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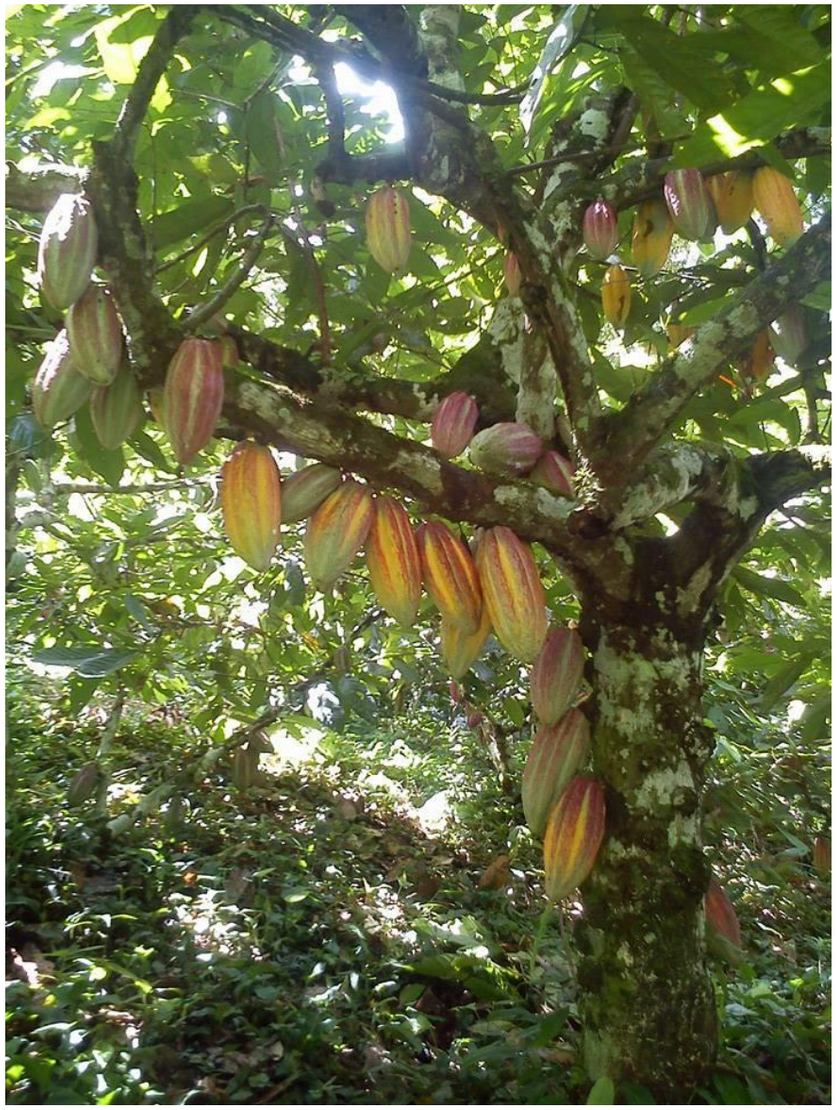
FiBL

Physiological response in beans of three cacao (*Theobroma cacao* L.) cultivars to micro-environmental growing conditions in cacao agroforestry systems and monocultures under conventional and organic management



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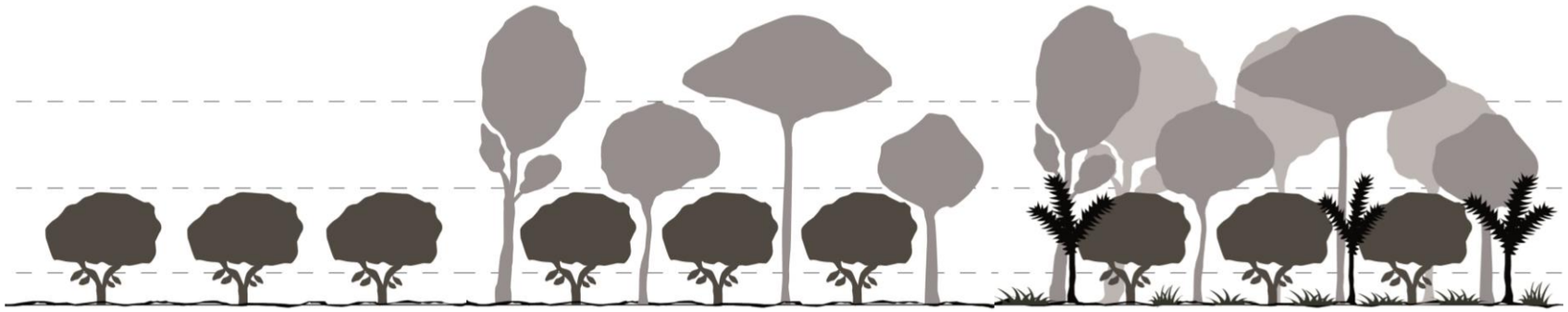
Cacao (*Theobroma cacao* L.) cultivation

