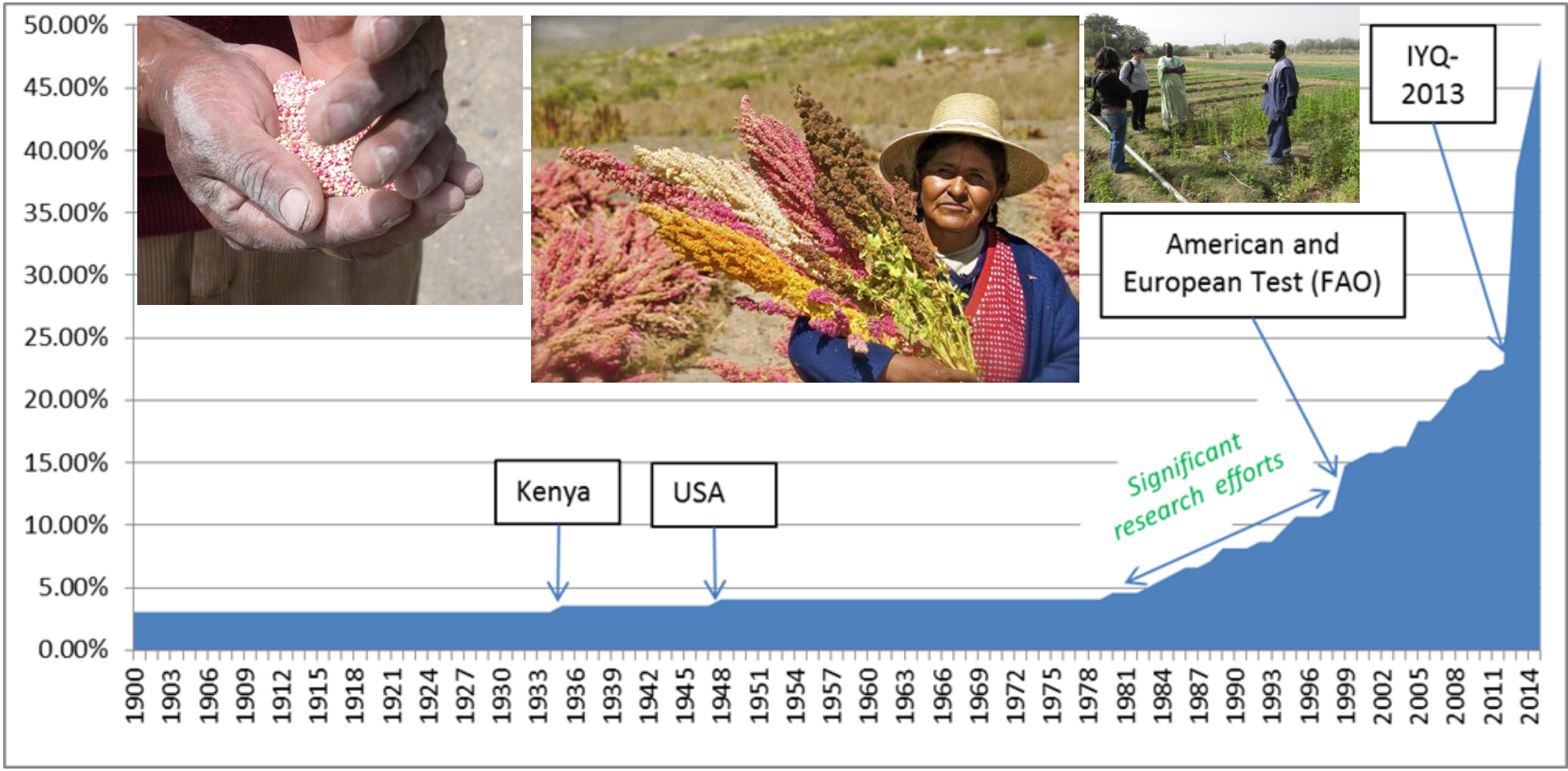
Collaboration with University (England) for the first quinoa experimentation (since 1981)



