

Seed Wars: Common Heritage, Private Property, and Political Strategy

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You have heard of "Star Wars." Now there are seed wars.
— *Wall Street Journal* (1984)

WHATEVER THE HISTORICAL PERIOD, whatever the mode of production, plants and their products have been a fundamental component of the material base on which all human societies have been raised. We must all eat, and what we eat is ultimately derived from plant material. What is a steak, after all, but embodied corn? As the prophet Isaiah phrased it: "All flesh is grass." And plants provide us not simply with food, but also with a multitude of useful goods ranging from cotton cloth to life-saving drugs.

If plant agriculture is one of the material foundations of society, the seed is the material foundation of plant agriculture. As such, plant germplasm—the genetic information encoded in the seed—is a resource of tremendous value. And, as the *Wall Street Journal* quotation given above implies, access to, control over, and preservation of plant genetic resources have now emerged as fields of international concern and conflict.

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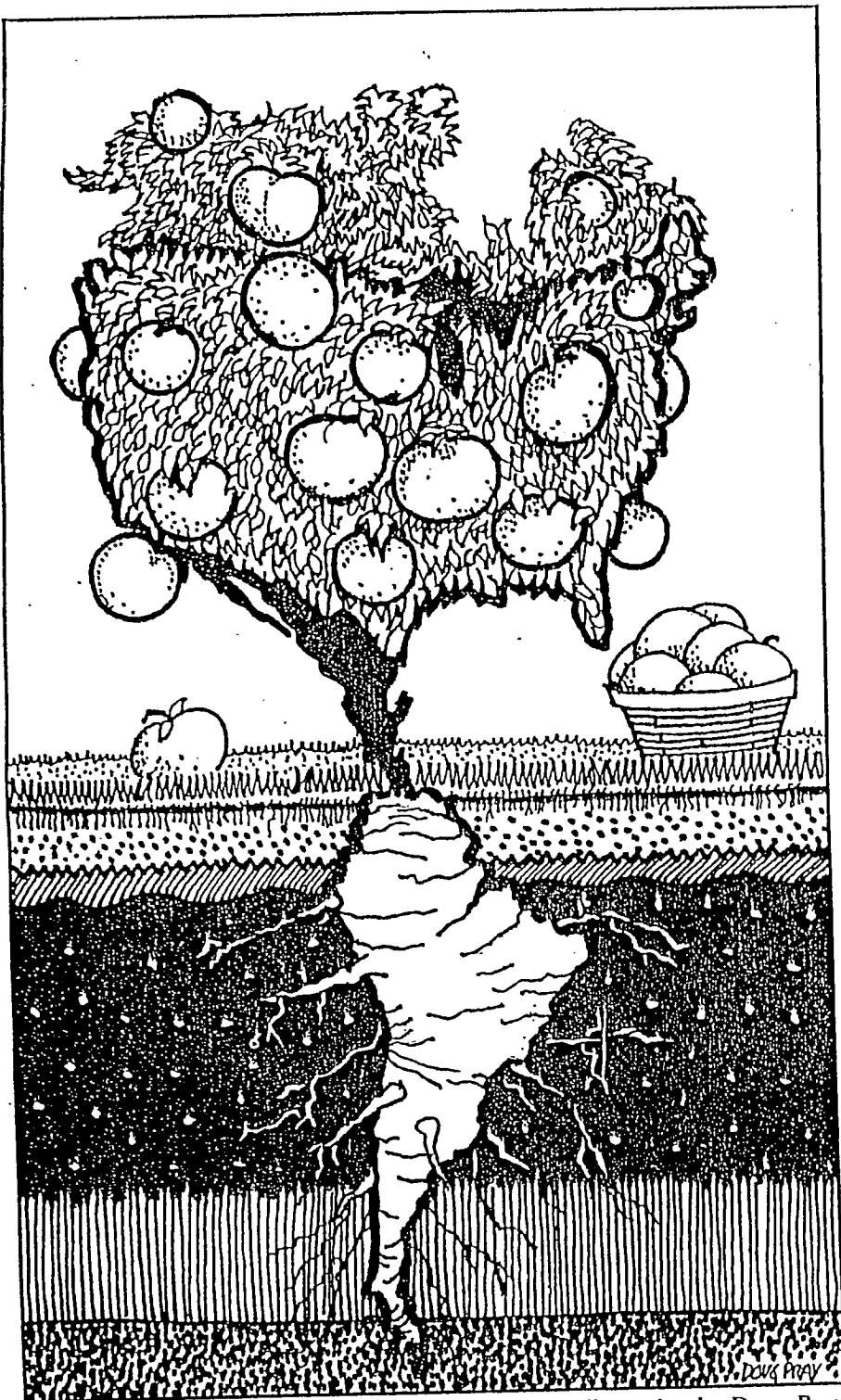


Illustration by Doug Pray

The principal arena for these "seed wars" has been the Food and Agriculture Organization (FAO) of the United Nations. Like so many debates within the United Nations system, the plant germplasm controversy finds the advanced capitalist nations of the North ranged against the less-developed countries of the South. At issue is the equity of global patterns of exchange of and access to plant genetic resources.

In the capitalist world economy today, extracted natural resources are treated as commodities. Plant germplasm is a notable exception. For over two centuries scientists from the advanced industrial nations have freely appropriated plant genetic resources from third-world nations for use in the plant breeding and improvement programs of the developed world. The uncompensated extraction of these materials has been predicated on a widely accepted ideology which defines germplasm as the "common heritage of mankind."¹ As "common heritage," germplasm is looked upon as a public good for which no payment is necessary or appropriate.

But as the private seed industries of the North have matured over the last decade, they have reached out for global markets. In order to facilitate this expansion they have sought international recognition of patent-like "plant breeders' rights" for the plant varieties they develop. With these developments, the developing nations began to see something of a contradiction in the status of their genetic resources as freely available "common heritage" and the status of seed companies' commercial varieties as "private property" available by purchase. That such commercial strains might be based on plant genetic resources originally obtained at no cost from the third world added insult to injury.

