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An aerial photograph of a dense, lush green forest. The trees are tightly packed, creating a vibrant green canopy. The lighting is bright, highlighting the various shades of green. Overlaid on the image is white text in a serif font. The text is arranged in three lines: the first line contains 'nic', the second line contains 'restry —', and the third line contains 'mix'. The dots above the 'i' in 'nic' and 'm' in 'mix' are also visible.

nic
restry —
mix

by Petra Heid

Looking at the development of supply and demand in the cocoa and chocolate industry, it's clear that cocoa production will have to step up to keep up with the growing appetite for chocolate in markets around the world. Consumers in emerging economies such as the BRIC countries Brazil, Russia, India and China and countries in the Middle East, for example, are developing a taste for chocolate. While this trend is welcome news for the cocoa and chocolate industry, it also underscores the need for significant and sustainable increases in cocoa production.

How to achieve this goal is a topic of intense debate among experts. While the systematic use of chemical inputs has long been regarded as a viable solution, another approach called "dynamic agroforestry" is currently also being explored. Dynamic agroforestry focuses on mixed crop farming. The aim is to grow cocoa with a variety of other plants that enable the cocoa trees to thrive.

Cocoa production practices

For decades, increases in cocoa production were achieved mainly through the conversion of tropical rainforest areas into cocoa plantations. Decreased soil fertility and sharp increases in plant diseases and pests in some cocoa growing regions – conditions observed after 20 some years of production – were countered by increasingly intense usage of chemical fertilizers and pesticides. Yet plant diseases are still a major problem, especially in West Africa and Asia. Moreover, it is now common knowledge that the large-scale clearing of tropical rainforest has played a key role in climate change. An expansion of cocoa farmland at the expense of the few remaining tropical rainforests would be irresponsible in today's world. The greatest challenge facing the cocoa industry is thus to ensure that it can continue to source its key raw material,

cocoa, in the quantity and quality required. And this will only be possible through the implementation of good agricultural practices on existing cocoa farms.

Lessons from Malaysia...

In order to fully understand the complexity of the problem, let's take a look at how cocoa cultivation has developed in Malaysia over the past 30 years.

As a country characterized by large-scale plantations, it was relatively easy to boost Malaysia's cocoa production volume rapidly within just a few years through cultivation programs, and cheap loans and subsidies supported by the World Bank. High prices on the global market during the 1970s and early 1980s motivated both the government and investors to expand cocoa farmland, even in less-than-ideal locations, to force a monoculture approach and to maximize yields through the use of chemical fertilizers and pesticides. In doing so, the country succeeded in boosting its cocoa production from 35,000 tonnes in 1980 to 241,000 tonnes in 1990. Malaysia was the fourth largest cocoa-producing nation after Ghana (295 tonnes), Brazil (362 tonnes) and Côte d'Ivoire (704 tonnes). Cocoa had thus advanced to become Malaysia's third-most important export.

At the end of the 1980s, exploding cocoa production was about to catapult Malaysia to the top of the list of the world's largest cocoa-producing countries. But then in 2000, the annual harvest fell back to 35,000 tonnes. The fall in cocoa production was just as swift as its rise. What had happened?

Malaysia's initially extremely high yields of two tonnes per hectare, achieved through the high-level usage of fertilizers and pesticides, could no longer be maintained. This was primarily the result of escalating soil depletion despite the use of fertilizers, as well as the fact that dis-

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eases and pests had become increasingly resistant to certain pesticides. The uncontrolled increase in these pests and diseases coincided with a period of falling prices on the global market. Oversupply, plus higher production costs made cocoa production unprofitable and triggered the gradual replacement of cocoa trees by rubber trees and oil palms.

... and other cocoa growing regions

The Brazil cocoa sector was devastated by an outbreak of another plant disease, witches' broom, which triggered a similar crisis. In the early 1990s, cocoa production in Brazil plummeted from more than 400,000 tonnes to less than 150,000 tonnes within a decade. This had a dramatic economic and social impact on the entire



cocoa cultivation region in the state of Bahia.

Over the course of the past two decades, Indonesia has advanced to become the world's third-largest producer of cocoa with an annual production volume of 800,000 tonnes in 2009. One cause for concern is that the same cultivation techniques are in use there which ultimately led to the collapse of cocoa production in Malaysia.

Côte d'Ivoire and Ghana, which together produce half of the world's total cocoa harvest, are also struggling with the problems of decreasing soil fertility as well as increasing rates of disease and pests. These conditions are causing relatively low or even decreasing yields per hectare on smallholder cocoa farms. In addition, various plant diseases, such as swollen shoot, are appearing with increasing frequency in certain regions. Containment of this disease requires the complete destruction of infected cocoa plants, which in turn severely threatens the cocoa farmers' livelihoods.

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Barry Callebaut's Research & Development activities in cocoa

Barry Callebaut has decided to address these new challenges and take action. Dynamic agroforestry is one of the approaches being studied by the company's Research & Development team. Even though it is a niche approach, dynamic agroforestry has demonstrated some promising results by boosting production and improving soil fertility on cocoa plantations in several Latin American countries.

Barry Callebaut's agricultural research draws on the experience and expertise of international specialists who, through many years of cultivation experiments and consultation with about 1,000 cocoa producers in Latin America, have successfully developed innovative cocoa production systems and implemented these in the day-to-day operations of small-scale farmers. Building on these experiences, an initial scientifically-conducted cultivation farm trial was implemented in Malaysia in 2011 in collaboration with the Research Institute of Organic Agriculture (FiBL), Switzerland, and the Bolivian consultancy ECOTOP. The results of this multi-year experiment will subsequently be used to help develop new strategies for increasing cocoa production.

What is special about this cocoa production system?

The cocoa tree comes from the Amazon rainforest and the rainforest regions of Central America. It grows there naturally in the shade of a large number of very different trees. According to the latest research, ideal conditions for cocoa tree growth and production should be based on the conditions found in their natural habitats.

Dynamic agroforestry is based on the concept that high productivity can only be achieved in agricultural ecosystems if they have a high energy flow or, in other words,

if many plants can grow within one system and carbon can be accumulated as an energy source. As soon as the living plants die, microorganisms transform these into mineral nutrients which can then be absorbed by the living plants. The more biomass a system produces, the higher its energy flow, the more intense its water and nutrient cycles, the more nutrients are available to living plants, and the higher its productivity and soil fertility.

The challenge of this system lies in combining as many plants as possible in such a way that they do not compete against the cocoa plants, but rather develop a positive growth dynamic and allow the cocoa plants to produce at optimum levels. An important benefit is that a highly-productive, diversified cocoa ecosystem is also extremely stable against pests and diseases.

Targeted measures also produce economically profitable yields: Farm revenues are higher than production costs over the long term with minimal use of fertilizers and pesticides. Farmers are always interested to reduce external inputs, especially if this means stable high yields plus lower external input costs. In addition to cocoa, the farmer families can harvest numerous other agricultural products, such as various fruits and root crops, and wood.

Another increasingly important advantage of the dynamic agroforestry approach is that it is better adapted to ever more frequent climate fluctuations and could even reduce such fluctuations at a regional level. If dynamic agroforestry proves to be successful not only on a small scale but also on a large scale, and under a variety of different agronomic and cultural conditions, this could be a real milestone toward sustainable cocoa cultivation. •