







Agroforestry impacts on yields

March 2016

CONTEXT

YIELDS QUALITY AND QUANTITY

- Cocoa yields depend upon cacao plant's general status, soil quality, climate, agricultural practices, shade.
- Harvest's quality can be evaluated from the damaged fruits rate.

	Name	Description	Solution
	Moniliasis – <i>Moniliophthora roreri</i>	Caused by a fungus Intern and extern necrosis of the fruit	Suppressing the damaged fruits to stop propagation
	Aborted	Natural mechanism exacerbated in stressful conditions	Identifying the cause: lack or excess of water, light or nutrients
	Rot - <i>Phytophthora</i>	Fruit infection and death Damages on the trunk and branches	Applying fungicide Adapting cultural practices
	Insects	The insects feed on cocoa Vector of viruses	Applying insecticide Implementing biological control Adapting cultural practices

OUR PARTNERS

- Université libre de Bruxelles, Belgium
- Universidad Agraria de la Selva, Peru



- Localization: Peru, San Martin, Alto Huayabamba project
- Climate: Subtropical humid
- Soil: Inceptisol (USDA Classification)
- Crop: Cacao

PROTOCOL

OBJECTIVE

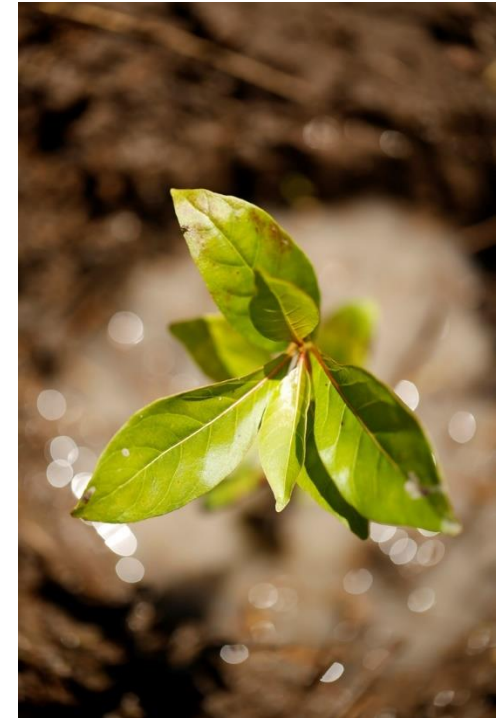
- To assess the optimal shade tree density to warranty cocoa yield and quality

TREATMENTS AND REPETITIONS

- 4 different shade tree densities

High density	440 timber trees/ha
Medium density	270 timber trees/ha
Low density	50 timber trees/ha
Full sun	0 timber trees/ha

