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Some countries....are seeking a middle road hoping to combine the promise of biotech with traditional agricultural techniques. In Africa, a continent largely bypassed by the first Green Revolution, a different kind of agricultural research is developiong. Recently, researchers at the International Institute of Tropical Agricultural (IITA), one of the youngest of the 13 IARCs headquartered in Ibadan, Nigeria, have had modest success developing new, better-yieldint varieties of crops like the plantain, cassava, yam, cowpea, and sorghum. But genetics is only part of the picture. In Nigeria, plantain has been "intercropped" with flemingia, a fast-growing bushy-leaved legume, whose periodically pruned leaves provide a protective mulch and shade for the plantain's fragile root system. What's more, this intercropping duo is eocnomic on 2.5 acres.

IITA's yam researchers have saved farmers money and used common sense in cutting up pieces of yam for "seed potatoes" where only whole ones were used before. A creative "herbicide" strategy of controlling weeds makes use of plastic sheeting affordable for the farmer with 2.5 acres. The yams produced from this acreage can fetch as much as $13,000 in Nigeria.

In Kenya, researchers at the Nairobi-based Institue for Insect Physiology and Ecology found that by simply advancing the planting date of sorghum by two weeks, the troublesome infestations of the stem borer pest could be greatly diminished. With two weeks' growth, the sorghum plants effectively beat out the shoot fly population, whose damaging larvae were normally deposited as eggs on the sorghum seedlings. IITA's researchers are also conducting experiments with various predatory insects, such as wasps, mites and beetles to control insect pests such as the cassava mealybug and the green spider mite.

High-yield agriculture doesn't have to come solely through the genes in the plant, the chemicals in the bottle, or the water from expensive irrigation projects -- it can also come through creative biology, human labor, and skilled economic organization.

Nevertheless, advanced countries are plying their agricultural producers with the latest biotechnological advances for wheat, corn, soybeans, rice, and cattle. Many have export subsidies and special credit programs ready in the wings for countries that would buy from them. This technological dominance coupled with subsidies will surely undermine the creative and common sense agricultural efforts now going on in Africa and other places.

Biotechnology is the real wild card now emerging in world agriculture. In one sense, biotechnology is a double edged sword for the Third World. It has the potential to increase the quality and efficiency of agricultural production, offering a long-awaited answer to malnutrition and foreign food aid dependency. But, it also has the potential to disrupt local agriculture and encourage further dependency on expensive agricultural imports and technology.

In many ways, it depends on who controls and dispenses this new technology. If biotechnology is vested primarily in the hands of advanced nations and major businesses, those interests will be in a position to pull the plug on locally significant kinds of agricultural development in the Third World, possibly with dire consequences for national economies and international trading patterns. (Multinational Monitor, 2-28-86, p. 15)

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## *"We Have to First Ask, 'Where Do We Want to Go?' Before We Ask, 'How Do We Get There?' "*

### Congressman George E. Brown, Jr.

*The potential power of the new biotechnologies requires thinking in terms of new farming systems rather than in terms of simply integrating a new technology, like some new type of plow, into our existing system. We should be thinking not just about ways to improve our current crops but also about developing entirely new crops. We should consider how these tools of biotechnology can be applied in developing countries where tremendous gains in production are possible. We should seek to use the unique power of these technologies -- by replacing chemical and mechanical energy with biological energy -- to reduce input costs and increase farm profits.*

*What discourages consideration of fresh, new ways of thinking about agricultural technology are the short-term nature of corporate research investments, inadequate public research investments, and inadequate public research planning....Corporate investments in biotechnology re-*

*search demand a quicker return than do public research investments....A series of easy, short-term research gains may not serve the long-term interests of agriculture.*

*The longer-term research projects and those with uncertain payoffs must be left to public institutions....Careful planning, however, is essential....The public sector is responsible for conducting the extensive technology assessment needed and setting out clearly defined goals for public investment in research, education, and teaching in this area....*

*The new agricultural research agenda that has emerged in recent years is beginning to look at productivity in terms other than yield per acre or yield per animal. Lower operating costs, the preservation of natural resources, and sustained yield have become as important as simple yield. Biotechnology can be a powerful tool, but if the goal is poorly defined, inefficiency may result. We have to first ask, "Where do we want to go?" before we ask, "How do we get there?"*

*-- From a statement in Issues in Science and Technology, Fall 1985. Rep. George E. Brown, Jr. (Dem./CA) serves on both the Agriculture Committee and the Committee on Science and Technology in the U.S. House of Representatives.*

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*DNA is a large molecule made up of a sugar and phosphate (the "sides of the ladder") and four kinds of bases (indicated by A,C,T,G below). When a new cell forms in the growth process of any organism, the DNA in the chromosomes must be copied exactly, carrying instructions for how the new cell should be built and function. The DNA "ladder" "unzips", and each half pairs up with new phosphates, sugars, and bases from the cell to make a new "ladder." During the 1960s, the "genetic code" along the DNA chain was beginning to be deciphered. Enzymes were discovered that could "cut" DNA segments at specific locations. These enzymes opened the way for transferring individuals genes and larger DNA segments to other segments in a process called "gene-splicing". By 1970 DNA had been photographed with the aid of an electron microscope and the rush for "gene splicing" experimentation was on. - Diagram by courtesy of Scott, Foresman and Company Life Sciences textbook, 1983.*

**DNA ladder separates to form two identical DNA ladders**