Collaboration with CIP-DANIDA for quinoa experimentations

Prueba Americana y Europea de quinua (>1996-98)

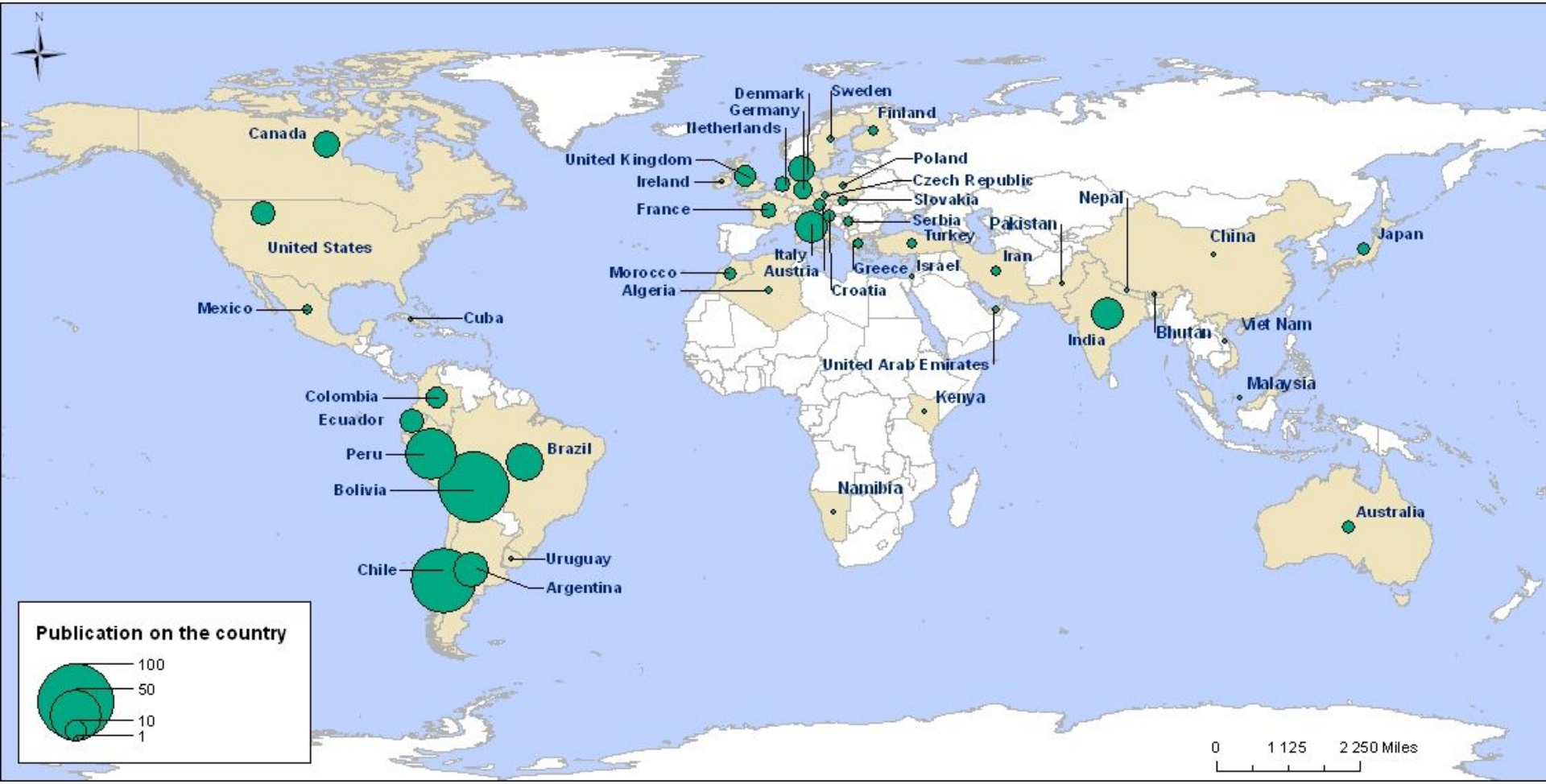
Percentage of countries with quinoa experimentation or cultivation.



