

Agroforestry system to ensure cacao yields

The conventional monoculture production of cacao trees not only leads to higher levels of pest and disease infestation, but also to loss of soil fertility over the longer term. Cacao farmers are struggling with declining yields. In long-term studies in Malaysia and Bolivia, FiBL is comparing the yield security and economic efficiency of agroforestry systems versus conventional monoculture production.

In nature, cacao trees grow in rain forests. They like shade and soils with decaying leaves and branches. It is true that the trees grow faster and produce high yields sooner in monoculture plantations without shade-providing species. Because of higher pest and disease pressure and declining soil fertility, however, the yields also start declining rapidly. Inadequate yield security has caused many Malaysian cacao farmers to switch to more lucrative palm oil or rubber production. The long-term supply of cacao is in jeopardy.

How can neglected plantations be rejuvenated?

On a cacao plantation northeast of Kuala Lumpur, FiBL is testing new production strategies for stabilizing cacao tree

yields over the long term. The sponsor of these studies is Barry Callebaut, one of the world's leading cacao dealers and processors.

Cacao has been grown conventionally on the study plantation since the 1980s. The trees were hardly maintained at all once the yields started to decline. "The first thing we want to do is find out the best way to rejuvenate a neglected, low-yielding plantation," explains FiBL project manager Monika Schneider. To this end, she and agroforestry expert Joachim Milz of the consultancy firm Ecotop set up an elaborate field study. Normally old cacao trees are torn out and replaced with young trees. But it takes two and a half years before the young trees start to yield. With the aim of shorten-



Standard practice to date: monoculture with no shade-providing species and with heavy fertilizer and pesticide use.



Agroforestry system for smaller plantations. Various fruit trees provide by-products.

ing the non-productive time, in a second variant they pruned the old trees back almost to the stump. A new tree canopy is then formed from new growth shoots.

In a further step, Schneider and Milz hope to ascertain which production systems enable long-term yield security. Hence the two rejuvenation methods (“new planting” and “back pruning”) are each being implemented in two different agroforestry systems.

Plant communities provide shade and by-products

The agroforestry system developed by Joachim Milz is based on natural plant succession. It encompasses annual crops such as napier grass and manioc as well as various fruit and forest trees. This system is ideally suited for smaller family farms, which can use the by-products such as bananas, manioc root, or firewood for subsistence. A second agroforestry system with a less complex species composition is suited for larger plantations. In this system the cacao trees grow in companionship with precious hardwoods, which provide shade. But this system also includes plants that supply biomass for improving the soil, legumes such as the *Gliricidia* tree or the peanut species *Arachis pintoii* that binds atmospheric nitrogen. The previous intensive monoculture production with chemical-synthetic fertilizers and pesticides serves as a comparison.

The experiment has been running since 2011. Project manager Monika Schneider is satisfied with the progress thus

far, even though pest and disease control has been very challenging in all of the variants. “We are continuously having to develop the necessary know-how ourselves,” says Schneider. For there are only a few research projects with agroforestry systems in the entire world.

There is a cacao research station in the tropical lowlands of Bolivia. Here in the Alto Beni region, Monika Schneider set up a long-term study in 2008 in cooperation with El Ceibo, the governing body of the local cacao cooperatives, and with the Institute of Ecology of the University of La Paz. Agroforestry specialist Milz is involved in this study as well. According to Schneider, leafcutter ants were the greatest threat to the growing cacao trees in every system during the three year startup phase. It will take another three years before the cacao trees reach their full yield potential. The preliminary analyses show that the trees grow faster and yield sooner in the monocultures. But they also show that the trees in the agroforestry systems are less frequently infested with fungus diseases.

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A long-term cacao trial in Bolivia also serves as an opportunity to provide basic and advanced training to local cacao farmers.