- Three 1000 m² crops per treatment with same cocoa density: 1800 trees/ha



NOTA BENE

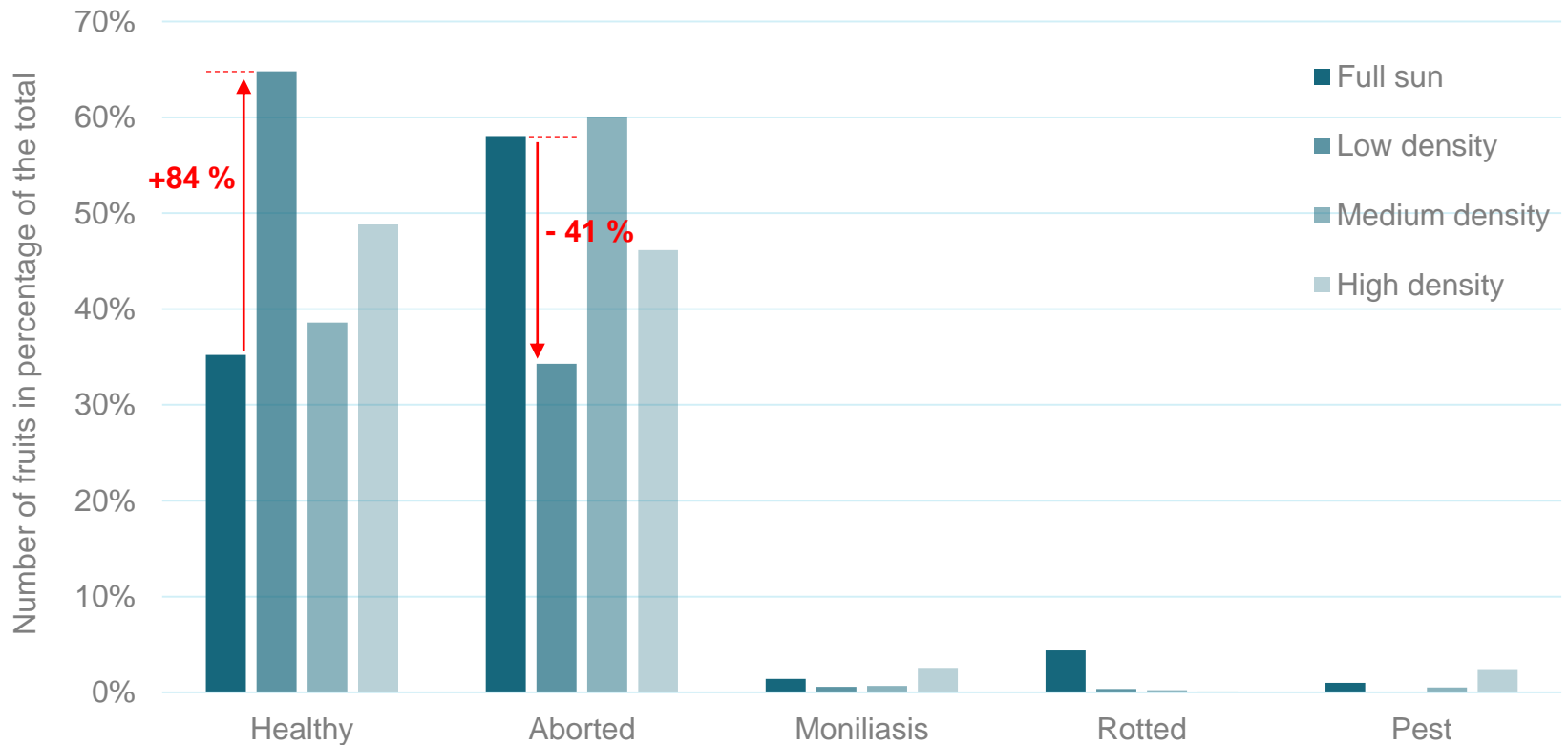
A very similar protocol is applicable to coffee.

RESULTS – ALTO HUAYABAMBA, PERU

Harvest quality

Influence of tree density on fruit abortion and diseases development

July 2015



In this case, low tree density is the optimum (50 timber trees / ha) with **an increase of 84% of the quality***, a diminution by **41% of abortion rate**, and less pests and diseases.

