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Evaluating the strategies for the management of biophysical resource in farm communities of the Mantaro Valley

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Introduction

- Research in Mantaro Valley is extensive, but focus-limited.
  - Fertilization, animal production, social factors…
- Local farmers have considerable traditional endogenous knowledge.
  - Planting times, soil management…
- Integrated research on systems level is elusive.

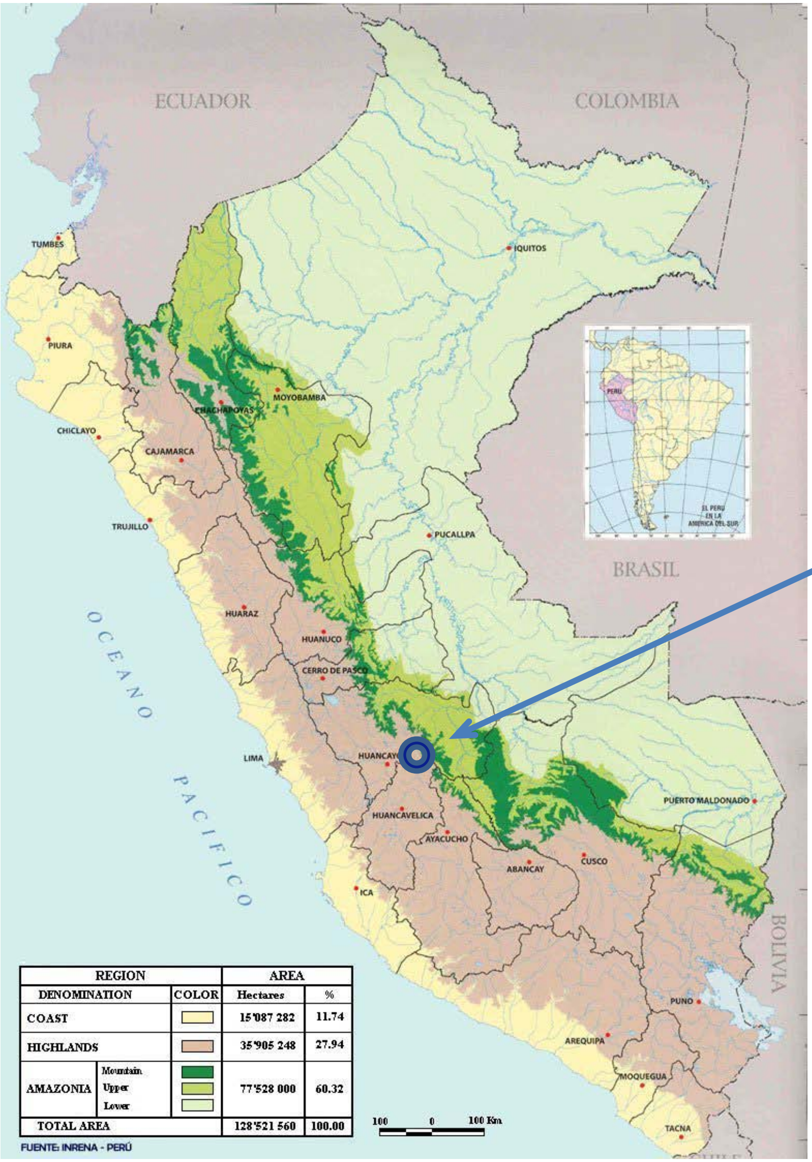
General objective

- Integrating the knowledge on systems level, with emphasis on biophysical factors related to technical sustainability aiming at optimizing resources management.

Specific objectives

- Characterizing the physical constraints affecting the production systems (climate and soil fertility).
- Evaluating the use of biophysical external inputs, the production of biomass and C- and NPK-balances.
- Describing the labor distribution for crop production.
- Characterizing the most frequent crop rotations in terms of biomass, C- and N-balance.

Site description



REGION			AREA	
DENOMINATION		COLOR	Hectares	%
COAST			15'087 282	11.74
HIGHLANDS			35'905 248	27.94
AMAZONIA	Mountain / Upper / Lower		77'528 000	60.32
TOTAL AREA			128'521 560	100.00

Mantaro Valley

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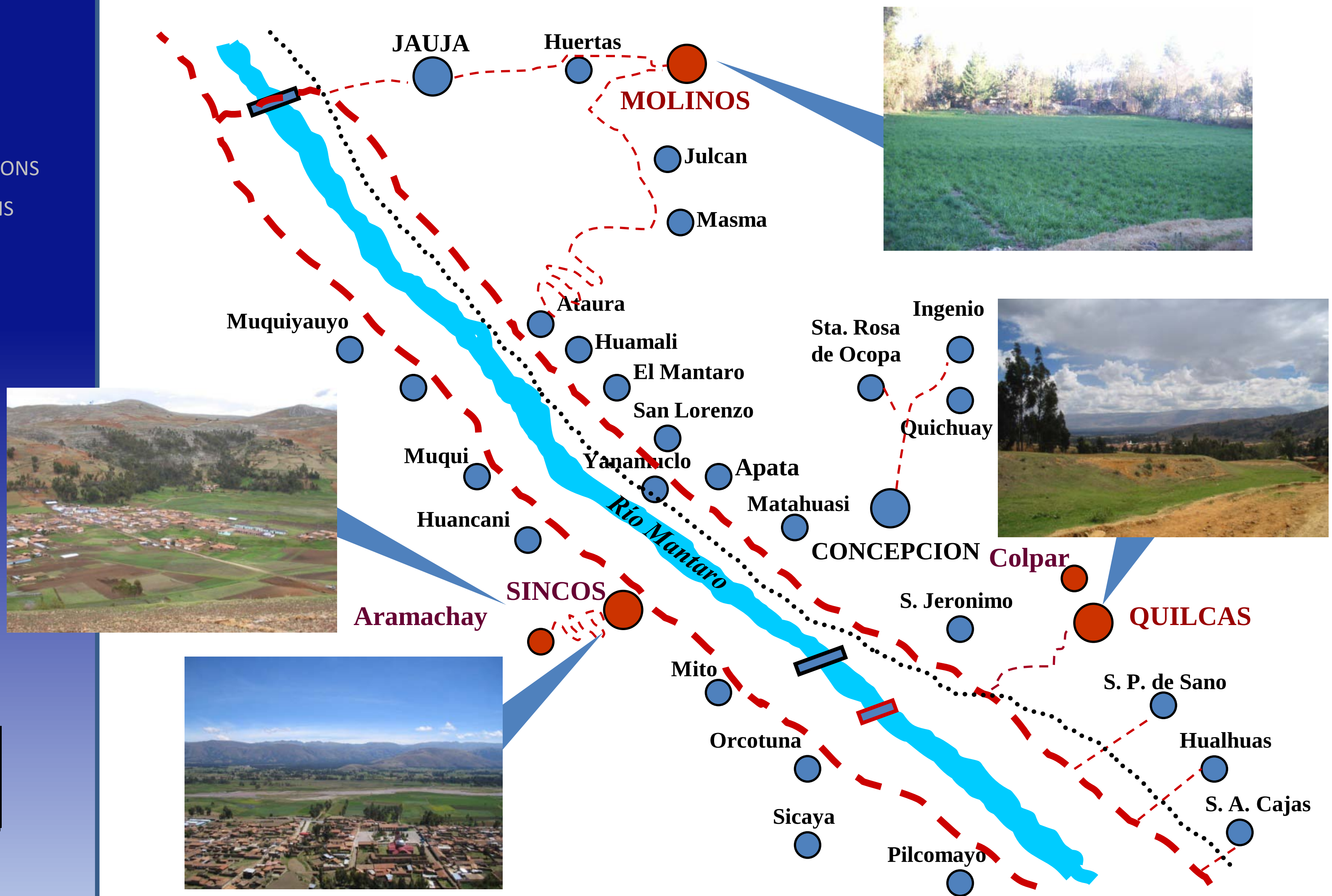
Mantaro valley, Peru