Mounting third-world dissatisfaction with this and other asymmetries found expression at the 1983 biennial conference of the FAO. At that time, an International Undertaking on Plant Genetic Resources was passed amid acrimonious debate and the vehement opposition of the capitalist nations of the industrial North. The Undertaking asserts the noble principle that "plant genetic resources are a heritage of mankind and consequently should be available without restriction." However, it goes on to specify that under the rubric of plant genetic resources is included "special genetic stocks (including elite and current breeders lines)."² That is, the Undertaking claims what are now proprietary materials as

no less the common heritage—and therefore common property—of humanity than the peasant-developed land races of the third world.

SUCH AN ARRANGEMENT is patently unacceptable to those advanced capitalist nations with powerful private seed industries. The Undertaking is viewed as nothing less than an assault on the principle of private property. And in fact it is. Governments and companies of the advanced industrial nations have good reason for concern. What the FAO Undertaking demands is literally the decommodification of commercial plant varieties.

The global strength of capitalism imposes important limits upon what constitutes viable and progressive political action. Actions that appear progressive may, given the political-economic context in which they are undertaken, actually serve to reinforce existing relations of power and patterns of inequity. At this conjuncture, we do not believe that the achievement of "common heritage" in plant genetic resources would result in more equitable relations of exchange between nations or benefit the mass of the world's people. The historical, structural, and institutional dynamics that make efforts to promote the application of the principle of "common heritage" to plant germplasm are misplaced. Recognition of national sovereignty over plant genetic resources would better serve the nations and peoples of the third world.

Germplasm: The Fourth Resource

SOIL, AIR, AND WATER are regarded as Earth's fundamental natural resources. But, of course, our planet's true distinction is the existence of life. And germplasm, the hereditary material contained in every cell, must be counted as a fourth resource of prime importance. The term "plant genetic resources" encompasses the total range of plant germplasm available in the global gene pool. While it is really the genetic information contained in the plant cell which is the resource of interest here, it is convenient to think of plant genetic resources as seeds, for that is the form in which plant genetic information is embodied and in which it is usually collected and stored.*

*However, for asexually (vegetatively) propagated plants germplasm is collected in the form of rootstocks or cuttings. To think of germplasm as seed is therefore convenient but not precisely correct.

The vagaries of natural history have resulted in the uneven distribution of plant species over the face of the globe. The northern hemisphere lost much under the grinding impact of the last glaciation. Consequently, biotic diversity is concentrated in what is now the third world. Moreover, it is in the third world that the domestication of plants first occurred and systematic crop production was first initiated.

In the process of domesticating and maintaining crops over the millennia, peasant farmers developed thousands of "land races" within any one species. Land races are genetically variable populations which exhibit different responses to pests, diseases, and fluctuations in environmental conditions.³ The genetic diversity in these land races was, and remains, a form of insurance for peasant cultivators. By planting polycultures comprising genetically diverse varieties, peasant farmers made certain that, whatever the year might bring in the way of weather or pests, some of the seed sown would grow to maturity and provide a crop. The objective of these early breeders was not high yield but consistency of production. And the result of their efforts was the development of great inter- and intra-specific genetic variability in particular and relatively confined geographic regions.

The existence of such areas was first recognized in the 1920s by the Soviet botanist N. I. Vavilov. He identified a variety of these areas which he considered to be the centers of origin of the crops with which they are associated. The "Vavilov Centers of Genetic Diversity," as they have come to be called, are identified in Figure 1. They are located principally in what is now called the third world.

Vavilov's work was seminal for the plant science community. But subsequent research has shown that centers of diversity are not necessarily coterminous with the area in which a crop originated, and that both crop domestication and the subsequent patterns of development of crop genetic diversity were more dispersed in time and space than Vavilov realized. There has emerged a general preference for a conceptual and schematic terminology that uses "regions of diversity" to account for the genetic variability generated as crops spread from their points of origin.⁴

The empirical analysis in this article builds upon this regional schematization. We divided the nations of the globe into ten regions on the basis of current scientific understanding of the location and