✓ A question of fair access to genetic resources

Quinoa Worldwide Genetic Resources Distribution
(*ex situ* conservation)

✓ A question of access to scientific knowledge



Number of scientific publications on the country

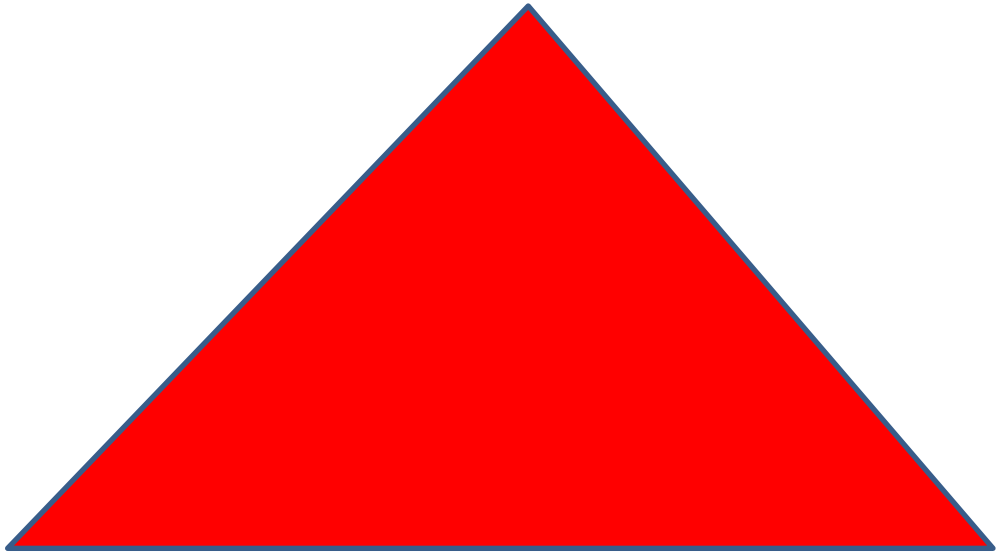
✓ A question of access to technologies

Key factors for the expansion of the quinoa and future improvement and breeding?

- Using molecular markers (SSR linkage map, marker-assisted selection),
- Improving feature selection based on genes of interest,
- PVB/PPB methods,
- Adaptation to climate change and salinity using variability.

✓ A question of sustainable development

Improving Resource Efficiency



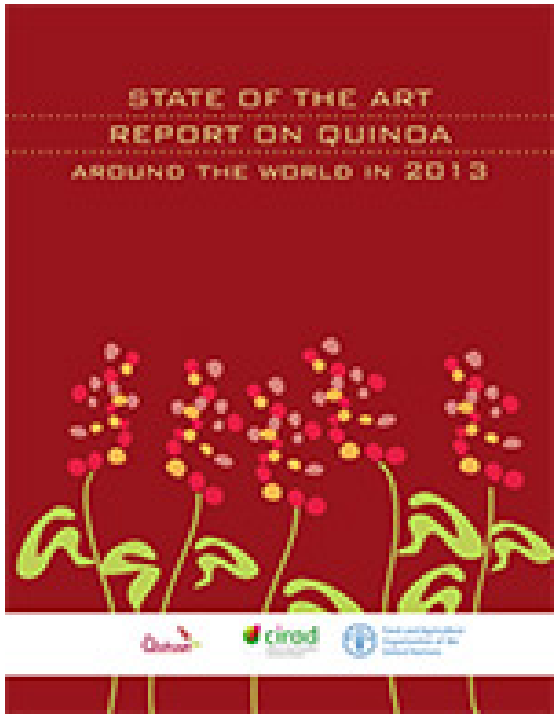
Strengthening Resilience

Securing Equity and Responsibility

3- GCN-quinoa:

Creating a shared vision and action plan for the future of quinoa beyond its origins

...