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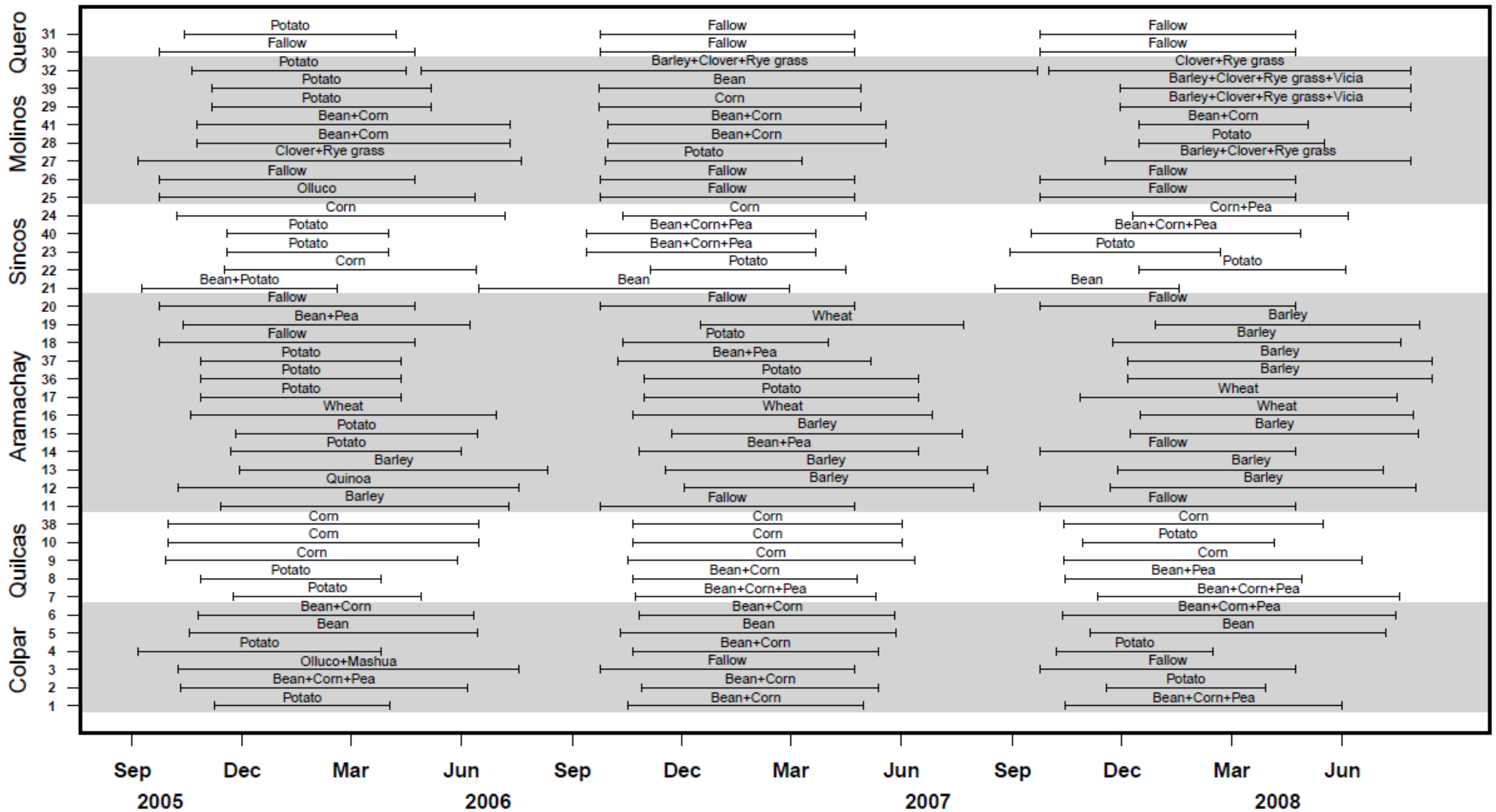
Data acquisition methodology

- Participatory rural appraisal
  - Participatory workshops (Colpar, Quilcas, Aramachay and Sincos).
  - Structured interviews.
  - Farm visits.
  - Farmers Database setup.

Data acquisition methodology

- Characterization of climate of experimental sites.
- Biophysical evaluation of pilot-plots.
- Full input-output accountancy of biophysical unit operations on 38 pilot plots.
  - Biomass production.
  - Agricultural inputs.
  - Labor, machinery….
- Research Database setup.

Crop cycles evaluated



- 95 cropping cycles recorded
- Most planted crop was potato (27%) followed by barley (12.6%)

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Data analysis

- Multivariate exploratory data analysis:
  - Descriptive profiles (Trellis graphics).
  - Correlational biplots (principal component analysis).

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OBJECTIVES
METHODOLOGY
RESULTS
GENERAL CONCLUSIONS
RECOMMENDATIONS
FUTURE WORK

Results

- Climate monitoring.
- Soil chemical fertility.
- Crops C- and NPK-mass balances.
- Labor distribution.
- Rotation systems.
- Farm level integration.