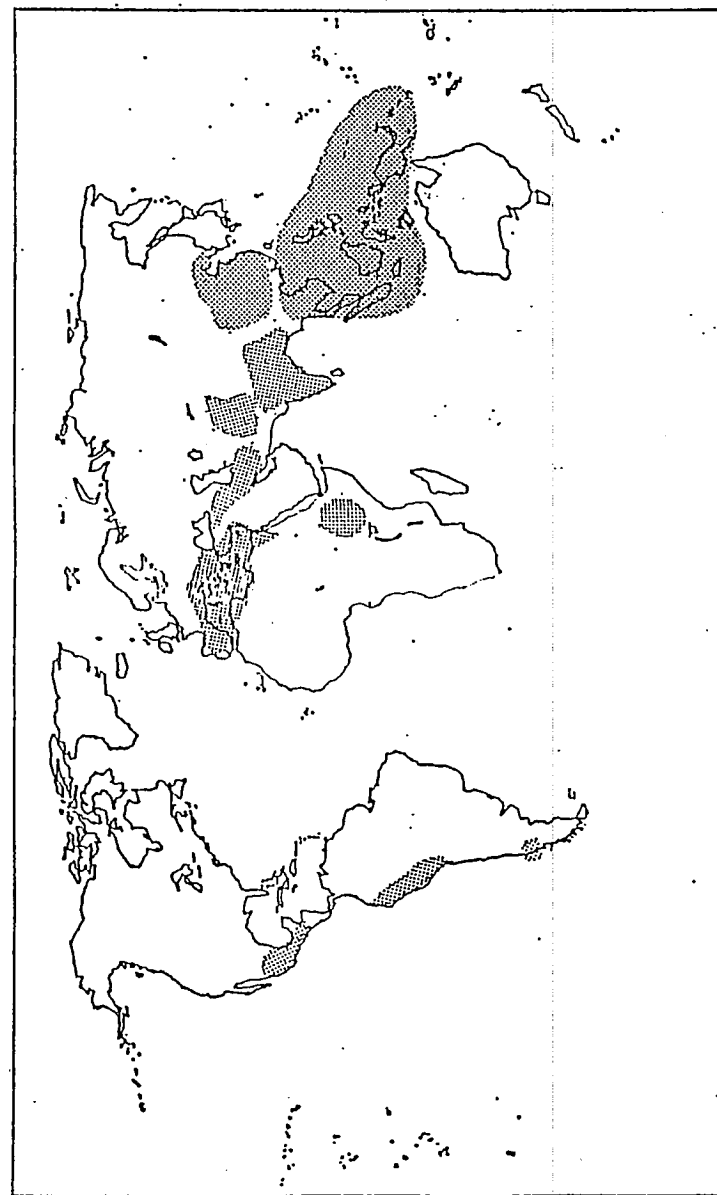


FIGURE 1: Vavilov Centers of Plant Genetic Diversity

extent of plant genetic diversity. The boundaries of our regions are indicated in Figure 2. We then selected the twenty food crops and twenty industrial crops that lead global production in tonnage and identified their respective regions of diversity.* This information is also provided in Figure 2.

It is clear from Figure 2 that the regions containing all of the advanced industrial nations except Japan are the source of few of the world's leading crops. The Australian region has contributed none of the top forty crops, North America only the sunflower, the Euro-Siberian region only oats and rye. Besides the sunflower the complement of crops indigenous to the United States includes the blueberry, the cranberry, the Jerusalem artichoke, and the pecan. An "All-American" meal would be somewhat limited. Northern Europe's contribution to the global larder is only slightly less meager: currants and raspberries in addition to oats and rye. The

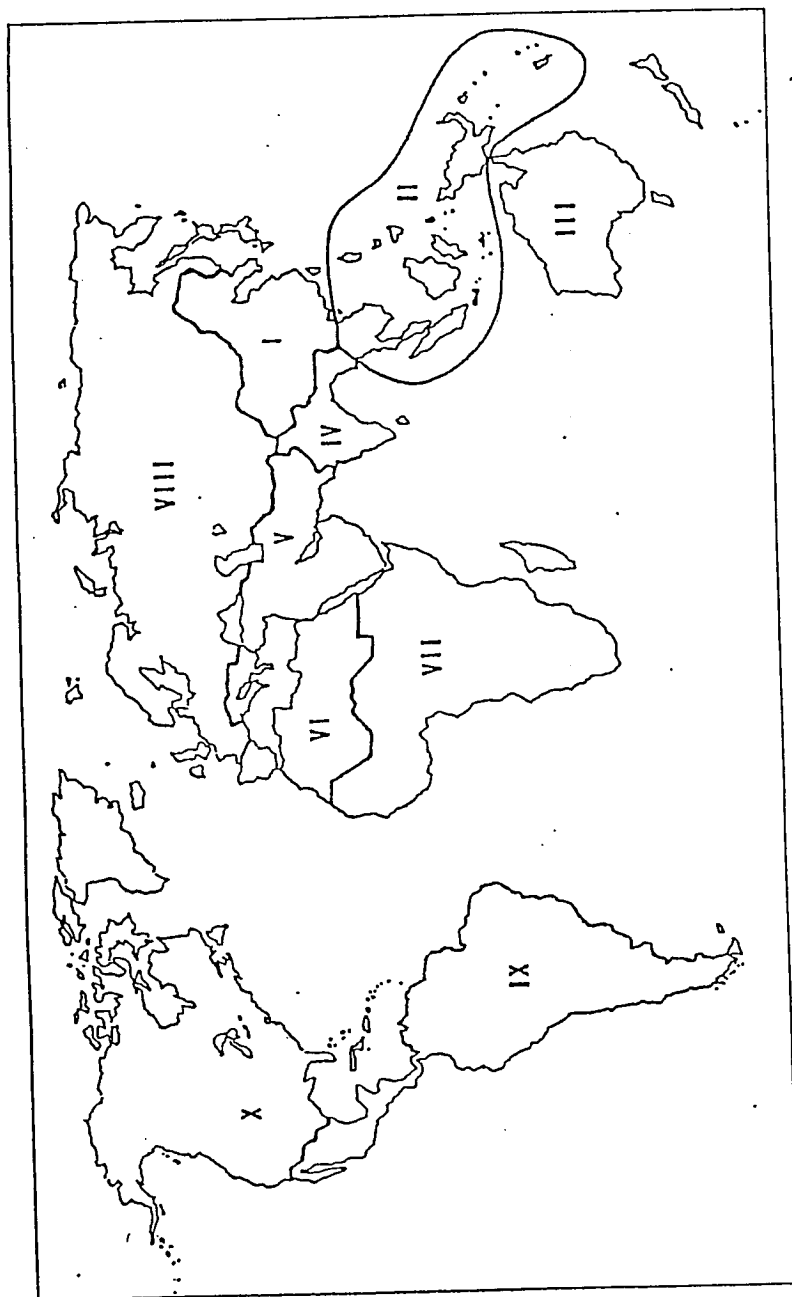
*Our source of data is the Food and Agriculture Organizations's 1983 *Production Yearbook* (Rome: FAO, 1984). We distinguish between food and industrial crops in order to capture an elusive but meaningful distinction. We define food crops as those that feed people more or less directly and are frequently grown by subsistence farmers around the world. Industrial crops are those that feed people indirectly after industrial processing, are often grown on plantations or large-scale forms, or are grown and processed for non-food purposes.

