

## AGRICULTURE IN AMAZONIA

*Amazonia: Agriculture Land Use Research*, Susanna Hecht (Editor), Centro Internacional de Agricultura Tropical, Cali, Colombia 1982, 428 p.

Conquest of one of the last remaining sizeable wildernesses always stirs the imagination and fans the flames of controversy. The largest remaining tropical forest that cloaks the seven million square kilometer Amazon basin is one of those frontier regions experiencing rapid development. The forest clad region is variously perceived as a green lung for the world's oxygen supply, a fragile ecosystem too delicate for extensive manipulation, and a haven for yet to be uncovered riches. Myths and misconceptions about Amazonia abound, and *Amazonia: Agriculture and Land Use Research* provides a sober assessment of the agricultural potential of the region. The book explores a major paradox for agricultural development in the Amazon: when the wall of lush tropical forest is pushed back, disappointing crop production normally ensues.

*Amazonia: Agriculture and Land Use Research*, edited by a geographer with a good grasp of the broad range of issues involved, is the proceedings of a conference held at CIAT (Centro Internacional de Agricultura Tropical) near Cali, Colombia in April, 1980. The paperback volume is organized into three sections. The first deals with reports from representatives of various countries with territories in the basin, for each country an overview of the environment, research objectives, and agricultural development efforts is provided. The second section of the book contains technical discussions of soils and the potential of various crops. The final part is an illuminating presentation of forestry and agroforestry efforts in Amazonia and other tropical lowlands.

The country reports section makes slow and choppy reading at times, and is occasionally repetitive, but two themes stand out. First, Amazonia is generally a poor piece of real estate. In neither the Bolivian, Peruvian, Ecuadorian, Colombian, Venezuelan, or Brazilian Amazon do naturally fertile soils cover more than ten percent of the areas involved; in the Peruvian Amazon for example, only three percent of the territory is considered suitable for annual crop production. Second, governments are clearly

increasingly aware of the constraints to agricultural development of Amazonia and are taking laudable measures to spur research and promote ecologically-viable crops. Venezuela's great caution in opening up its Amazonas territory exemplifies the wisdom of careful study prior to development.

In the Technical Reports section, the essay by Cochrane and Sanchez summarizes many of the obstacles to agricultural development of Amazonia. Four-fifths of the soils suffer from strongly acid conditions where a pH of 5.3 or less prevails. Furthermore, three-quarters of the land suffers from toxic levels of aluminum. Traditional shifting cultivators have circumvented these drawbacks by capitalizing on the nutrient-rich ash generated by burns and then clearing a fresh patch of forest when crop yields slip due to declining soil fertility and the build-up of weed and pest populations. Cochrane and Sanchez describe rotational cropping systems developed in the Peru-

vian Amazon that employ fertilizers profitably.

Although there are doubtless situations where fertilizers can be utilized economically in the Amazon, such as near urban centers, it would be a mistake to assume that all one needs to do is make fertilizers available so that food production is boosted in the region. Fertilizers are extremely expensive in Amazonia, partly because they have to be transported from distant factories. Since the region is a net food importer, annual food crops could be grown on a much larger scale on the floodplains of silt-laden rivers to feed the burgeoning cities. Alluvial soils of such white-water rivers as the Amazon are rejuvenated each year by floods and thus require little if any fertilization to achieve high yields. To reduce the acidity of upland soils for perennial crops, the extensive deposits of limestone in Amazonia could be mined to provide lime.

Commercial nitrogen fertilizer requires fossil fuel as a feedstock, usually natural gas or petroleum, and other nutrients such as phosphorus and potash need large amounts of energy to mine and up-grade. Fertilizer prices are thus climbing steeply, and other strategies for boosting crop production barely touched upon in the book are worth exploring. Crop breeders, for example, could profitably devote more attention to plants that promote nitrogen fixation by symbiotic and associative bacteria and



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encourage the development of particularly efficient root-va mycorrhizal relationships.

Another method of reducing the need for commercial fertilizer mentioned in the book is the use of mulches. An additional benefit of a layer of plant material on the soil surface is that it helps conserve moisture. But not all crops benefit from mulches; in the rainy season rice can suffer from increased damage due to fungal and bacterial diseases if organic matter is deposited around the base of the plants. Furthermore, mulches require time and land to produce. In the Brazilian Amazon, the only crop that I am aware of that regularly receives a mulch dressing is black pepper. Farmers at Tomé-Açu place rice husks around the base of the plants to retard weed development and to conserve moisture during the dry season.

The chapter by Schubart and Salati touches on an important potential problem: the increase of atmospheric carbon dioxide. The burning of tropical forests will un-

doubtedly accelerate this trend; the Amazon forest alone contains twenty percent of the carbon locked up in the global biomass. The ultimate outcome of this trend is still disputed, but climatic patterns over wide zones are likely to be disrupted. Temperate zone people thus have a stake in the future of this tropical region.

The papers by Toledo and Serrão, Alvim, Hecht, Peck, Valencia, and Bishop focus on the prospect for perennial crops in the Amazon, with particular emphasis on agroforestry schemes. Rubber, cacao, African oil palm, and Brazil nut are among various tree crops now undergoing extensive testing and planting in the region. Food crops can be planted while the trees are becoming established, or in some cases, intercropped with mature trees. The integration of agroforestry and animal production systems, such as cattle pasture sown in rubber and African oil plantations, receives attention by several authors. Multiple cropping with trees and

other cultigens is ecologically and economically sound; farmers are less prone to catastrophic outbreaks of diseases and pests.

Hecht points out a major obstacle to the agricultural development of the Amazon: the confused land tenure picture. Few bankers issue agriculture loans to people without titles to their land and only a small fraction of farmers in Amazonia have secure titles to their properties. Most small-scale cultivators do not have any documents for their land, while large landholders often dispute their rights to the land with other contenders. False titles abound. The pace of cadastral surveys and the issuing of legitimate land titles needs to be accelerated to provide a more favorable environment for the blossoming of agricultural development projects.

Given the heterogeneous nature of Amazonian ecosystems, agricultural technologies will have to be tailored to local conditions. Research institutes within the region

thus need to be strengthened. Unfortunately, sporadic budgets and frequent changes of political leadership often undercut efforts to develop farming strategies for the region. Sustained support by national governments is therefore necessary if agricultural research is to bear fruit.

Although the book is marred by numerous misspellings, several grammatical errors, some one sentence paragraphs, and a lack of an index, it will prove most useful to development planners and research institutes working on tropical agriculture. The book summarizes the current knowledge about agriculture in Amazonia, identifies priorities for research, and wisely calls for the establishment of parks and Indian reservations. The volume is a valuable addition to the growing literature on Amazonia.

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