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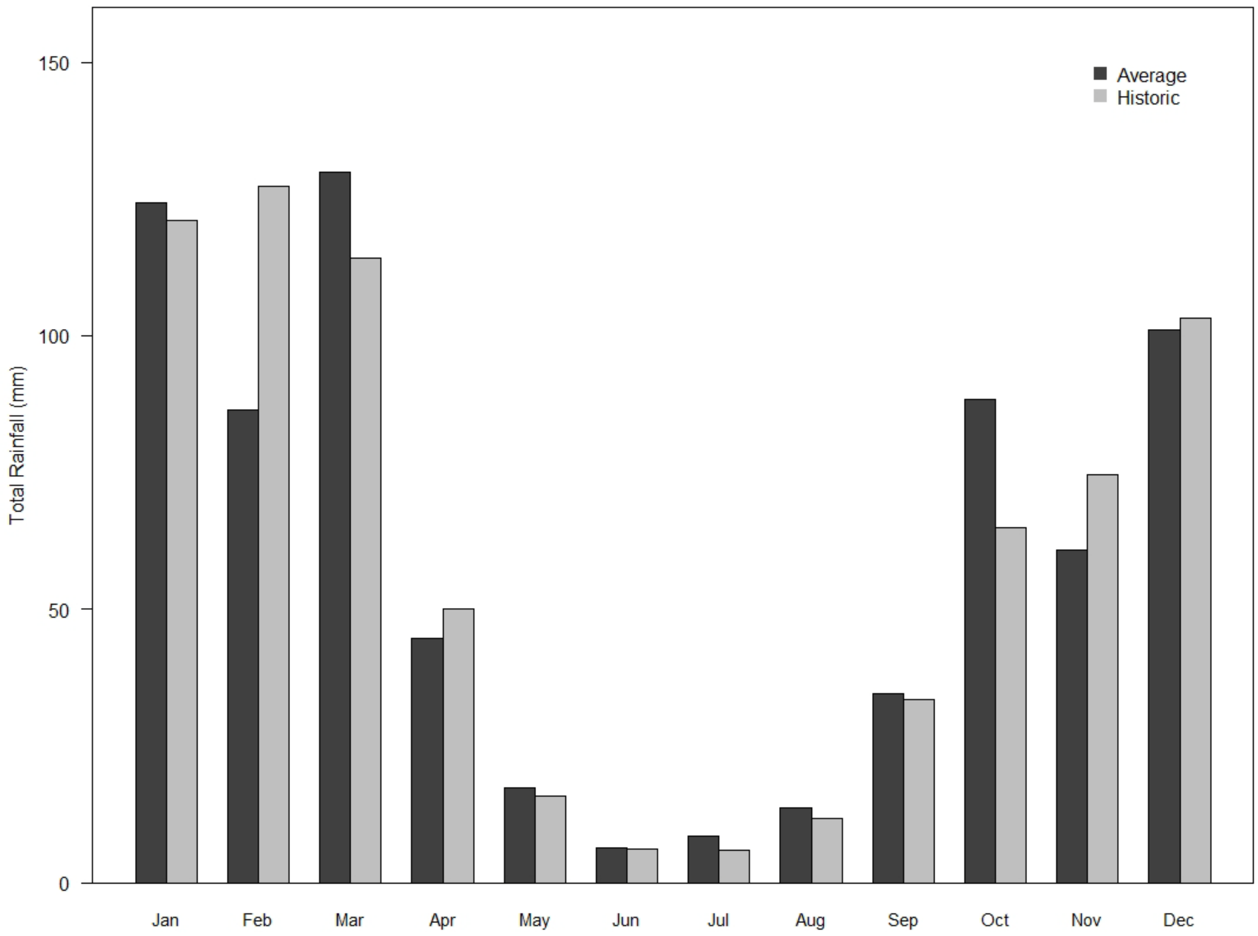
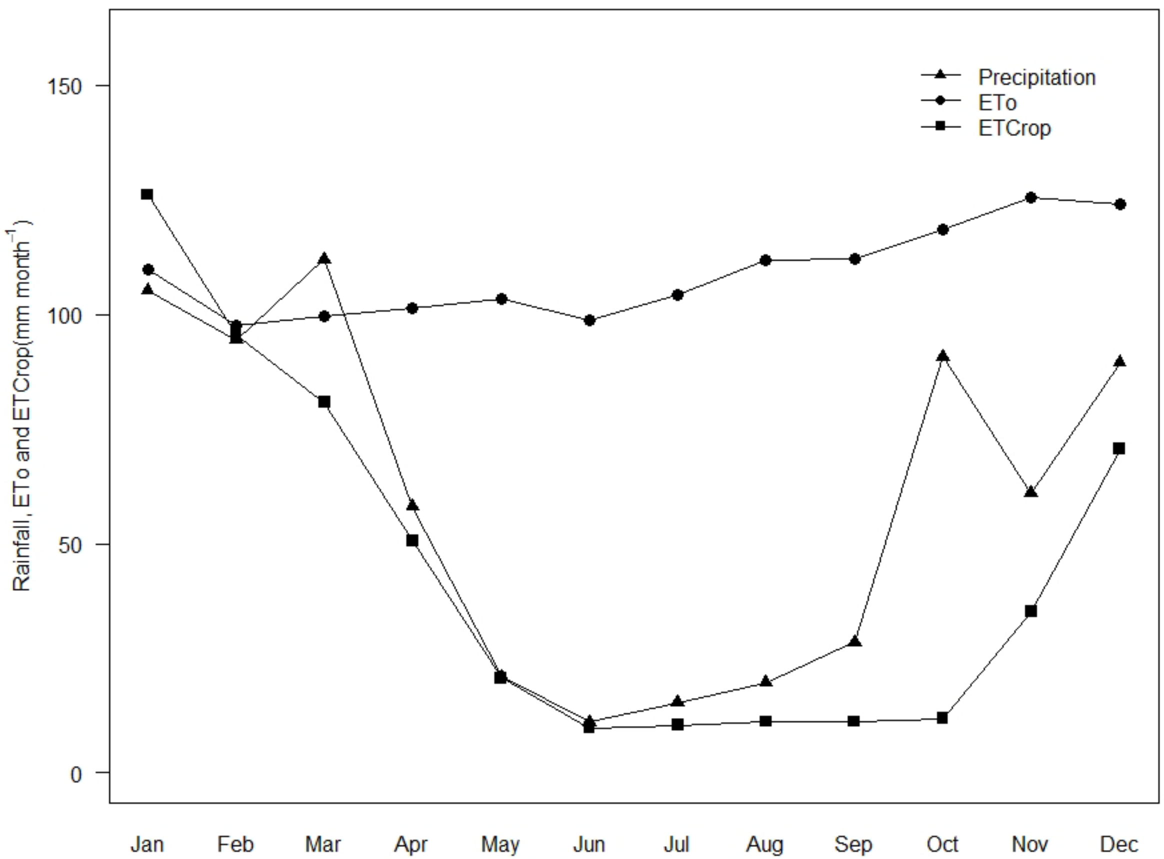
Climate monitoring



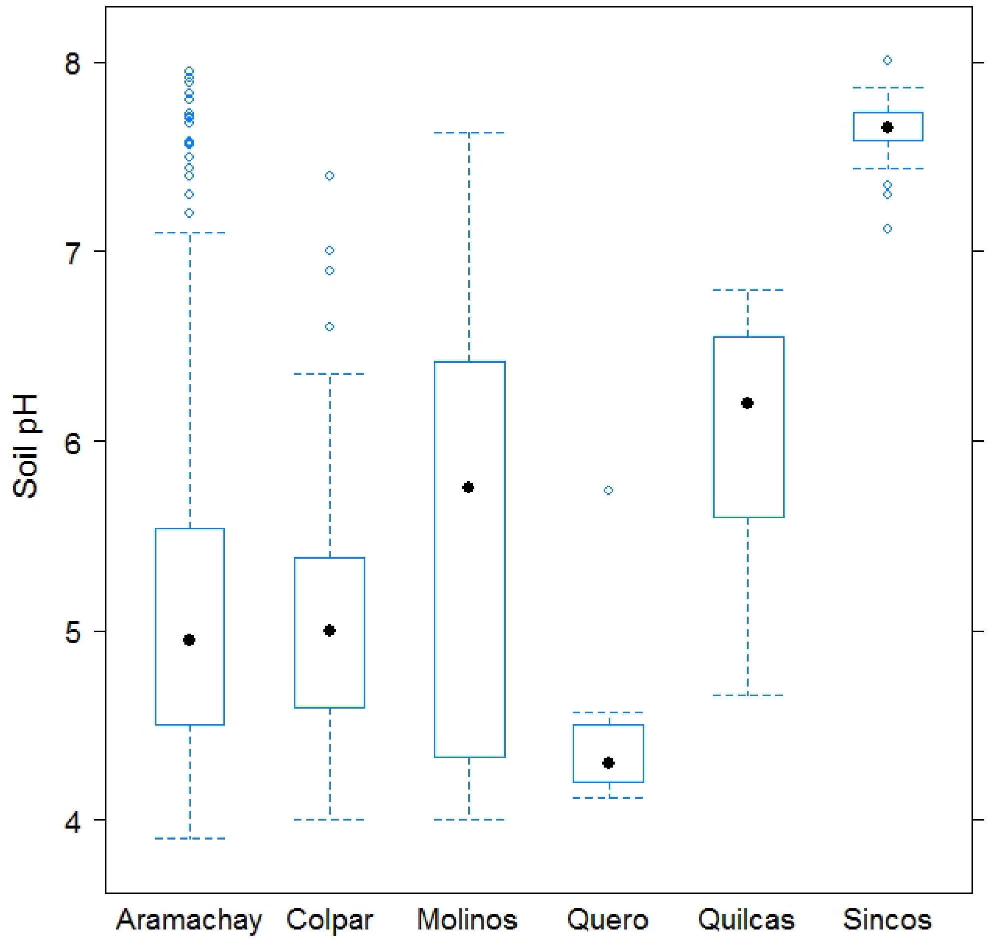
Average monthly distribution of precipitation during 2005-2008

Climate monitoring



Distribution of precipitation, potential evapotranspiration and crop evapotranspiration (potato)