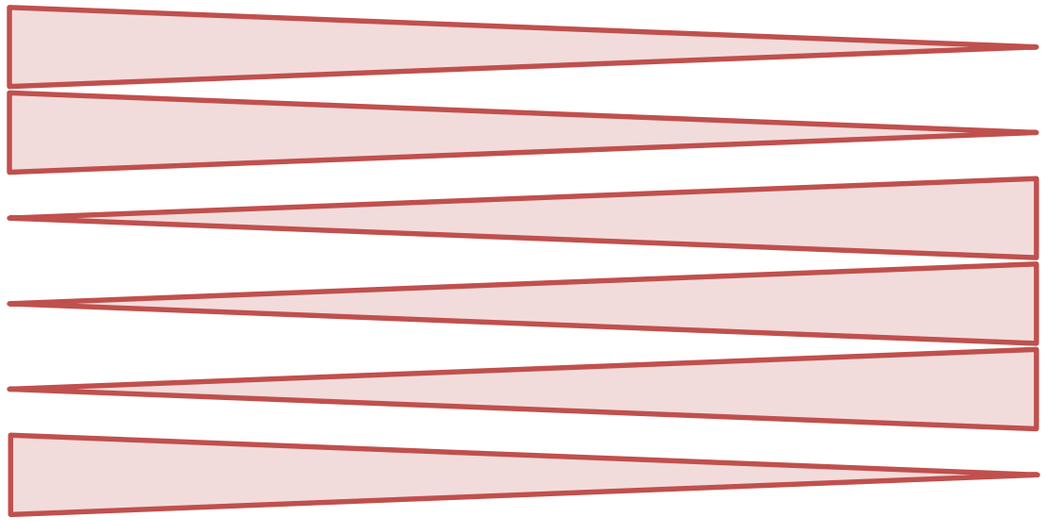
- Production systems:
  - Monocultures → simple agroforestry systems → complex agroforestry systems

full-sun



shaded

- Radiation intensity
- Temperature fluctuations
- Leaf area index
- Stem density
- Soil organic matter
- Farming intensity



- Cacao cultivars
  - Foreign cultivars ⟺ locally adapted cultivars

Plant response to abiotic factors

Season

Production system

Monoculture conventional

Successional agroforestry system

Cacao tree cultivar

Beans

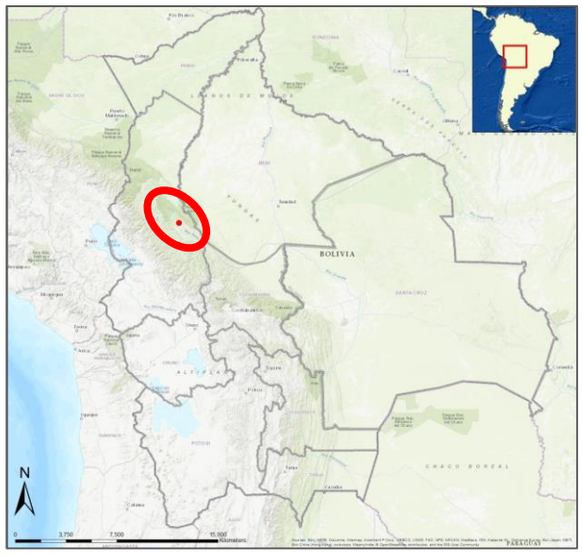
Cacao performance

- Tree growth
- Total yield
- Bean quality

Stress indicators in beans

- Polyamines
  - → Putrescine
    - → Spermidine
      - → Spermine
- Phenolic compounds