Estado del arte de la quinoa en el mundo en 2013

Edited by

Bazile, D., Bertero, D. & **Nieto, C.**

Castellano & English

http://www.fao.org/3/a-i4042s/index.html

Food and Agriculture Organization of the United Nations (FAO)

Santiago, Chile

Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD)

Montpellier, France

The Vision of the GCN-Quinoa

- GLOBAL COLLABORATIVE NETWORK ON QUINOA will serve as a tool to foster the development of inclusive, respectful, responsible and ethical quinoa programs and projects in the world.
- The global dimension of this initiative is of highly importance to connect ***Andean countries*** to ***New country producers*** in order to avoid conflicts by generating more mutual understanding and partnerships.

5 objectives of the GCN-Quinoa

- To support the co-development and exchange of technologies to multiple stakeholders;
- To promote access to a wide range of technologies for conservation, characterization, evaluation and sustainable use of quinoa's GR;
- To support South-South Cooperation as a tool for technical assistance;
- To facilitate the emergence of the Andean Quinoa Farmers Network for establishing strategic linkages between farmers and researchers networks

➢ **to develop a common participatory research agenda**;

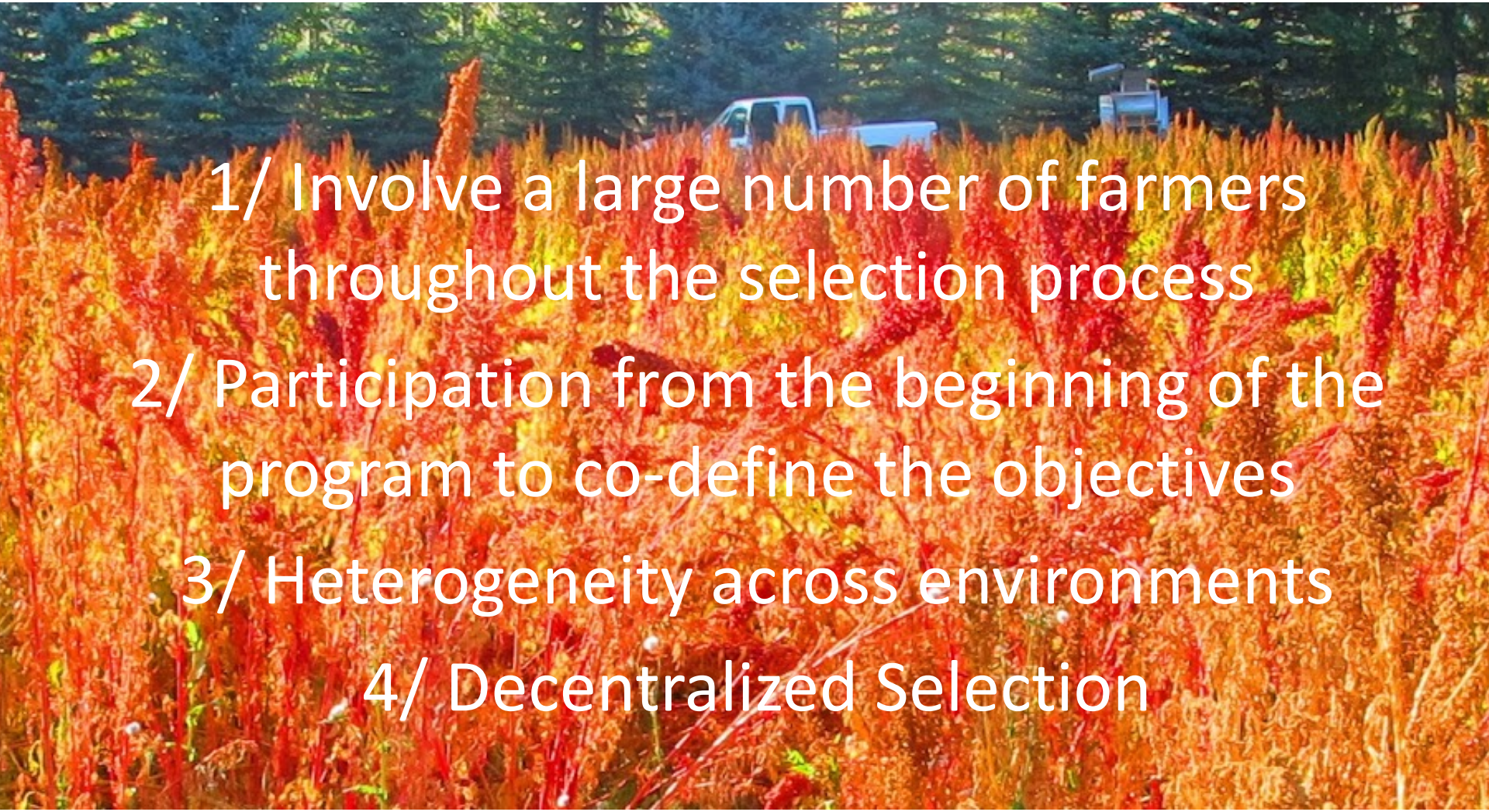
Global distribution of the current members of GCN-Quinoa.org