Soil chemical fertility



Values for soil pH in six zones evaluated

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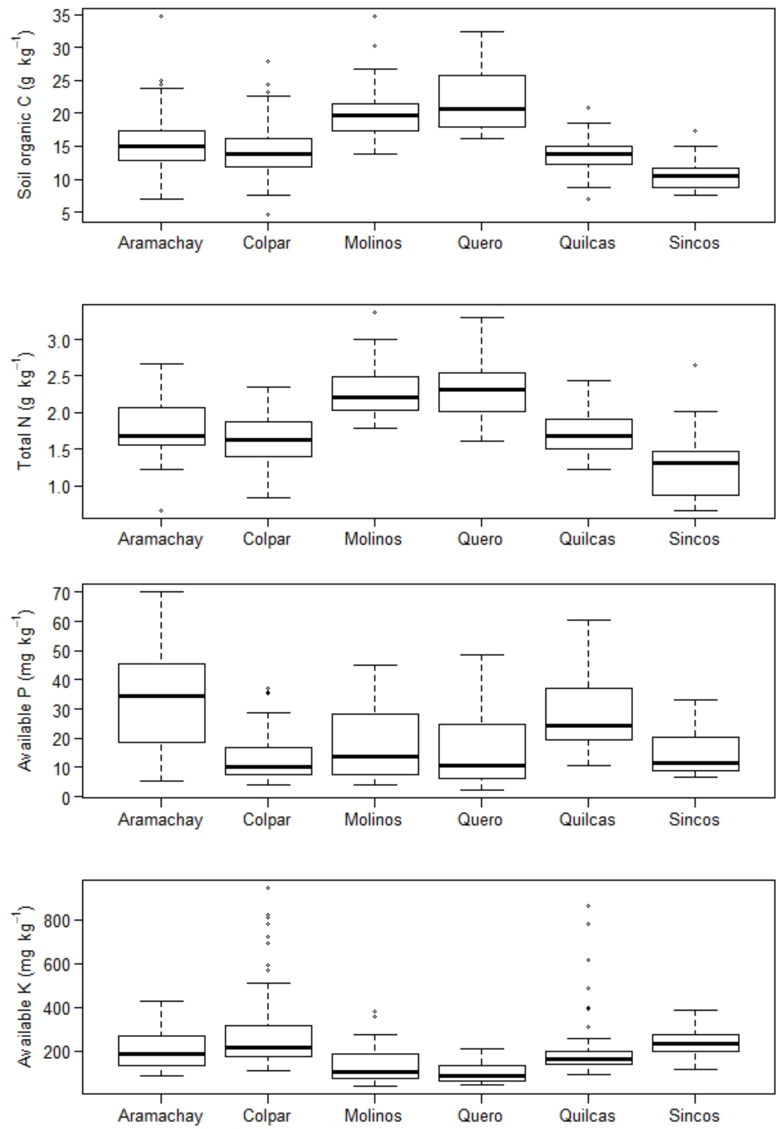

Contents of soil organic carbon, total nitrogen, available phosphorus and potassium in six zones evaluated

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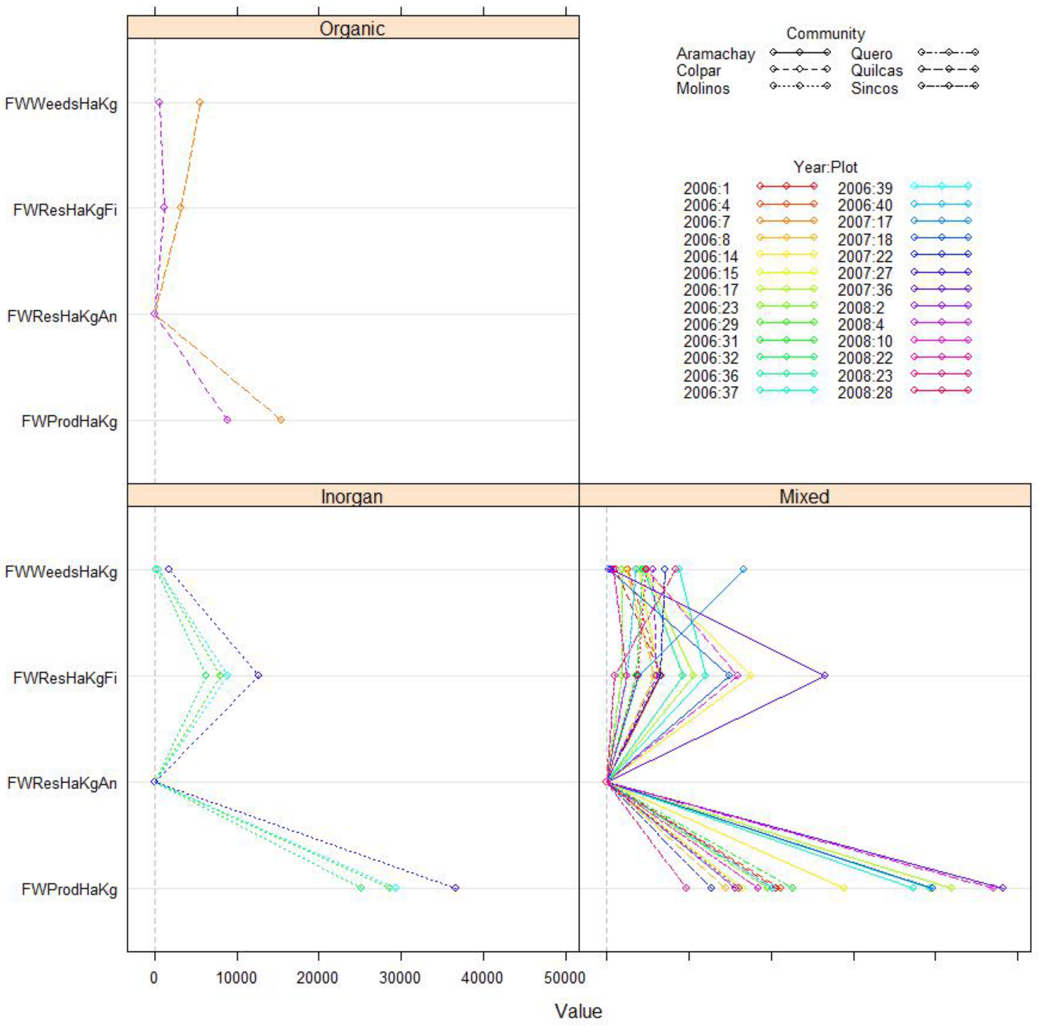
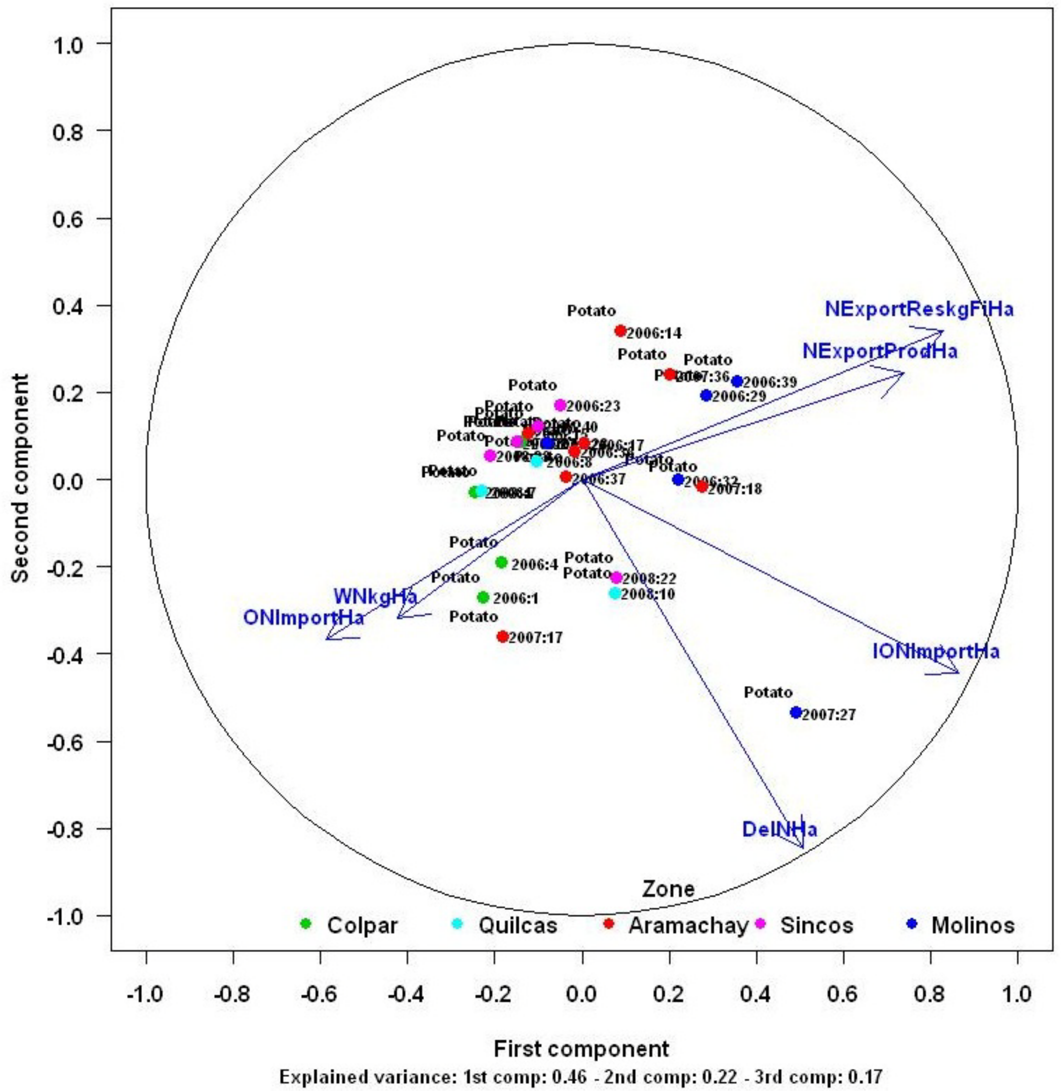
Potato C and NPK-balances