Long-term experiment and land-use systems



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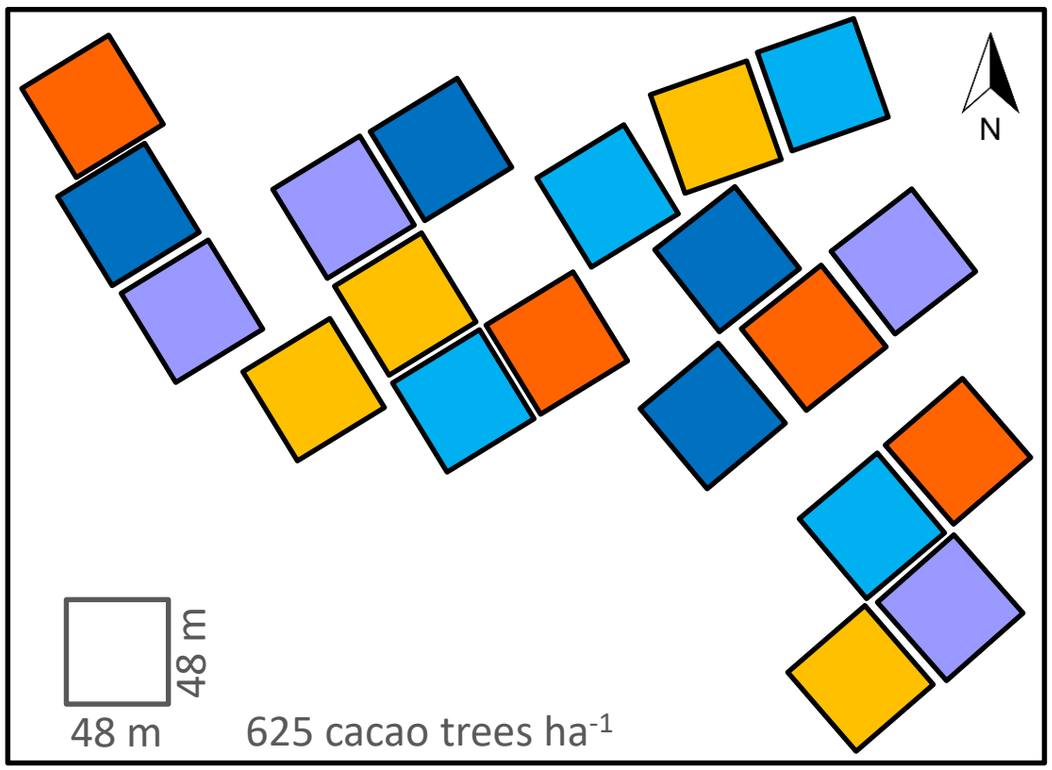
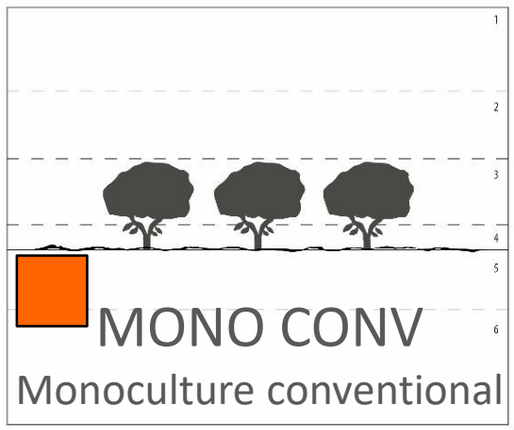
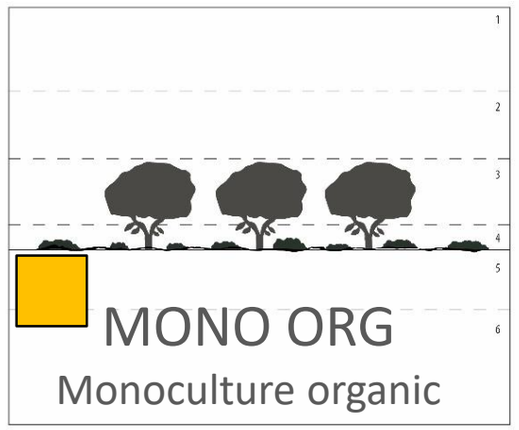
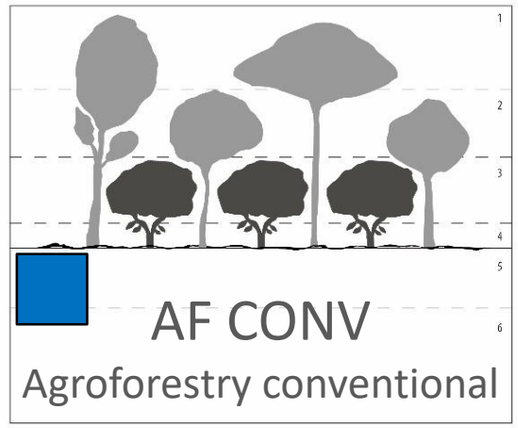
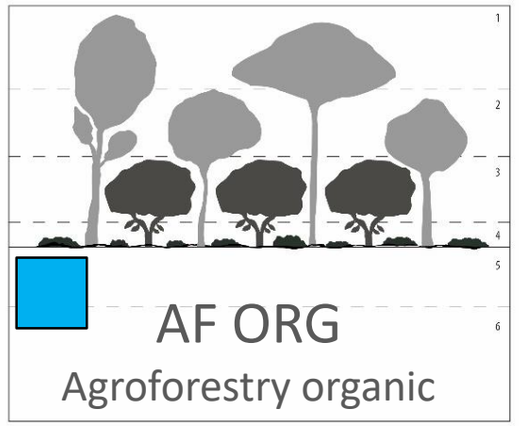
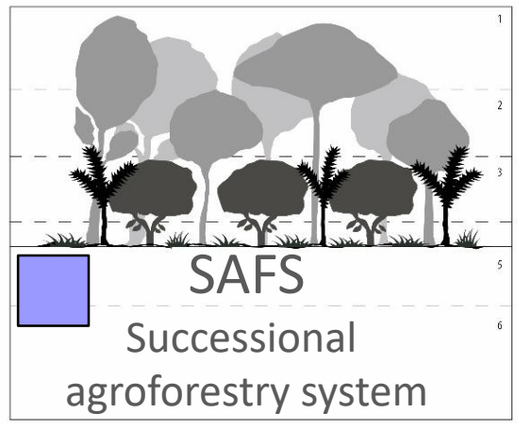