170 members from 65 countries

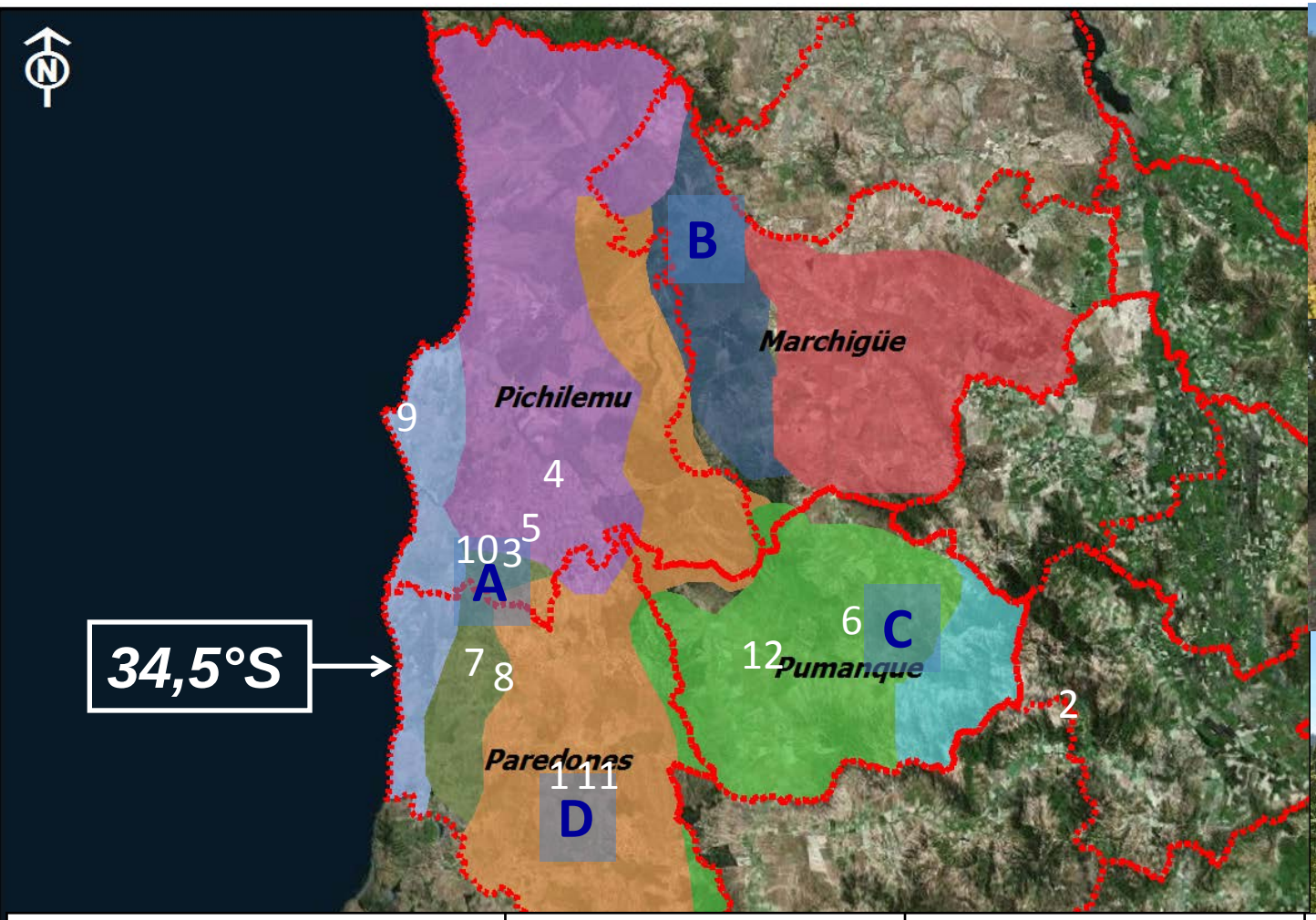
Various conditions but some key breeding objectives across them:

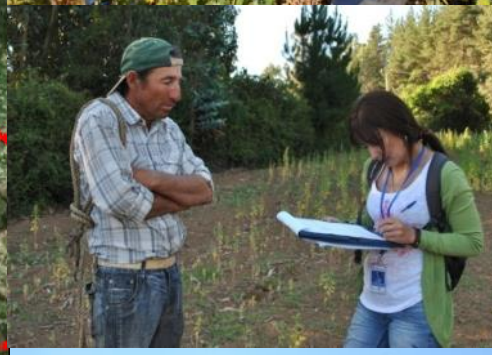
- **Seed yield**
- **Heat tolerance**
- **Resistance to downy mildew**
- **Low saponin content**
- **Drought tolerance**
- **Early maturity**
- **Pre-harvest sprouting resistance**
- **Nutritional value and flavor**

How do you breed for farmer's needs and with developing countries?



PPB in Central Region of Chile with local varieties





Ensayo		1° Siembra	2° Siembra
A- La Plaza – Pichilemu	David Cornejo	5 de Noviembre	27 de Noviembre
B- Pailimo – Marchigue	Orlando Cabezas	17 de Octubre	18 de Noviembre
C- Centro-Pumanque	Guillermo Mckenzie	21 de Octubre	25 de Noviembre
D- La Vega - Paredones	Lautaro Díaz	5 de Octubre	5 de Diciembre

Current and future activities among GCN-quinoa members:

- Facilitate exchanges with IT Tools and Web Platform
- Debate of ideas among members through participation to online forums and international meetings
- Developing Breeding Populations for PPB under different environmental contexts
- Permanent dialogue with farmers' organizations for participatory research agenda

Conclusions

- Great potential to contribute to worldwide food security.
- Varietal and environmental differences in the content of nutrients, bio-active compounds and saponins are considerable in quinoa.
- To facilitate the informed decision-making concerning the usage of quinoa, data on nutritional composition of quinoa under different conditions are necessary.
- More flexible genetic material with the potential to maintain yield stability while continually evolving in response to changes in climate.
- GCN-Quinoa could be the vector to disseminate and test evolutionary material in new environments.

Thanks for your attention !

Contact:

didier.bazile@cirad.fr