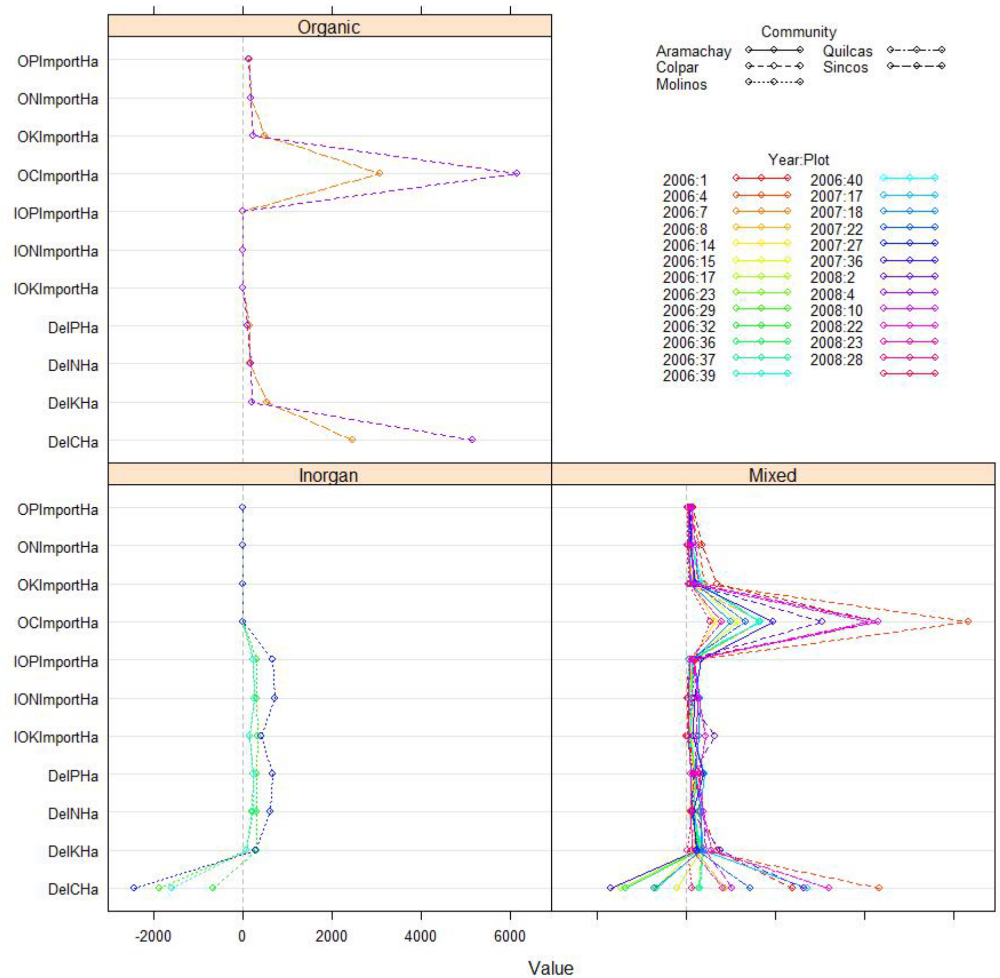
Production of biomass by residues, harvest and weeds in potato