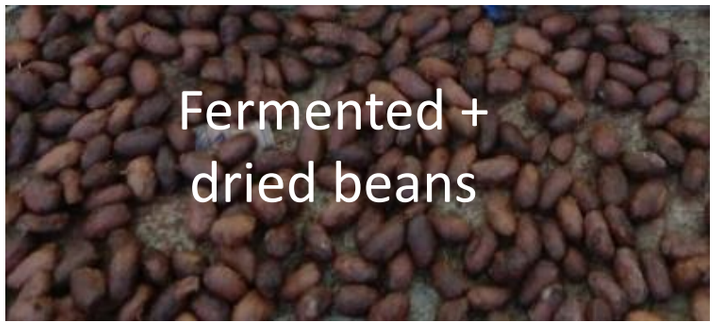




Sample collection, preparation, analyses

Bean collection

- 2 season (wet vs. dry)
- 5 production systems
- 3 cultivars
  - ICS-1 x IMC-67
  - IIa-22
  - TSH-565



Milled

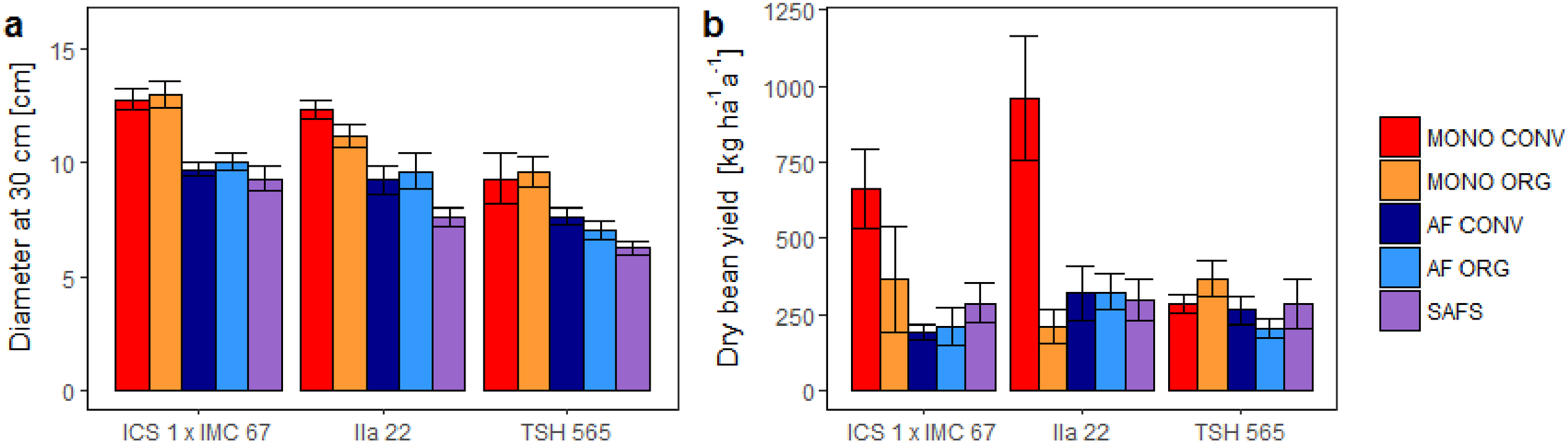
Milled + defatted

Abiotic stress indicators

- Total phenolic content
  (Folin-Ciocalteu´s assay)
- Element composition
  (CN-Analyzer, ICP-OES)
- Fat content
  (Weibull-Stoldt, Soxhlet)