LEGEND FOR FIGURE 2 (facing page)

| | | |
|-------------------|--------------------|---------------------|
| I. CHINO-JAPANESE | V. WEST CENTRAL | VIII. EURO-SIBERIAN |
| soybeans | ASIATIC | oats |
| oranges | wheat | rye |
| rice | barley | |
| tea* | grapes | IX. LATIN AMERICAN |
| | apples | maize |
| II. INDOCHINESE | linseed* | potato |
| banana | sesame* | sweet potato |
| coconut (copra)* | flax* | cocoa* |
| coconut | | cassava |
| yam | vi. MEDITERRANEAN | tomato |
| rice | sugar beet* | cotton (lint)* |
| sugar cane* | cabbage | cottonseed (oil)* |
| | rapeseed* | seed cotton (meal)* |
| III. AUSTRALIAN | olive* | tobacco* |
| none | | rubber* |
| IV. HINDUSTANEAN | VII. AFRICAN | X. NORTH AMERICAN |
| jute* | oil palm (oil)* | sunflower* |
| rice | oil palm (kernel)* | |
| | sorghum | |
| | millet | |
| | coffee* | |

*industrial crops

FIGURE 2: Regions of Genetic Diversity and Their Associated Crops (legend on facing page)



crops that dominate the agricultural economies of the North—corn, wheat, soybeans, and potatoes—are not indigenous species at all. Rather, they have been introduced from elsewhere, principally from the South. Necessarily, then, the development of the rich but “gene-poor” nations of the North has been predicated on transfers of plant genetic resources from the poor but “gene-rich” nations of the South. The historical process by which this has occurred provides an important context for the current controversy.

Germplasm Appropriation

THE SPREAD OF CULTIVATED PLANTS to new areas has been a constant feature of human history. But such processes were long characterized by slow extensions at the margins of ecological adaptation. By 1300 Europe had added barley, wheat, alfalfa, and a variety of vegetables to its original complement of crops. But the discovery of the New World touched off a dramatic and unprecedentedly widespread movement of plant genetic resources. The emergence of an expansive mercantile capitalism committed to the global transformation of agricultural production had much to do with the rapidity and geographically extensive nature of this movement.

When Columbus returned from his voyage of exploration in 1493 he brought not only news of his discovery, but also maize seeds. The next year he was back in the New World carrying planting material for wheat, olives, chickpeas, onions, radishes, sugar cane, and citrus fruits with which he hoped to support a colony. Thus was initiated the great “Columbian Exchange”: maize, the common bean, potatoes, squash, sweet potatoes, cassava, and peanuts went east, while wheat, rye, oats, and Old World vegetables went west. Germplasm transfers of staple food crops were undertaken as a matter of course principally by sailors and settlers interested in subsistence production.

Maize and potatoes in particular had a profound impact on European diets. These crops produce more calories per unit of land than any other staple but cassava (another New World crop which spread quickly through tropical Africa). As such they were accepted, though often reluctantly, by a growing urban proletariat and by peasantries increasingly pressed by enclosures.⁵ It is too

much to say that European industrialization would have been impossible without maize and the potato, but it is certainly true that these new crops facilitated the emergence of industrial capitalism by greatly lowering the costs of reproducing a population that nearly doubled in the one hundred years after 1750.

The transfer of plant germplasm was directly as well as indirectly useful to capital. In addition to new food staples, the New World offered new crops of great medicinal and industrial significance such as cocoa, quinine, rubber, and tobacco. The Americas also provided new locales for the production of the tropical crops of Asia and Africa (spices, bananas, tea, coffee, sugar, indigo). While food-crop germplasm moved in all directions, the tropical nature of many plantation crops meant that their germplasm tended to move laterally, among colonial possessions, rather than from the colonial periphery to the imperial center. The banana, originally from Southeast Asia, was transferred to Central and South America as well as to the Caribbean and Africa. Coffee from Ethiopia made its way to the Caribbean, South and Central America, and Asia. Sugar cane from Southeast Asia was transferred to East, North, and Southern Africa as well as to Central and South America and the Caribbean.⁶

A nascent botanical science was called early on into the service of capital. In Britain, the establishment of the Royal Botanic Gardens at Kew in the eighteenth century was tied directly to the objectives of developing both colonial and domestic agriculture. Systematic, and sometimes illegal, efforts were made by Kew Garden botanists to collect plant materials and ascertain their commercial utility.⁷ The plant materials and knowledge acquired by Kew botanists was passed along to colonialists and proved crucial to the success of many plantation crops and plant-based industries. As the commercial value of plant products increased, germplasm was recognized as a resource of tremendous strategic importance. European governments went to great lengths to prevent their competitors from obtaining useful plant genetic materials. The Dutch, for example, destroyed all the nutmeg and clove trees in the Moluccas except those on the three islands where they had established plantations. And the French made export of indigo seed from Antigua a capital offense.

IN THE YOUNG UNITED STATES the need to collect both food and industrial-crop germplasm was particularly acute given the North American continent's relative genetic poverty.⁸ In 1819 the Secretary of the Treasury directed all consular and naval officers abroad to collect seeds and plants that might be useful to American agriculture. The military played a pivotal role in this "primitive accumulation" of germplasm. As one nineteenth-century botanist observed, "As long as our troops are there, science may as well profit by them."⁹ Thus it was that Admiral Perry's gunboats not only opened the harbors of Japan to American commerce, they also brought back rice, soybean, vegetable, and citrus seeds and cuttings.

By 1878, germplasm collection activity accounted for one third of the Department of Agriculture's (USDA) annual budget. The government distributed much of the collected material to American farmers who provided a testing ground and ultimately created the genetic base upon which industrial capitalism could be founded. With the creation of the Plant Introduction Office in 1898, the USDA formally institutionalized the global collection of plant genetic material. In what has been called the "Golden Age of Plant Hunting," the first third of the twentieth century saw some fifty USDA-sponsored expeditions scour the world in search of useful new plant types.¹⁰

Such germplasm collection efforts on the part of the advanced industrial nations of the North have continued, indeed even accelerated, up to the present time. Although North American and European powers had by 1900 appropriated the plant genetic material that enabled them to become the breadbaskets of the globe, achievement of agricultural hegemony has been genetically precarious. The germplasm transferred from the source areas of genetic diversity constituted only a small proportion of the total genetic variability available there. Although the plant breeders of the North have worked this material into extremely productive "elite" varieties, this process has further narrowed the genetic makeup of advanced industrial agriculture. The commercial plant cultivars developed in the North are high-performing but also exhibit "genetic uniformity" and consequently suffer from "genetic vulnerability."¹¹ Biological populations are dynamic and malleable entities. As pests and diseases mutate and as the environment changes, crop varieties are faced with new challenges to their

survival. Genetically narrow cultivars have, by definition, limited genetic capabilities with which to respond to such challenges.