Potato N-balance



PCA biplot for the N-inputs, outputs and balance in potato

Potato C and NPK-balances



Characterization of production systems in potato

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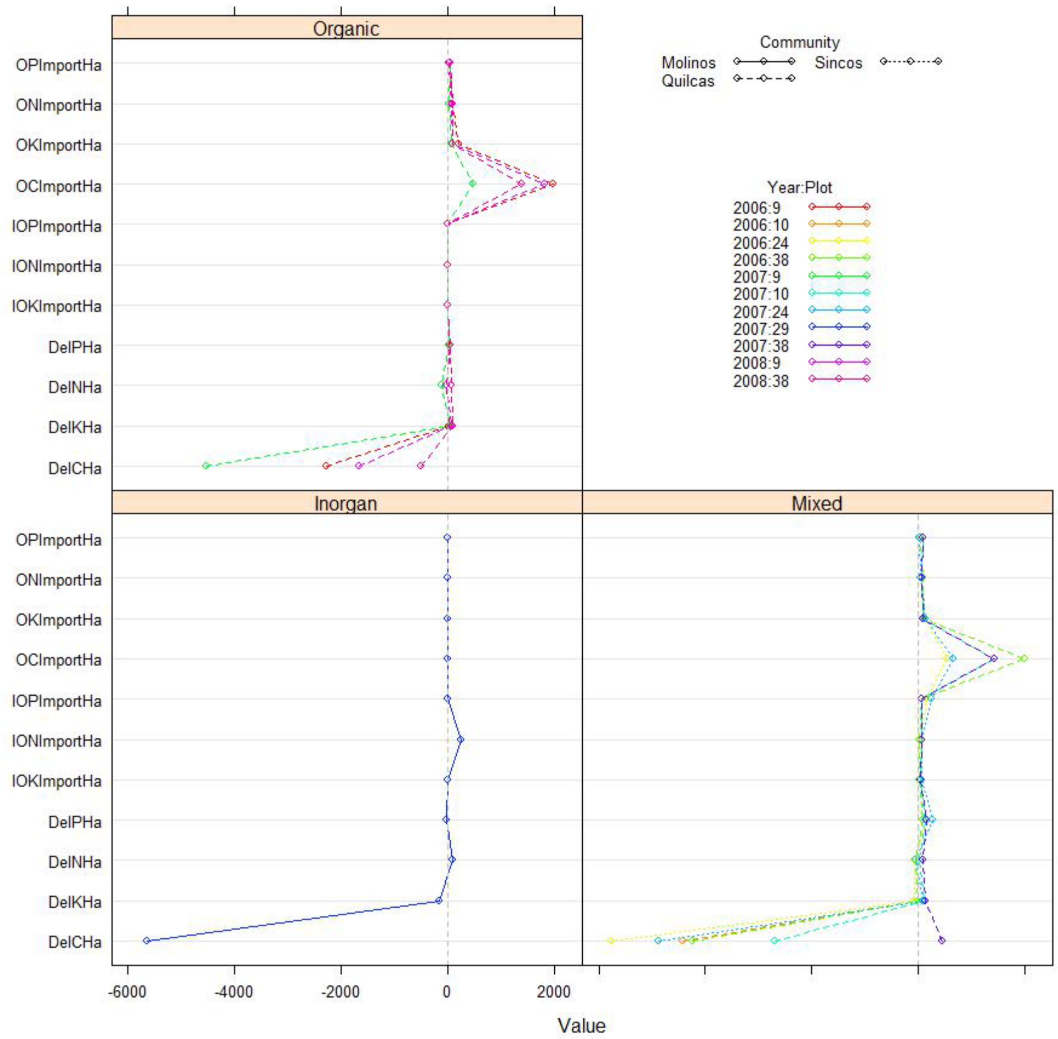
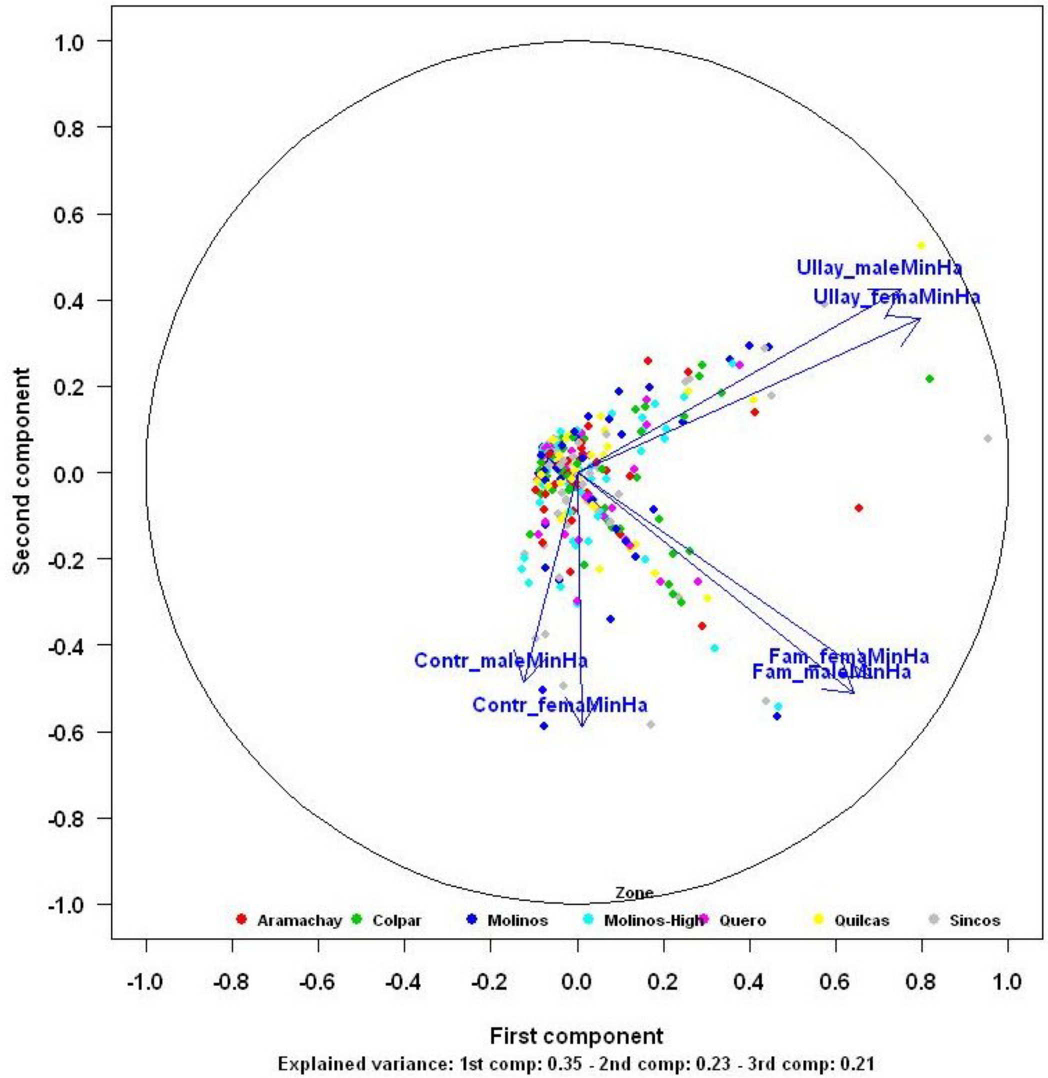
Corn C and NPK-balances



Characterization of production systems in corn

Labor distribution



PCA biplot for the labor distribution between gender and source for the communities

