AMAZONIA III

Curing Amazonia's

The solution to the ills of the jungle must be technical, political, social

by Christopher Weathersbee

Three elements are needed in order to raise good crops: soil, water and sunlight.

Sunlight must be plentiful, water should come down often enough to keep the soil humid and the soil should be full of plant food and structurally capable of holding the correct balance of water and air.

Amazonia qualifies on most counts as prime agricultural land, as might be expected from its luxuriant plant cover. But the one qualification it lacks makes the difference between marginal agriculture and successful crops: The soil is almost without plant nutrients.

The local vegetation has evolved to do without very much in the way of soil nutrients, but only at the expense of being miserly. The rain forest of the region does not yield much of a commercial harvest. When the forest is cut the cleared land yields even less.

Yet, says Dr. Hugh Popenoe, director of the University of Florida's Center for Tropical Agriculture, Florida farmers would be happy to trade their soil for Amazonia's, this in spite of the fact that Florida has one of the fastest growing agricultural outputs in the United States.

The difference would seem to be simple—fertilizer. Florida's farmers, with their nutrient-poor and structurally unsatisfactory soils, add in the form of chemical fertilizer the nutrients that the soil lacks naturally. Accustomed as they are to the use of heavy chemical fertilizing, they would indeed be happy to have a soil that at least drained properly and kept crop roots aerated.

The difference isn't simple, however, for a complex of technological, sociological and economic reasons; shipping a CARE package full of fertilizer to an Amazonian farmer would be a waste of packaging materials.

In the first place, Florida's fields are watered by about 50 inches of rain a year, while Amazonia gets 80 inches on the average and well over 100 inches in large areas. Fertilizer applied in Florida has a reasonable chance of making its way into a plant where it can do some good. Rapid rainwater leaching would remove fertilizer from Amazonian fields almost as soon as it was applied. Ordinary fertilizer in rain forest country would be inefficient in the hands of the most scientific American farmer, let alone as used by a Colombian peasant.

Even if the farmers could be persuaded to experiment, and if their experiments were wholly subsidized to dilute the risk of failure, there would still be the ultimate barrier in a free economy. There would be no market for their products, and no means to get them there did a market exist.

Markets, good transportation, and appropriate fertilizers, could enable the rain forest farmers to stay still and work their farms on a sustained basis, instead of cutting out a new patch of forest every few years. And all three are social and political, as well as technological problems. Only a properly motivated government can build the roads, and farmers themselves cannot be left to bear the sole risk of experimentation with agricultural innovations.

Even were these bases covered, however, there would still be the problems of soil chemistry and agricultural technology with which to contend.

The soils of Amazonia are quite good structurally. They are sandy clays which provide good drainage and good root aeration; what they lack is humus and plant food.

Dr. Popenoe suggests that these could both be provided by legume covers planted on cleared land.

Legumes contain in their roots symbiotic bacteria which fix atmospheric nitrogen in the form of the nitrogen compounds that are vital to plant growth. Thus legumes can survive where nitrates are lacking in the soil. Such legumes as alfalfa and clover could be planted as pasturage. A by-product would be a gradual build-up of organic matter, humus, from cattle droppings and last year's alfalfa.

A measure that would require a little more patience on the part of the farmer would be to plant a legume cover and plough it under for several years. This would build the soil faster, but would yield nothing for the first years.

Dr. Popenoe says the possibility of using legumes, tried and true though they are in the north, has received very little attention and research in the tropics. Research would be needed to develop those strains of legumes which would be resistant to high rainfall and which could utilize to advantage the great amount of sunlight and the year-round growing season.

A change in the physical form of chemical fertilizers could make them

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Travelers in Caquetá Province of Colombia migrate in precarious dugout canoes on the Caquetá River to mud landings hacked out of the river bank. Their transient slash-and-burn farms (below) are on subsistence level.

anemic jungle soils

acceptable in Amazonia. Already new kinds of fertilizers hold promise.

One type consists of fertilizer compounded with glass in a frit. The mixture is pelletized and incorporated into the soil. As the pellets weather they release the fertilizer, slowly and in a manner similar to the natural release of mineral nutrients from soil components. An advantage of frits, besides the fact that they do not leach out in a flood, is that plant rootlets wrap around them. The trickle of nutrient from each pellet is absorbed before it has a chance to wash away.

The disadvantage of the glass pellets is that they are useful only with the so-called minor elements, such as zinc, copper, manganese, boron and iron. Dr. Popenoe says progress now is being made with incorporating the big three —nitrogen, phosphorus, potassium— into plastic pellets which act the same way as frits. Asphalt pellets also are being tried.

Another approach is to add nitrogen in chemical forms that are only slowly soluble in water, urea formaldehyde for example. The nitrogen is released from these compounds by microbial action; chemicals can be added with them that retard and control the rate of microbial action.

Rice already is an important crop in much of Amazonia, and probably should be developed further. The blue-green algae that grow in flooded rice paddies are able to fix atmospheric nitrogen and make it available to the rice, so wet rice culture has some of the advantages of legume culture.

At the same time as crop strains are developed for the area and fertilization methods worked out, a search for new forms of livestock should be mounted. Dr. Popenoe says experiments in Brazil with water buffalo indicate that they can fatten in areas of the forest where other cattle would starve to death. Water buffalo eat aquatic succulents that are low in nutrients and difficult to digest because of the amount of water in them. The buffalo have a much longer gut to enable them to do this. Thus they could be valuable in swampy areas of the jungle.

The fact that there is a year-round growing season in Amazonia has its disadvantages, Dr. Popenoe says. It means that there is a year-round growing season for pests also. Without a winter to break their life cycle, pests breed continously. Thus they are difficult to control with methods which depend on a once-a-year attack.

Weeds are another problem. In Amazonia they reach the point of being voracious. Weed infestation can be so severe that crops are completely obliterated before they can be brought in. And their presence is a nutrient drain when nutrients are the last thing that can be wasted.

"Amazonia has tremendous environmental potential," says Dr. Popenoe. "But it's also got a lot of problems to lick. While there is a year-round season, water, energy and space, there are a lot of ecological obstacles. They need long-term research. Everyone always wants immediate results, but this is a hard environment to work with." ◇