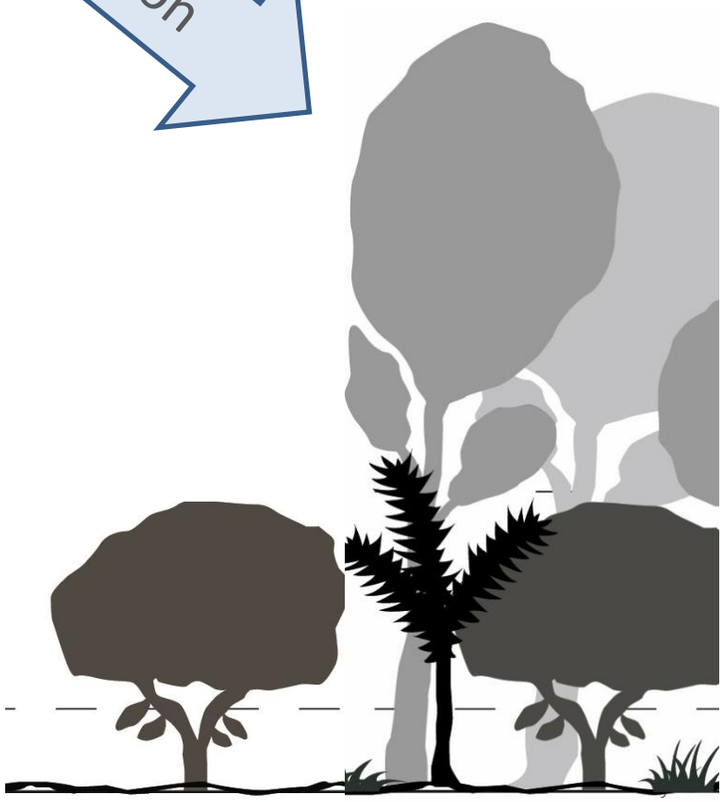
- Polyamine concentration (HPLC)
  - Putrescine
  - Spermine
  - Spermidine

Cacao tree performance (2014)