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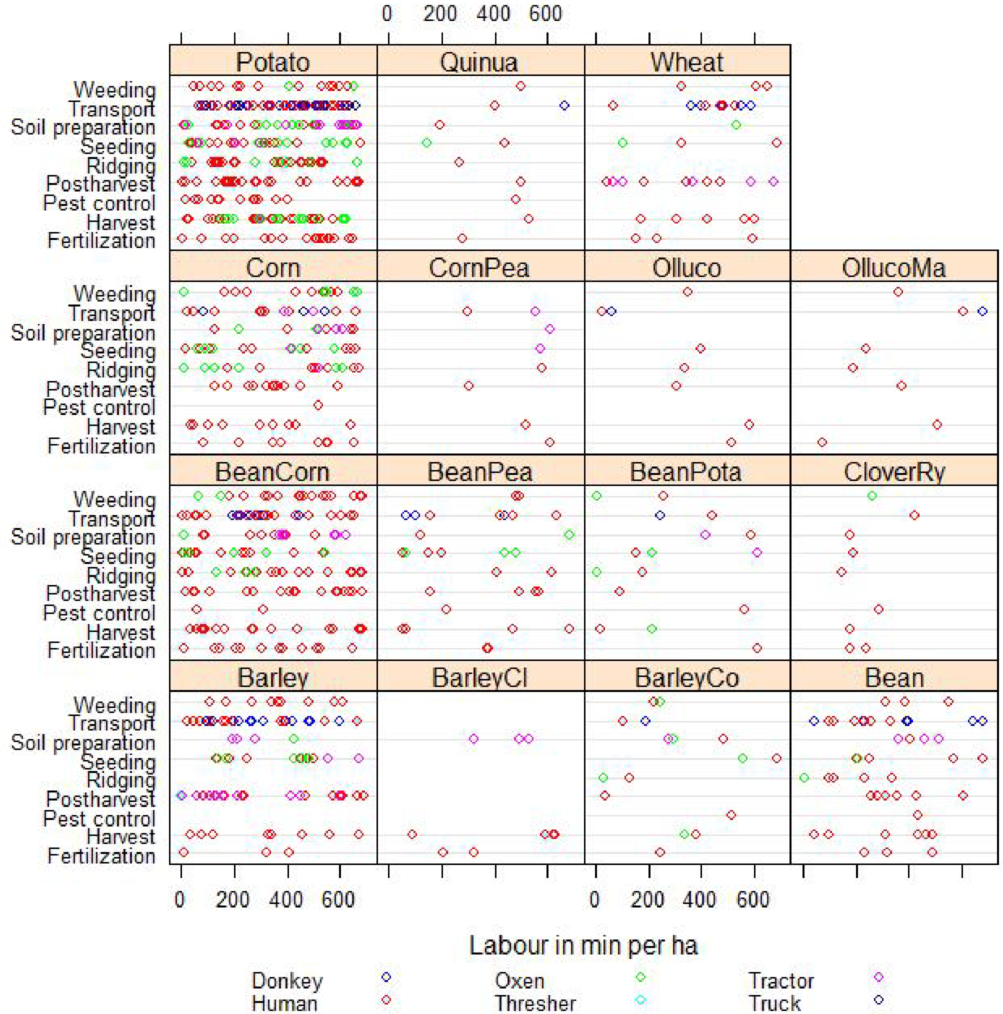
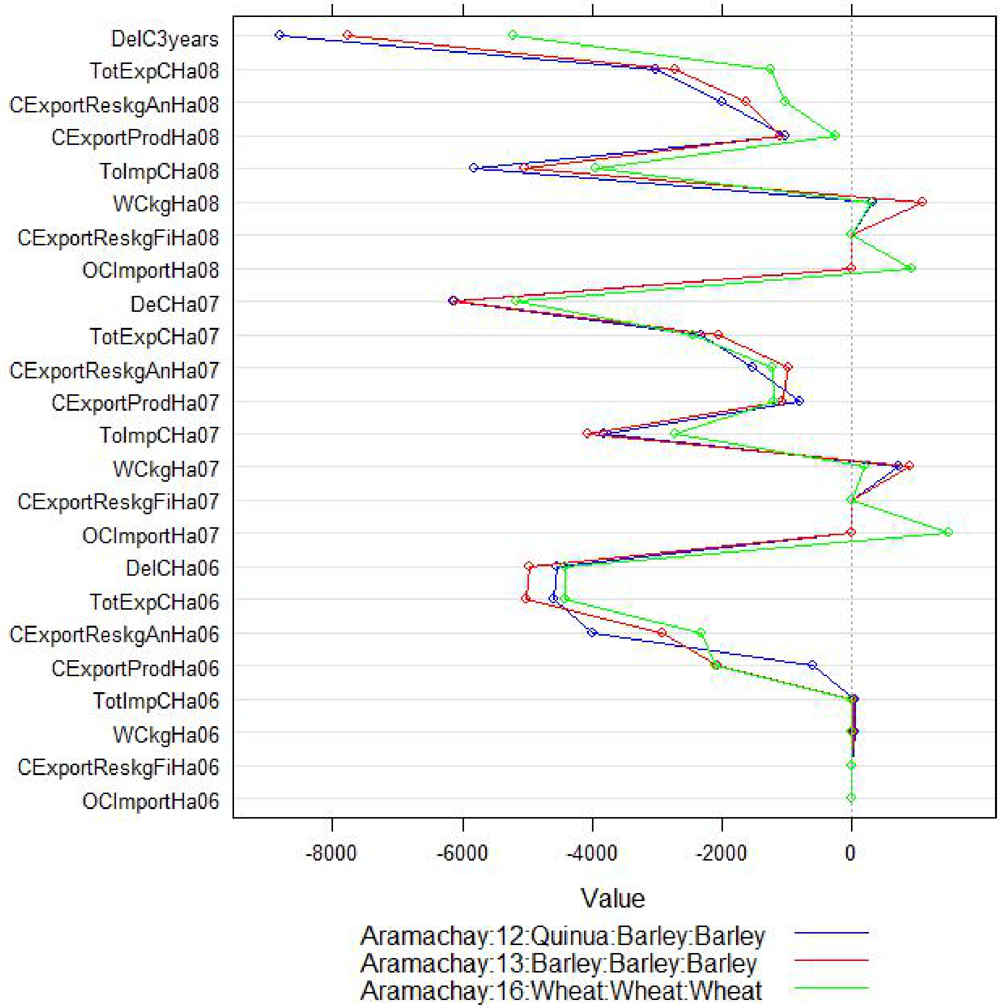
Labor distribution



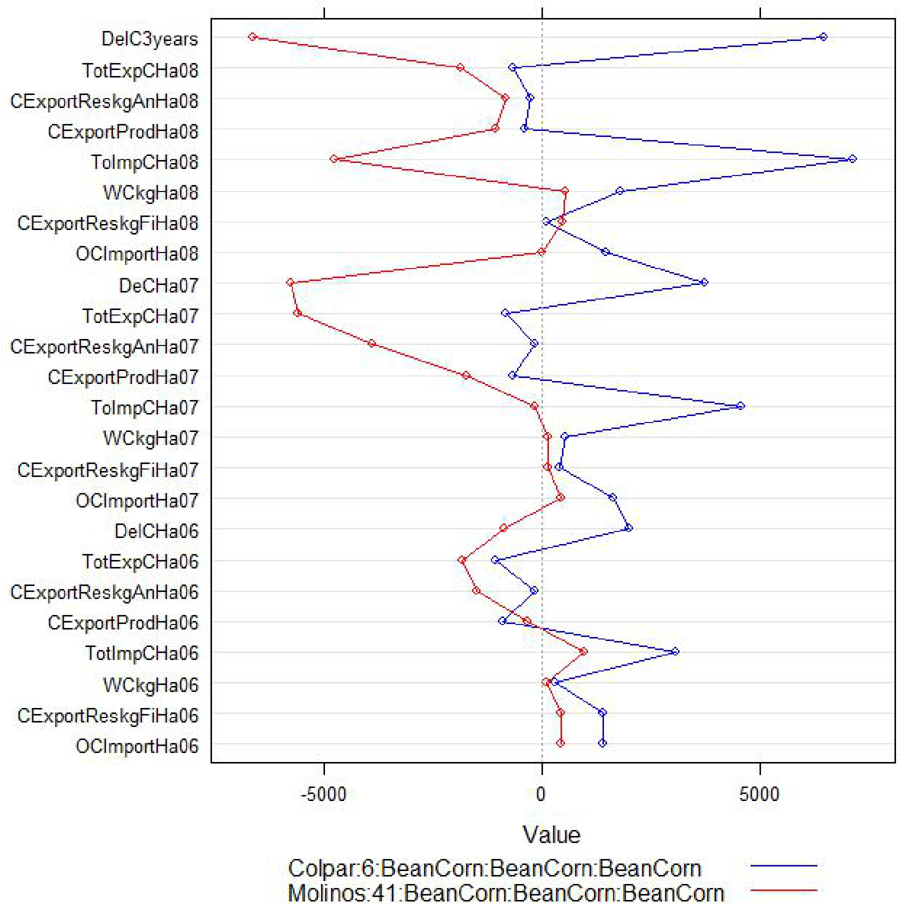
Distribution of labor, machinery and animal traction for all crops

Rotation systems



C-inputs, outputs and balance in three-year monocultures of cereals (Aramachay)