THE CLASSIC ILLUSTRATION of the perils of genetic uniformity and vulnerability is the "Great Hunger" visited upon Ireland in 1846-1847 by the failure of the potato crop. Introduced from its Andean home in the early sixteenth century, the potato quickly became the staple food of the Irish peasantry. But the entire stock of potatoes planted in Ireland was derived from only a few closely related Andean varieties. And because potatoes are clonally propagated (that is, by cuttings of tubers rather than by seed from a sexual cross) the millions and millions of individual potato plants were genetically almost identical. When, in 1845, a blight appeared to which the Irish strains were susceptible, the entire crop of genetically homogeneous plants was lost. Over one million people died and at least twice that many emigrated.*

Less devastating but more recent examples of the possible consequences of genetic uniformity can be drawn from American agricultural history. During the early 1940s, derivative lines of the variety "Victoria" were sown on nearly all the land planted to oats. But in 1946, a new disease termed "Victoria blight" attacked all those lines and caused major losses. Similarly, wheat farmers experienced widespread crop failure during the wheat stem rust epidemic of 1954. Most recently, in 1970 a new form of southern corn leaf blight attacked a cytoplasmic character carried by more than ninety per cent of all corn plants in the United States. The one-billion-dollar loss associated with the ravages of this disease focused attention on the issue of genetic diversity. A subsequent National Academy of Sciences study found American crops to be "impressively uniform genetically and impressively vulnerable."¹²

*Most published references to the role of genetic uniformity in the Irish potato famine commonly subscribe, at least implicitly, to a kind of natural determinism: biological factors caused the famine. As sociologists, we want to emphatically and explicitly reject this notion. English landlords put most of their Irish lands in wheat and flax for the export market. The landlords permitted their tenants to work only very small plots for their own needs. Since the potato yields more per unit of land than any other temperate crop, Irish tenants came to depend almost exclusively on that crop for their survival. When the potato failed, they died. That they died is less a function of plant biology than of the social relations of production. Given better access to land and the capacity to grow a greater variety of crops, the potato failure would not have produced famine.

In order to maintain productivity in the face of such vulnerability, plant breeders must continually incorporate new genes into elite cultivars in what has been aptly termed a "varietal relay race" that maintains a steady flow of lines into and out of production.¹³ The source of many of these genes is the lower-yielding but genetically variable land races and other materials that are located in regions of diversity in the third world. Since World War II, the nations of the advanced industrial North have been collecting germplasm not for the purpose of adding new species or new varieties to their agricultures, but to accumulate material from which specific genetic characters may be extracted for incorporation into existing cultivars as they are rendered vulnerable by the changing nature of pests, disease, and environmental factors. In order to store these materials, they have constructed "gene banks" in which germplasm can be preserved at very low temperatures for long periods.

To fill these banks, the plant scientists of the North have continued to undertake expeditions to the South. In addition, military activities have once again provided opportunities for the appropriation of germplasm in foreign lands. For example, the dwarfing stock for contemporary peach varieties was brought to the United States from China by an American flyer returning from World War II. The wheat germplasm containing the famous Norin 10 dwarfing gene was sent to the United States from Japan in 1946 by an agricultural adviser working with the Army of Occupation.¹⁴ And University of New Hampshire plant breeder Elwyn Meader noticed a gynoeious (all female flowers) cucumber plant while serving as horticulturist for the U.S. Army Command in Korea. It was this germplasm that made possible the development of hybrid cucumbers.

FOREIGN ASSISTANCE PROGRAMS have also provided a useful institutional framework for germplasm collection. While the nature of the Green Revolution as a moment in the self-expansion of capital is well documented,¹⁵ the reciprocal impact that the Green Revolution has had on the advanced industrial nations has been less well recognized. The research centers established by the Consultative Group on International Agricultural Research (CGIAR) have been not only mechanisms for encouraging capitalist development in the third-world countryside, but also vehicles for the efficient extraction of plant genetic resources from the third

world and their transfer to the gene banks of Europe, North America, and Japan. For example, a University of Wisconsin horticulturist has recently developed strains of dry beans capable of supplying up to sixty per cent of their own nitrogen needs. As a result, bean growers in the United States may be able to reduce fertilizer applications by half. The seed samples from which these lines were developed were obtained from the International Center of Tropical Agriculture (CIAT) in Cali, Colombia, which had collected them in Central and South America.¹⁶ It is not happenstance that the CGIAR institutions are located in the Vavilov centers of genetic diversity.

Infusions of genes obtained from the third world in these various ways have been crucial in maintaining and increasing the productivity and value of the crops grown in the advanced industrial nations. Annual returns on the incorporation of exotic germplasm into commercial cultivars are difficult to assess, but are thought to be very high. For instance, a Turkish land race of wheat supplied American varieties with genes for resistance to stripe rust disease. This contribution alone is estimated to have been worth \$50 million per year to the United States. The Indian selection that provided American sorghums with resistance to greenbug has resulted in \$12 million in yearly benefits to American agriculture. And an Ethiopian gene protects the American barley crop from yellow dwarf disease to the amount of \$150 million per annum. The value to the American tomato industry of genes from Peru which permitted an increase in the soluble content of the fruit is reported to be \$5 million per annum.¹⁷ It is no exaggeration to say that the plant genetic resources received as free goods from the third world have been worth untold *billions* of dollars to the advanced industrial nations.

Contemporary Plant Genetic Dependence and Interdependence

HISTORICAL PROCESSES of appropriation and transfer of plant genetic resources have directly shaped contemporary patterns of the distribution of the crops now produced throughout the world. Inter- and intra-hemispheric transfers of germplasm have created a world in which domestic agricultures are often based on, and continue to benefit from, genetic materials with origins well beyond domestic borders. Any assessment of the political econ-

omy of plant genetic resources must take into account this "genetic geography." Our melding of regions of genetic diversity with political boundaries, as illustrated in Figure 2, permits us to address the question of the plant genetic contributions and debts of particular geopolitical entities in an empirical fashion.¹⁸

Using production statistics from the FAO's 1983 *Production Yearbook*, we calculated two types of measures for each of the ten regions of genetic diversity specified in Figure 2. First, we calculated the proportion of global production of the leading crops that is accounted for by species for which each region is the locus of genetic diversity. This figure, expressed as a percentage, is a measure of the *genetic contribution* of each region to world agriculture.