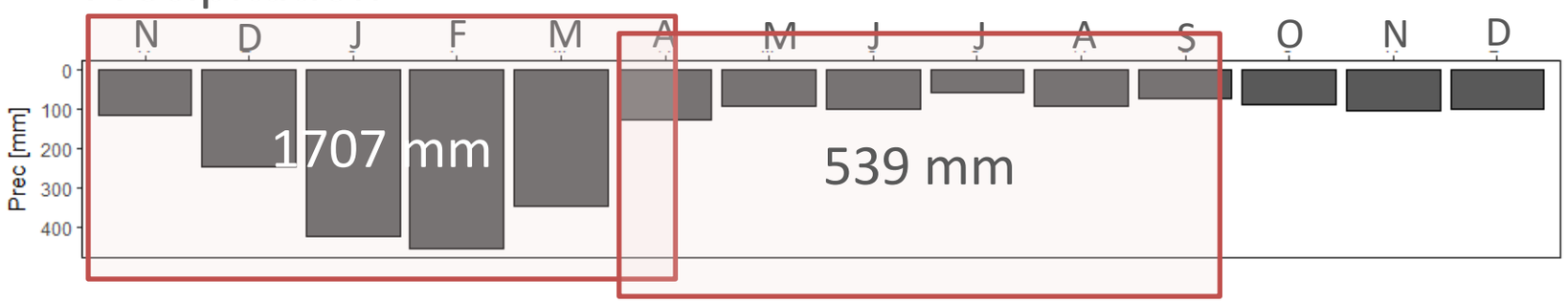


Seasonal changing conditions

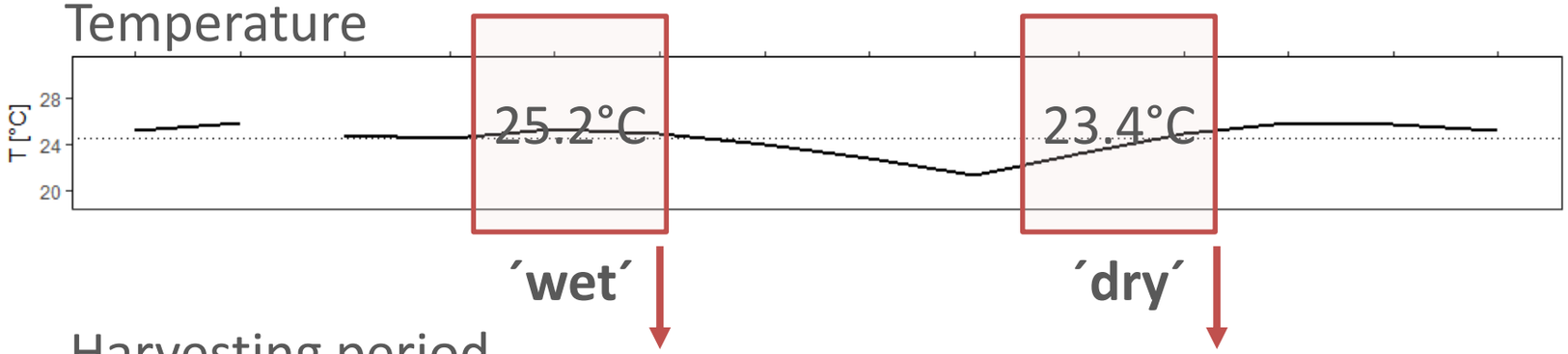
Season



Precipitation



Temperature



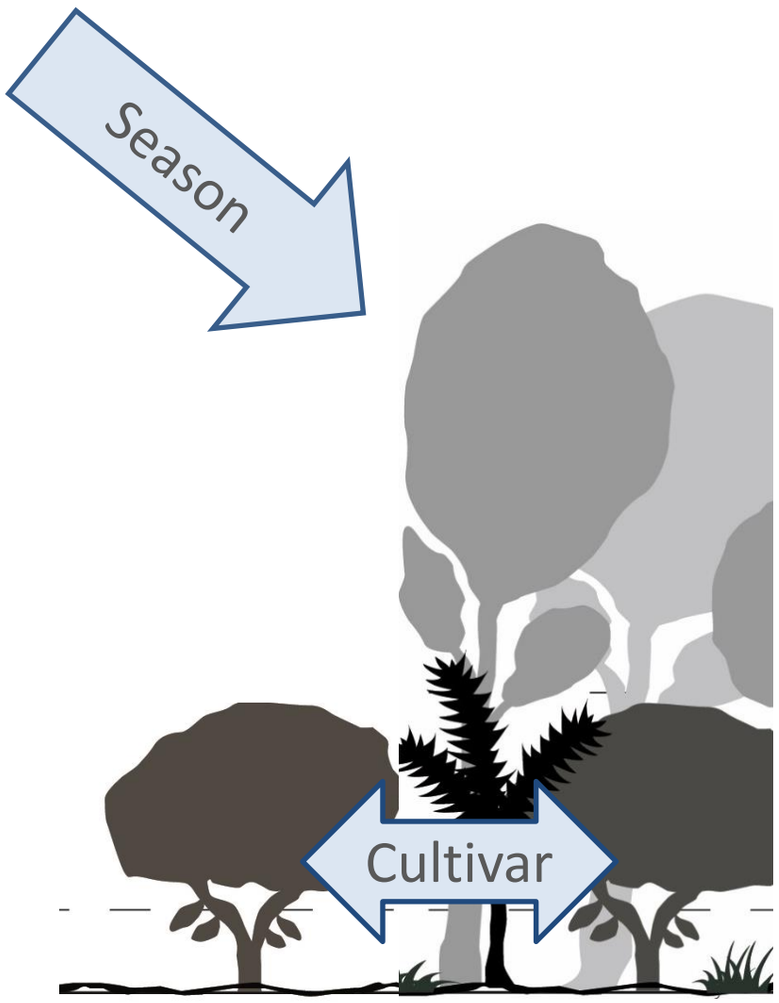
´wet´ **´dry´**

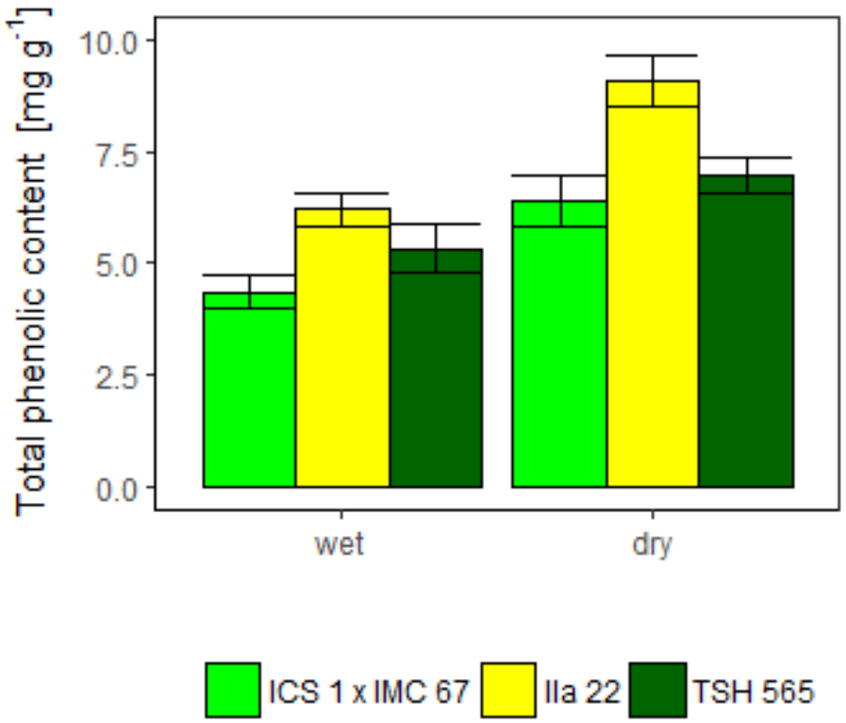
Harvesting period

Phenols [mg g^{-1}] 5.3 → 7.5

Spermine [µg g^{-1}] 2.6 → 2.0

Seasonal changing conditions and cultivar effect

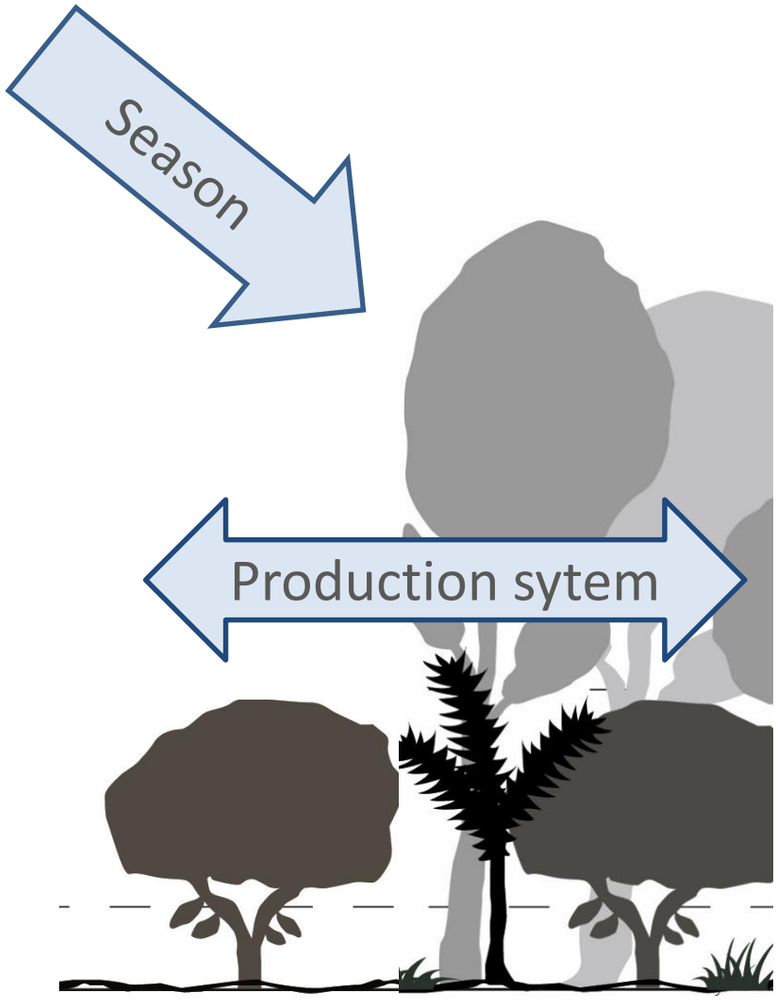


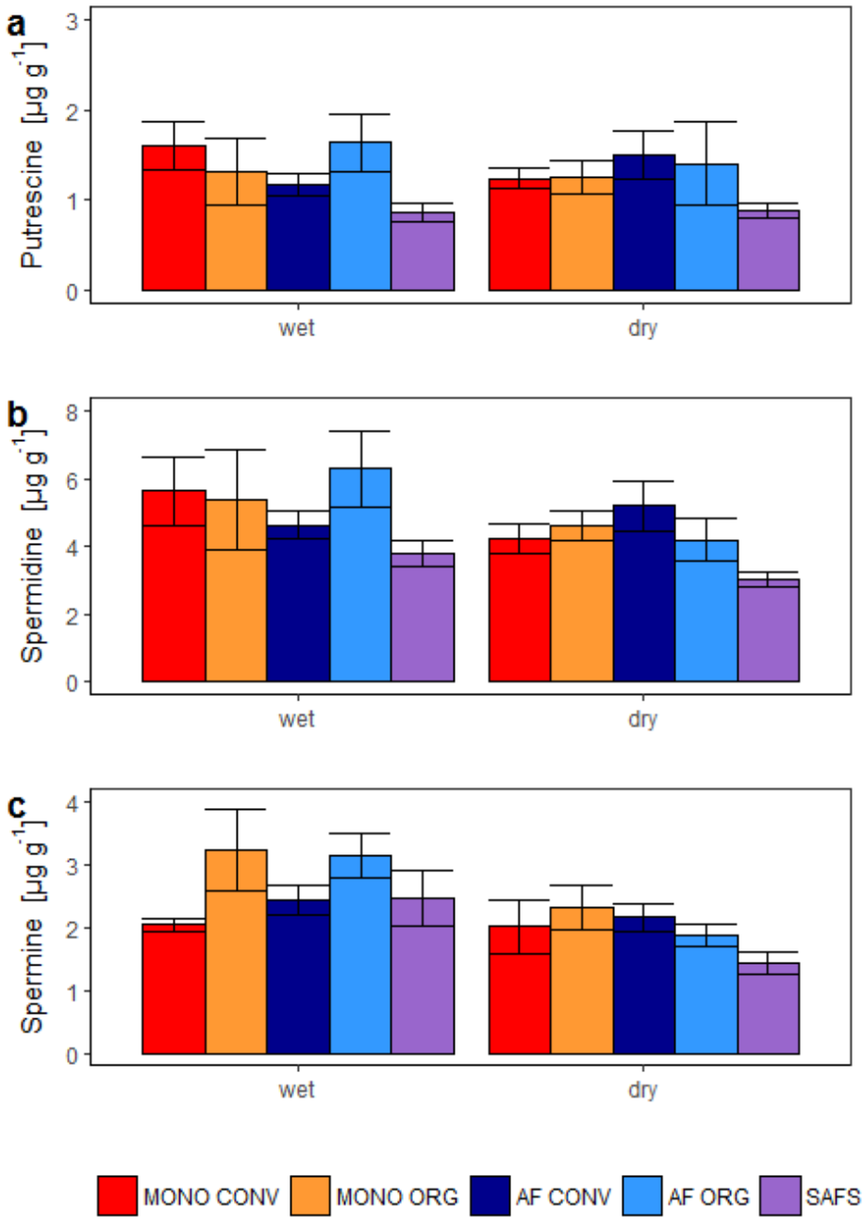


