



Deutscher Tropentag, October 9-11, 2002, Witzenhausen  
“Challenges to Organic Farming and Sustainable Land Use  
in the Tropics and Subtropics”

## Organic Coffee, Biodiversity, and Agrochemicals: The Use of Shade Trees for Low-Input Coffee Production in Central America

REINHOLD G. MUSCHLER

*Center for Research and Higher Education in Tropical Agriculture (CATIE), Department of Ecological  
Agriculture, Costa Rica*

### Abstract

Together with sugarcane and bananas, coffee has played a central role for the economic development of many countries in the tropics. However, the expansion of these export crops during the past two centuries has also left a strong ecological footprint in terms of reduced biodiversity and increased soil and water degradation. For decades, high productivity often was achieved by reducing a naturally high diversity of plants in natural ecosystems to but a few, if any, shade trees in coffee monocultures and by using high inputs, often of dangerous agrochemicals. Today, excessive agrochemical residues are commonplace — often with uncontrollable long-term effects on non-target organisms, including man. Using organic coffee as an example, this paper reviews the principal challenges for rural development in Central America and proposes priority interventions for applied research and development of organic production systems.

For Central America, coffee production continues to be one of the main sources of foreign exchange and employs a large portion of the agricultural work force. In Costa Rica alone, coffee employs about 23 % of the agricultural work force of the country. Given the continuing erosion of coffee prices due to increasing global supply, primarily by large producers in South America and Asia, the economic survival for many, if not most, Centralamerican smallscale coffee producers depends, in large part, on their ability to access and shape the increasing specialty coffee markets. These markets, currently in rapid expansion, pay premiums for organic and other specialty coffee produced in environmentally sustainable and socially responsible ways. Compared to the 2002 prices of US-\$ 50 to 70 for conventional coffee, often below production costs, certified organic coffee can fetch more than US-\$ 130 per 100 lb green coffee. However, high certification costs, consumer doubts about the criteria, quality and credibility of certification, lack of market access for smallholder producers, and lack of agronomic information on improved management of organic coffee farms are currently limiting the growth of this promising sector.

Biophysical studies suggest that, with few exceptions, organic coffee cannot be grown sustainably without a significant presence of trees for shade, nutrient cycling, additional tree products, and habitat for mammals, migratory and resident birds, and beneficial insects and microorganisms. Furthermore, the shade helps suppress aggressive weeds, and allows the coffee berries to ripen more slowly resulting in higher-quality beans that receive a premium from many specialty coffee buyers. At low-elevation sites, intermediate to high shade levels have been shown to significantly increase coffee plant vigor, bean quality, and coffee taste. Applied agricultural research should aim for the design of pest-suppressive agroecosystems and the evaluation and validation of practices such as the use of coffee

genotypes with high tolerance or resistance to pests and diseases, biological control of pests and diseases, effective soil and foliar applications of low-input/organic fertilizers, system diversification, and, finally, environmentally sound management of the associated trees and weeds. Among the most promising options for diversification are fast-growing timber or fruit trees for local and export markets and annual crops such as bell peppers, tomatoes or root crops which can be planted between the coffee plots. Promising timber species are, for example, *Cordia alliodora*, and species in the genera of Spanish Cedar (*Cedrela*), mahogany (*Swietenia*), walnut (*Juglans*), and many leguminous timber species. Particular attention should be given to native tree and their ecological roles for the native and migratory fauna.

In order to adequately address farmers' needs, R&D initiatives should focus on the entire commodity chain rather than only on individual aspects. Traditional agronomic research and outreach activities should be complemented by technical backstopping on quality control/certification, processing, and marketing of coffee (and other products) for specialty markets. Examples from participatory work of CATIE with producer groups from Mexico, Nicaragua, and Costa Rica illustrate ways to use organic production systems for biodiversity conservation and the reduction of agrochemical pollution. In order to strengthen the productive and administrative capacity of organic coffee producers, the following topics are central for organic agriculture and agroforestry:

- Crop breeding for increased disease/pest resistance;
- Biological control of pests and diseases (e.g. biological control of the coffee berry borer, nematodes and foliar diseases) and plant protection with non-synthetic agents;
- Diversification of monocultural crop systems with underexploited tropical crops ("emerging crops");
- Increased use of trees for their ecological services and products (nutrient inputs, microclimatic buffering, benefits for coffee quality, product diversification, biodiversity conservation, reduced environmental degradation; watershed stabilization);
- Support for effective but low-cost quality control protocols (e.g., internal control systems) and certification with technical backstopping from regional institutions;
- Support for local processing for increased value-added and secondary products;
- Support of direct marketing initiatives for shared benefits for producers and consumers; and finally
- Awareness creation of consumers and producers.

Increased efforts to synthesize and distribute training materials in agroecology, agroforestry, biological control and organic production/certification are required. Increased networking among projects and initiatives supported by different donors should allow to maximize impact at reduced costs. Positive examples are the collaboration among regional projects funded by NORAD and GTZ/BMZ on IPM, agroforestry, and non-synthetic pest control which cover six Central American countries. These long-term projects, strengthened by scientific and methodological inputs from CATIE's graduate students and staff, provide technical assistance throughout Central America and deliver essential inputs for the future development of organic production in Central America.