Second, for each region we calculated the proportion of production in that region accounted for by species introduced from the other regions of diversity. This figure, also expressed as a percentage, is a measure of the *genetic debt* owed by each region to the others. Moreover, to the extent that plant-breeding improvement in any crop depends on continued access to the genetic resources in that crop's region of diversity, this measure provides an index of what can be termed the plant genetic "dependence" of a region on non-indigenous sources of genetic diversity.

We performed these calculations for the twenty leading food crops and for the twenty leading industrial crops.* The results of these calculations are displayed in Figures 3 and 4.

The most general conclusion to be drawn from Figures 3 and 4 is that, in plant genetic terms, the world is strikingly interdependent. With regard to food crops, only three (Indochinese, Hindustanean, West Central Asiatic) of the ten regions defined in this study have indices of dependence less than 50 per cent. With reference to industrial crops, only one region (Indochinese) shows a dependence index less than 70 per cent. The world's regional agricultures are characterized not by crop genetic self-sufficiency but by substantial, and often extreme, dependence on "introduced" genetic materials.

* Calculations for food crops are based on metric tons. However, because of the skewing introduced by tremendous differences in weight among some industrial crops (e.g., sugar cane and cotton), we calculated industrial crop figures on the basis of hectares in production rather than tonnage.

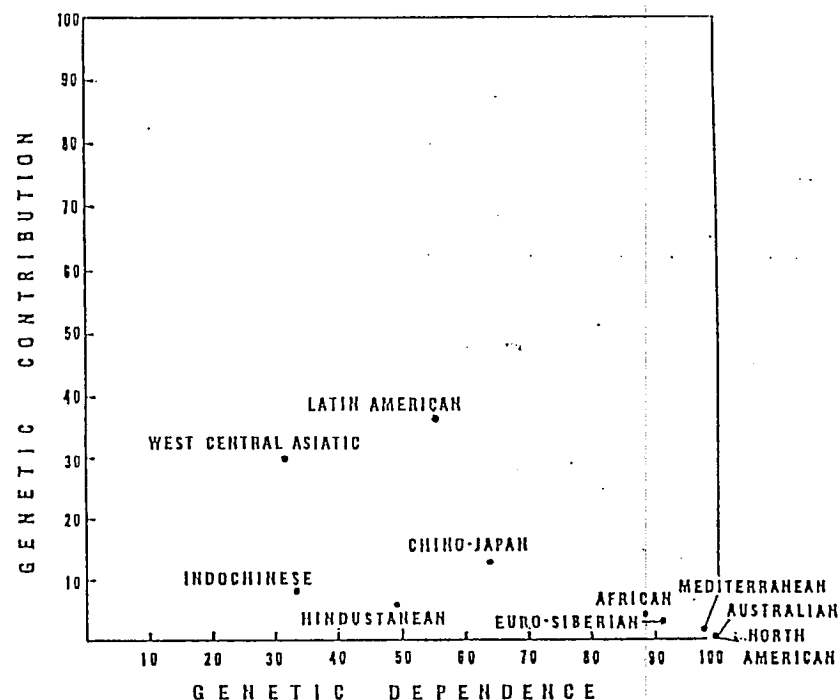


FIGURE 3: Plant Genetic Contribution and Dependence, Food Crops

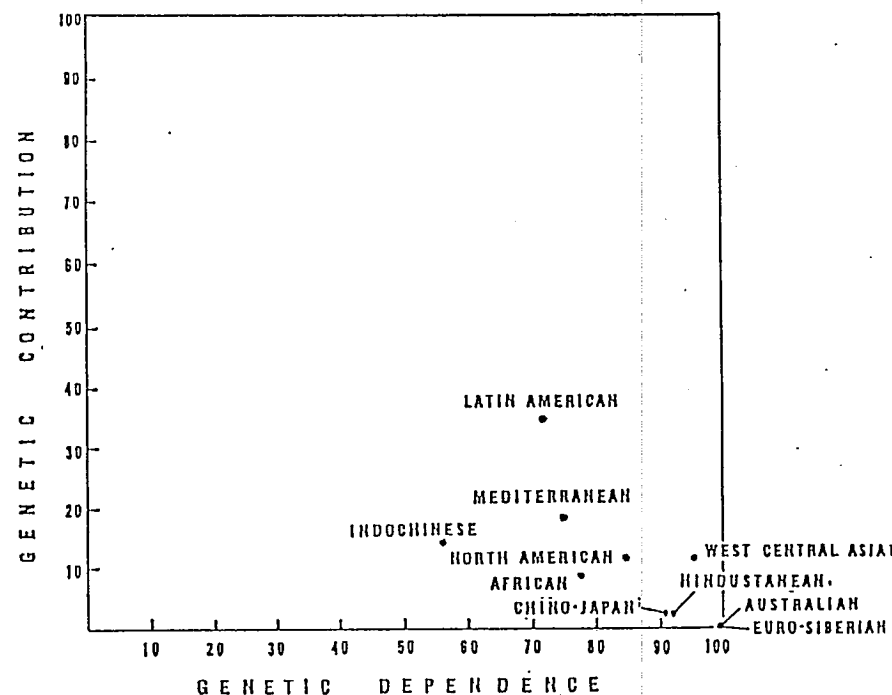


FIGURE 4: Plant Genetic Contribution and Dependence, Industrial Crops

THERE ARE IMPORTANT PATTERNS of variation within this broad structure of interdependence. Figure 3 shows three distinct clusters of points. The Latin American and West Central Asiatic regions have made particularly significant contributions to global food-crop production, and are also among the most genetically self-reliant of regions. A second cluster includes the Indochinese, Chino-Japanese, and Hindustanean regions. These share a moderate level of dependence and a lower, but significant, level of contribution to the crop genetic base of global agriculture. These five regions contain nearly all of the third-world nations (with the exception of African countries), and *they have provided the genetic material that undergirds fully 91.7 per cent of global production of food crops.*