Phenols [mg g^{-1}] 5.3 – 7.5

→ No effect of production system
→ Local cultivar IIa-22 higher totel phenolic content

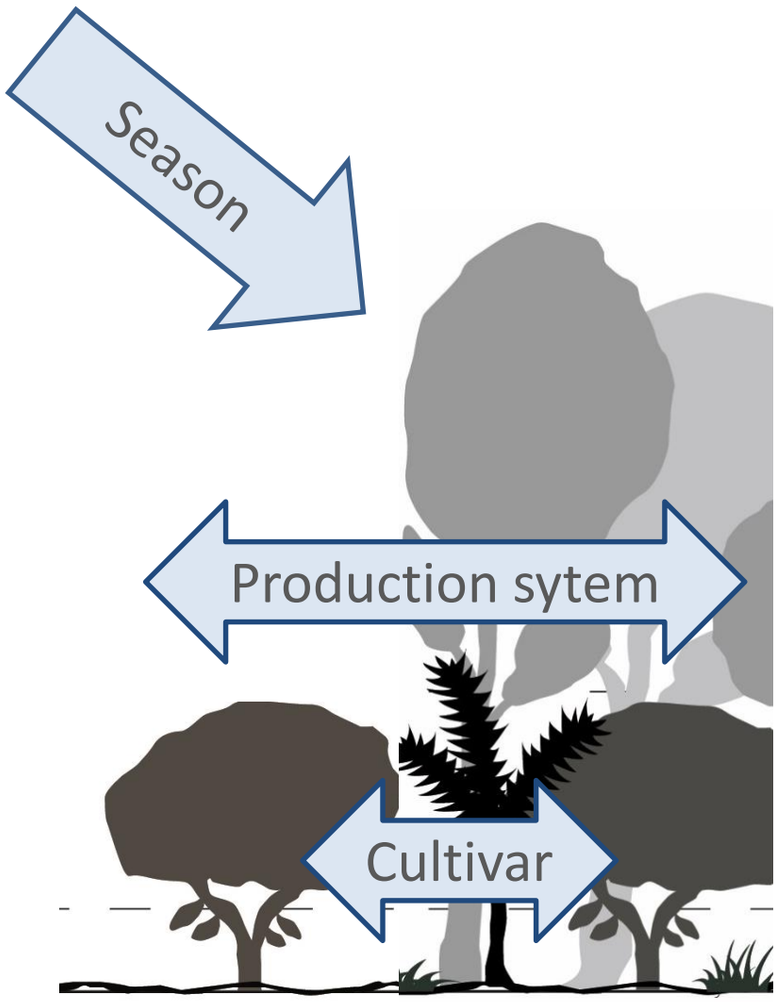
Seasonal changing conditions and production system





Polyamines
→ Linear relationsships
→ No cultivar effect
→ AF > SAFS

Conclusions



Production systems

→Despite the total production little effect on beans that can be realted to allelopathic interactions of the tree species

Cultivars

→React different to environmental conditions → local adaption!

Season

→Strong influence on the tree and finally the beans!

When discussing the compounds of beans from different origins, environmental conditions should be considered.
Also climate change may effect the bean quality and flavor of the beans.

Thank you Gracias Merci

Project partners:

FiBL

ECOTOP CONSULT

instituto de ecología

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