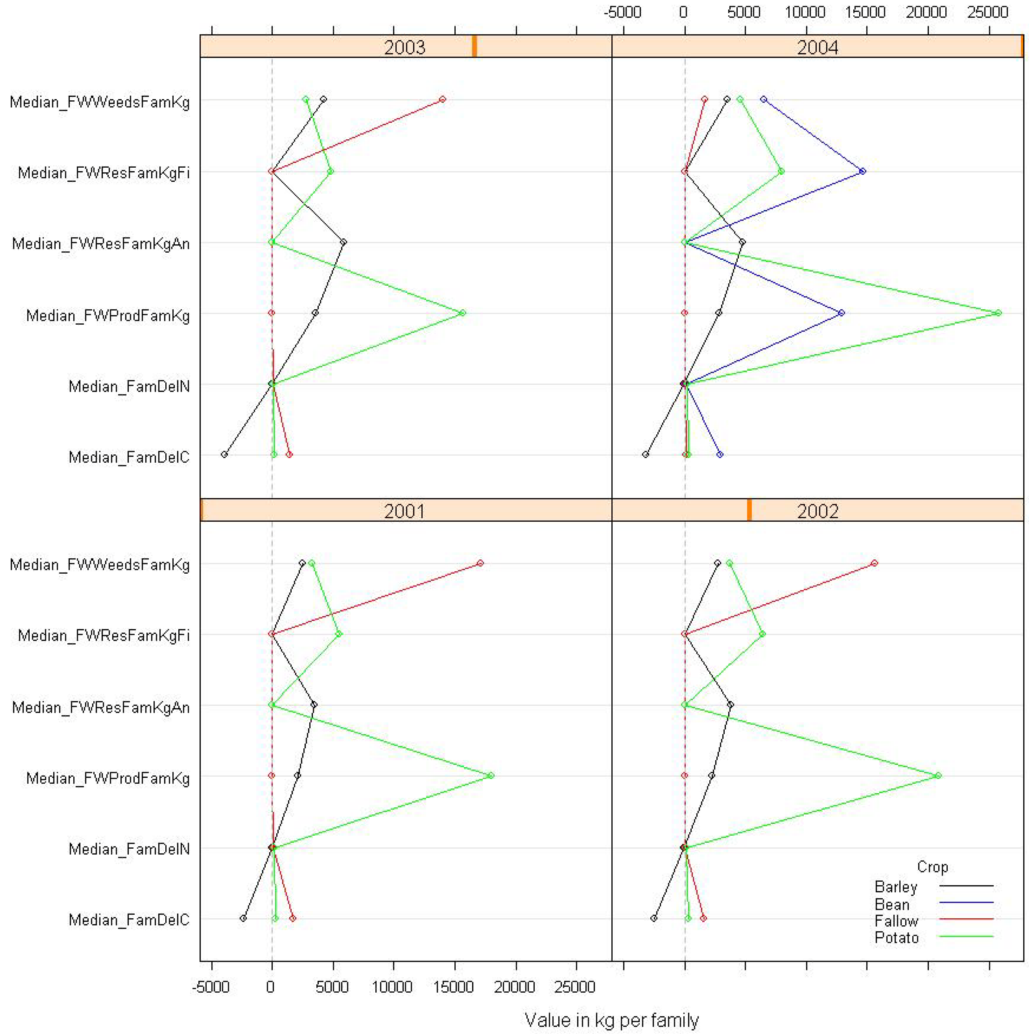
Rotation systems



Corn:faba bean ratios
Colpar:
20:80 – 20:80 – 60:40
Molinos:
70:30 – 80:20 – 27:75

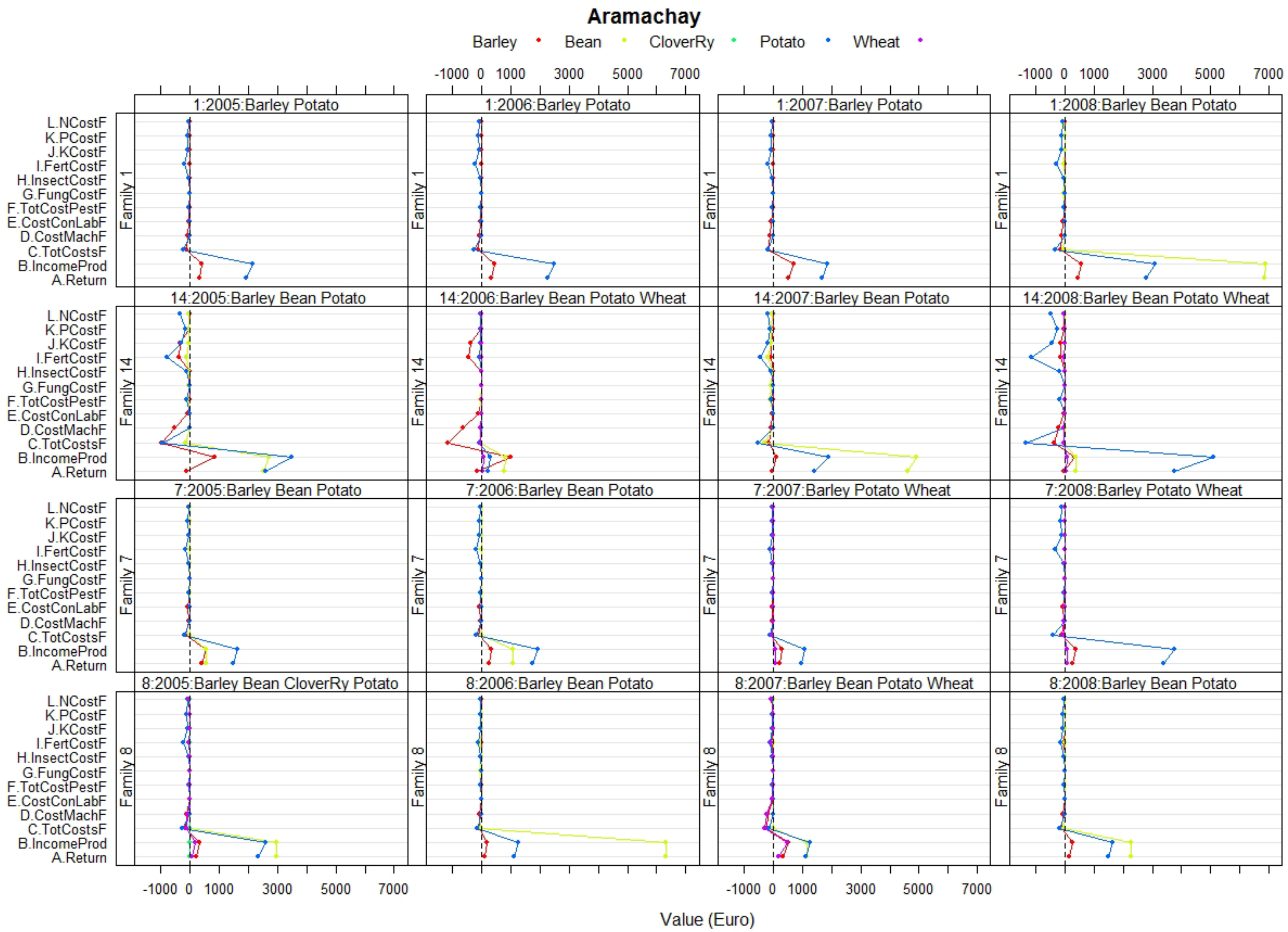
C-inputs, outputs and balance in three-year rotations of associated corn-faba bean

Farm level integration



Farm level integration of fresh weights, N- and C- balances in Aramachay

Farm level integration



Costs, gross values and net returns estimated for different crop rotations at family level in Aramachay

Conclusions

- The climate is restrictive but local microclimate conditions are sufficient for rainfed agriculture of specific crops.
- Soil chemical fertility is not strongly limiting the production systems.
- Most agricultural inputs and resources are applied to potato, while other crops depend on residual effects.
- High variability was found between the fertilization rates and modalities, from nil to high rates (organic and/or inorganic).

Conclusions

- High variability in the use of labor between the communities, from subsistence to high input systems.
- Crop and livestock production systems are strongly linked, resulting in considerable export of C, N, P and K.
- Monoculture of grains (barley, wheat corn) lead to strongly negative C- and N-balances, while rotations including legumes result in positive balances.
- As an average, farmers in Aramachay manage 10 times more land than Colpar and Quilcas, and obtain 5 times more net returns.

Recommendations

- Fallow periods can be improved with inclusion of annual legume forages.
- Fertilization should be optimize for full rotation systems:
  - Reasonable doses.
  - Fractionation.
  - Application modalities.

Future work

- Methodology and data collection.
  - Implementing a methodology for evaluation of root biomass.
- Hypotheses to test experimentally.
  - Inclusion of forage legumes within the rotations.
  - Fertilization on barley, wheat and corn.
  - Liming of acidic soils.
- Evaluation of biological production systems.
  - Deeper analysis on livestock production system.
  - Evaluation of N_2 fixation capacity in legume crops.

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Thanks for your attention