The final set of points is associated with the regions that contain (with the exception of Japan) all of the world's advanced industrial nations. These regions are characterized by very high, even absolute, dependence indices and by minor, and even null, genetic contributions. Ironically, the agricultures of the advanced industrial breadbaskets of the world are almost completely based on plant genetic materials derived from other regions. At least in food crops, there is empirical justification for the characterization of the North as "rich, but gene poor," and the South as "poor, but gene rich." And the former has clearly benefited from the genetic largesse of the latter. While no single region can claim genetic self-reliance, and while the South is not uniformly "gene rich" (witness the case of Africa), a clear differentiation of North and South is apparent in Figure 3.

The data on industrial crops in Figure 4 reinforces our overall vision of a genetically interdependent world. The North-South relation characteristic of food crops still holds, but is weaker and involves a greater degree of regional and crop specificity. With 30.4 per cent of the world's industrial crop area devoted to descendants of Latin American origin, that region retains its position as the prime global donor of plant genetic material. But while the Australian and Euro-Siberian regions do not serve as the region of diversity for a single industrial crop, over 10 per cent of world industrial crop area is planted with the sunflower, a species indigenous to the North American region. An even higher 18.2 per cent of world industrial crop area is planted in varieties originally from the Mediterranean region. And in general, regional contributions

of industrial crops are more evenly distributed than is the case with food species.

More detailed calculations of inter-regional relations show that it is the interdependence of regions *within* each hemisphere, not the relation between the developed and underdeveloped regions, that is the important feature in the global patterns of industrial crop production. For instance, over a third of Mediterranean industrial crop land is planted in North American sunflower. Similarly, nearly a third of North American industrial crop hectareage is planted in crops of Mediterranean origin such as the sugar beet and the olive.

In the South, as in the North, intra-hemispheric relationships are most significant. These patterns are in large measure the product of lateral transfers of germplasm that occurred during the colonial era. Over 50 per cent of the industrial crop hectareage in Latin America, for instance, is accounted for by sugar cane (30.4 per cent) which originated in the Indochinese region and by coffee (25.7 per cent) which originated in Africa. And despite the fact that over 35 per cent of world industrial crop hectareage is planted in crops of Latin American origin, less than 30 per cent of Latin American hectareage is planted in indigenous species.

Genesis of the Controversy

IT WOULD BE ONE THING if these patterns of genetic contribution and debt were only of historical interest. But, as we have seen, the transfer of plant genetic material remains a vital component of contemporary agricultural advance. Genetic diversity is the raw material not only of evolution but of the plant breeder who is charged with maintaining and improving crop varieties. And as the crops of the industrial North are threatened by the appearance of new pests and diseases, plant scientists must look to the reservoirs of genetic diversity in the South, to the "primitive" varieties of third-world peasants, for the genes that will allow them to breed resistance into the productive but vulnerable "elite" varieties of modern high-tech agriculture.

By "plant genetic resources," plant scientists have conventionally meant primitive cultivars, land races, and wild and weedy relatives of crop plants. Such materials have long been objects of collection and have been appropriated principally from the South

for preservation in gene banks and for use in plant breeding programs.¹⁹ Despite their tremendous utility, such materials have been obtained free of charge as the "common heritage," and therefore common good, of humanity. On the other hand, the elite cultivars developed by the commercial seed industries of the North are accorded the status of private property. They are commodities obtainable by purchase. A number of factors have combined to galvanize the emergence of global political conflict around this apparent asymmetry.

Over the last fifteen years there has been a growing awareness that global process of industrial and agricultural development have often resulted in substantial environmental externalities. One of the most serious of these has been the accelerating destruction of biological diversity. The most visible and well-publicized example of such biological impoverishment is the destruction of tropical rainforests by timber and mining companies and by mega-projects such as the Trans-Am highway or the Jari paper plant in Brazil. General concern over the broad problem of biological destruction helped focus attention on the question of plant genetic resources in particular.²⁰

It is now recognized that one of the consequences of the Green Revolution has been the gradual displacement of the traditional land races upon which the development of high-yielding Green Revolution varieties has been based.²¹ The 1970 corn blight epidemic in the United States brought the consequences of this genetic erosion home to the developed nations. It became clear that the preservation or loss of genetic diversity in the third world had material consequences for the advanced industrial nations since what is being lost is the raw material out of which responses to future pest and pathogen challenges to genetically uniform and vulnerable crop varieties must be fashioned.²² And a principal rationale for developed-nation support for biological conservation in the third world is the potential utility and economic value of the genetic resources located there, a point that has not been lost on developing nations.

PROCESSES OF CONCENTRATION and internationalization in the seed industry have also proved to be catalysts for the emergence of the current controversy. Since 1970, a wave of mergers and acquisitions which has still not run its course has swept virtually every American or European seed company of any size or

significance into the corporate folds of the world's industrial elite. Many of the acquisitions have been made by transnational petrochemical and pharmaceutical firms with substantial agrichemical interests. The seedsmen of today are the Monsanto, ICIs, Pfizers, Upjohns, Ciba-Geigys, Shells, and ARCOs of the world. And these companies have marketing ambitions for their seed subsidiaries that match that global character of their other product lines. In order to facilitate creation of a world market for seed, these companies have sought global extension of a legal framework that would give them proprietary rights to the new seed varieties they are developing for sale. Controversy over the institution of plant breeders' rights legislation in both developed and developing nations necessarily entailed consideration of the commercial value of the various forms of plant germplasm.