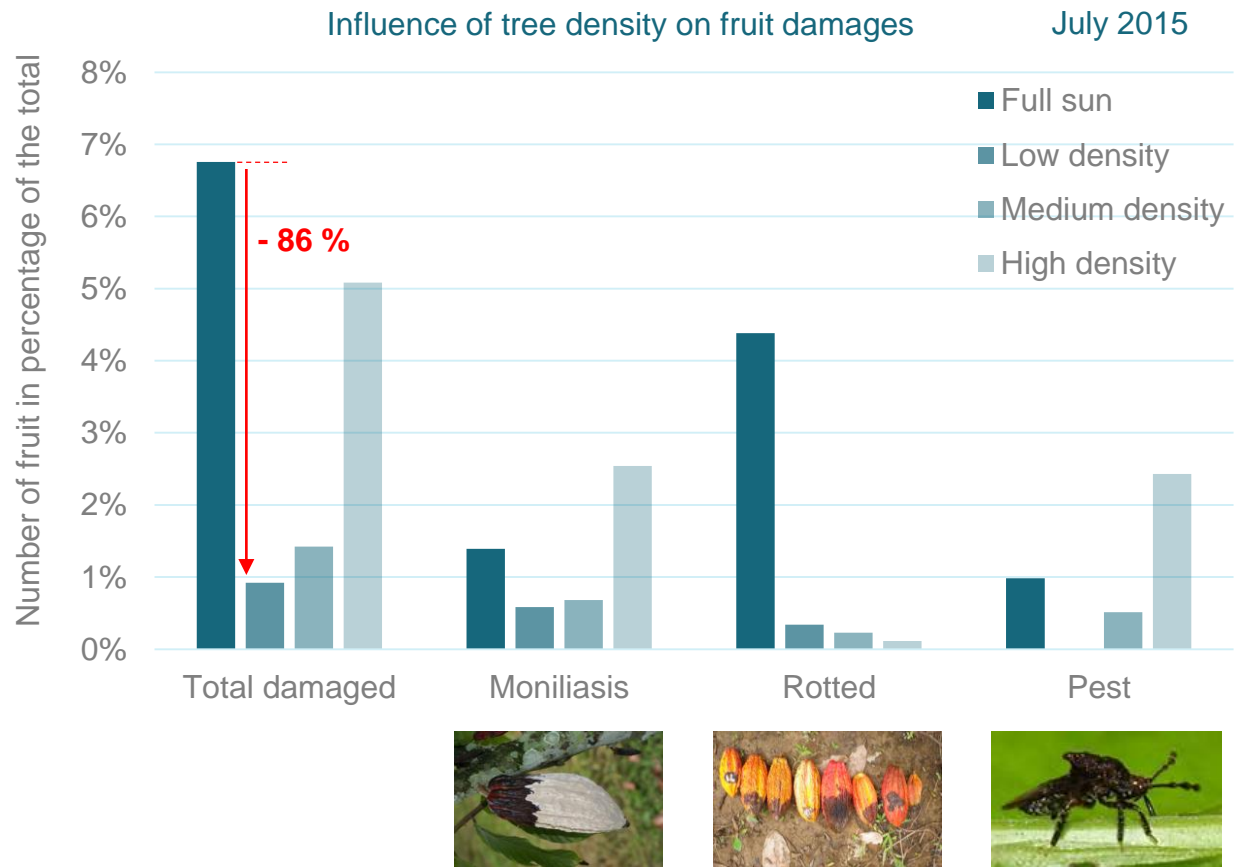
*Rate of healthy fruit

RESULTS – ALTO HUAYABAMBA, PERU

Harvest quality

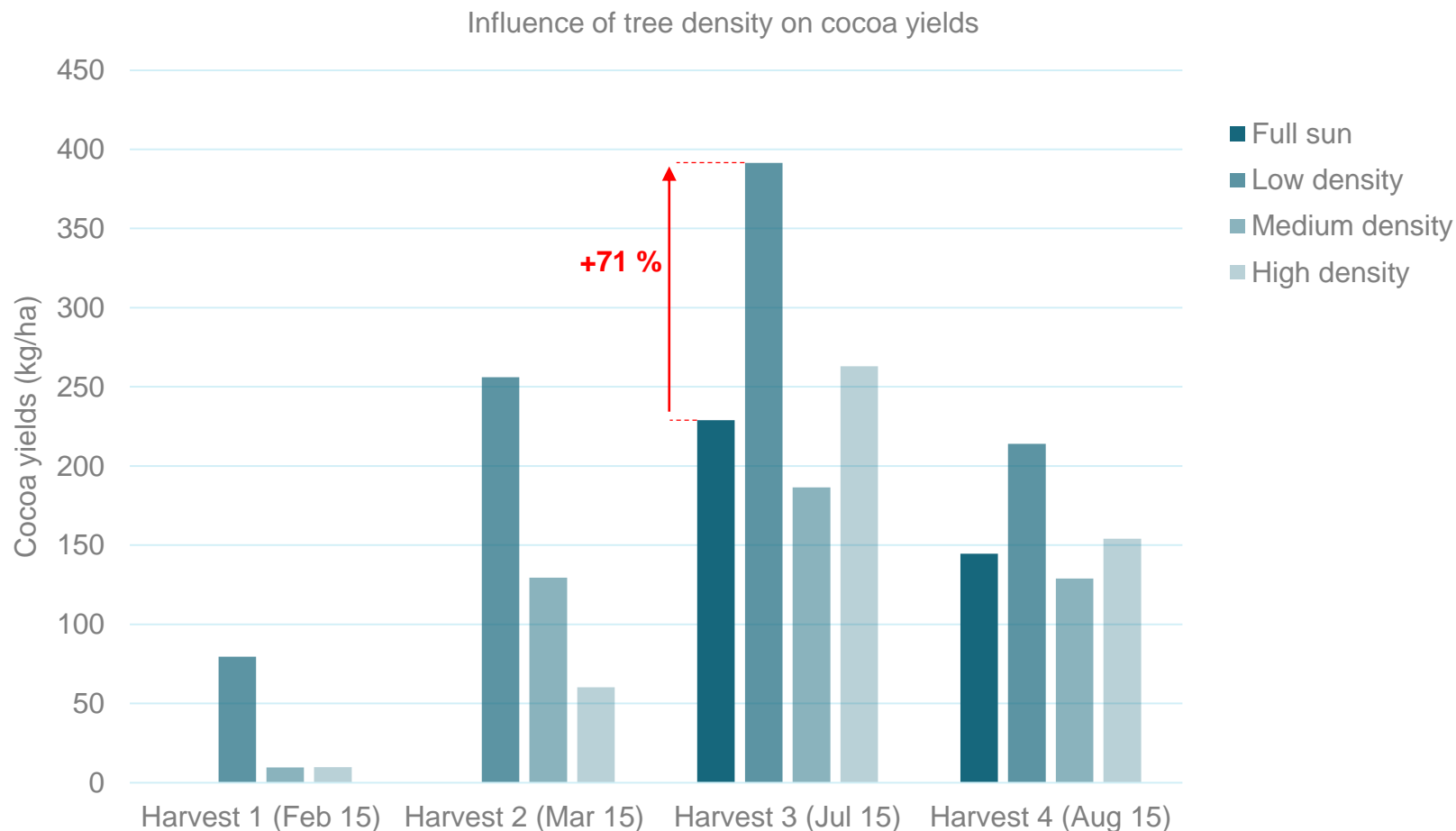
FIRST RESULTS

- Full sun condition **increases by 86%** the rate of damaged fruit in comparison with low tree density. It could be explained by the lack of biological control in full sun system
- High density systems generate more humidity which explains fungi diseases development



RESULTS – ALTO HUAYABAMBA, PERU

Harvest quantity



In this case, a low density of trees induces an **increase of 71% of the yields** in harvest 3 (biggest harvest for the period under review) in comparison with full sun.

RESULTS – ALTO HUAYABAMBA, PERU

Global conclusions

FIRST RESULTS

- There exists an optimum timber tree density for harvest quality and yields. In our particular context, it could be around **50 trees/ha**.
- Full sun and high tree density are both damageable for harvest quality and yields.
- Low tree density increases **fruits health and yields** compared to full sun system.
- Full sun conditions **increase by 86%** the rate of **damaged fruit** in comparison with low tree density.

NEXT STEPS

- Doing more repetitions with different farmers to increase statistical significance
- Studying a lower range of tree density
- Collecting data all year long to assess the impact of tree density over a long-term period