Attention to questions of value and property rights in germplasm have been further emphasized by the emergence of the cluster of new genetic technologies commonly referred to as "biotechnology." Germplasm is the fundamental raw material of the genetic engineer, and as Winston Brill of the American biotechnology firm Agracetus has observed, with the development of such techniques as recombinant DNA transfer and protoplast fusion, "genetic wealth... until now a relatively inaccessible trust fund, is becoming a currency with high immediate value."²³ Indeed, the value of plant genetic material has been recognized by the United States Board of Patent Appeals which, following the logic of the Supreme Court's decision in *Diamond v. Chakrabarty* in 1985 found plants to be patentable subject matter.²⁴

As the transformed seed industry pushed for the recognition of the monetary value and proprietary status of "elite" cultivars, plant germplasm as "common heritage" was brought into unambiguous and contradictory juxtaposition with plant germplasm as a commodity. Global patterns of germplasm exchange came to seem doubly inequitable to some third-world observers since the commercial varieties purveyed by the seed trade have been developed out of germplasm initially obtained freely from the third world. Sudan, the source of the germplasm out of which many American varieties have been developed, is offered the latest Funk Seeds sorghum hybrid (packaged with parent company Ciba-Geigy's herbicides) in exchange for its genetic largesse. Whereas germplasm flows out of the South as the "common heritage of mankind," it returns as a commodity.

AS A RESULT of this constellation of factors, there was by 1980 a growing unease with the global germplasm system among some third-world politicians, diplomats, and scientists. That this unease found political expression is due in large measure to the activities of environmental, consumer, and other activist groups opposed to plant breeders' rights legislation and concerned about the consequences of genetic erosion and of growing concentration in the seed industry.* Such organizations focused their lobbying efforts on the United Nations system, and especially the FAO. This strategic choice facilitated the emergence of "seed wars" as a North-South issue and probably forestalled a more narrowly nationalist approach to the issues of control over plant genetic resources.

Third-world resentment and disaffection with the international "genetic order," informed and encouraged by the activities of activist groups, culminated in political action at the FAO. This action took concrete form in Resolution 8/83 which mandated the inclusion of the elite and proprietary varieties of the North under the rubric of mankind's common heritage in plant genetic resources. This enlarged conception of what constitutes common heritage is opposed by those nations with highly developed private seed industries, which are engaged in breeding proprietary crop varieties for commercial sale. Australia, Canada, and the United States have indicated that they will not adhere to the Undertaking, and Belgium, Denmark, Finland, France, the Federal Republic of Germany, Ireland, Israel, the Netherlands, New Zealand, Norway, Sweden, and the United Kingdom have agreed to do so only with restrictions. Conversely, virtually every non-aligned or third-world member-nation of the FAO that has provided an official response has expressed "support without restriction" for the Undertaking.²⁵

The unwillingness of the developed nations to give unqualified support to the Undertaking, and thus countenance the free exchange of commercial cultivars and advanced breeding lines, has

*Pat Roy Mooney's 1979 book *Seeds of the Earth: A Private or Public Resource* was widely distributed and was instrumental in focusing worldwide attention on the questions surrounding control of plant genetic resources. Among the public-interest groups and non-governmental organizations that have lobbied against plant breeders' rights and the inequities of contemporary plant germplasm exchange are the International Coalition for Development Action, Rural Development Fund, Friends of the Earth, International Organization of Consumers Unions, Pesticide Action Network, and a variety of other groups.

angered militant third-world countries. Some nations have gone so far as to suggest that, in the absence of free exchange of all genetic resources, no germplasm should be exchanged freely. There has been talk of a "Genetic OPEC." In fact, several nations have already closed their borders to the export of plant germplasm.²⁶ And in the almost four years since the passage of the Undertaking, movement towards accommodation or agreement has been slow. The twenty-third biennial conference of the FAO and the first meeting of the Commission on Plant Genetic Resources (CPGR) set up by the FAO to implement the Undertaking concluded in 1985 with third-world and industrialized nations as far apart as ever.²⁷

The Politics of Common Heritage: North

THE CONTROVERSY TURNS, of course, upon the question of property. Politicians, scientists, and businessmen in the industrial North believe that the Undertaking "strikes at the heart of free enterprise and intellectual property rights," as a position paper of the American Seed Trade Association expresses it.²⁸ They argue that a legitimate distinction can be made between germplasm that is considered common heritage and germplasm that is considered a commodity. There are four principal arguments made to justify the appropriation of certain categories of plant genetic resources as a common good.

First, it is asserted that "raw" germplasm cannot be given a price because of the indeterminacy associated with the usefulness of any particular germplasm accession. For example, the chairman emeritus of the leading American seed company, Pioneer Hi-Bred, asserts that "collections of so-called 'exotic' germplasm may and often do contain useful genes, but until the accession is evaluated and its traits identified, it is an unknown quantity" and cannot be priced.²⁹ It is important to understand that the claim being made is not that wild relatives and land races of crop varieties have no utility. Indeed, even the American Seed Trade Association admits that "our national interests are dependent upon continued access to the world's germplasm."³⁰ The argument is not that the genetic materials collected in the third world have no *use-value*, but that this utility cannot and should not take on *exchange-value*.

When plant genetic resources are collected, there is no way of

knowing whether any of the genes contained in the sample will be of any use. Only after expensive and time-consuming evaluation and characterization of the materials does their use to current breeders become apparent. And as some traits may only become useful at some time in the future, it may be decades before their latent utility is revealed by changing conditions in agricultural production. Moreover, since genes from a variety of nations may be incorporated into a single cultivar, crediting the original supplier of a particular gene would require an impossibly large program of genetic monitoring. For these reasons, it is argued that "raw germplasm" simply cannot be priced.

It is true that genetic materials present the market with some unique problems in pricing. But the inability to set a price through the "natural" operation of the market is not in itself justification for failure to assign some sort of exchange-value to something with recognized utility. There are a variety of non-market strategies that could be used to establish compensation schedules for appropriation and use of raw genetic materials if there were a willingness to do so. And while there are technical problems associated with monitoring the movement of genes in breeding programs, private breeders are developing tools to provide "genetic fingerprinting" for the purpose of keeping track of their own patented genes. Market failure is an excuse, rather than a logical justification, for current practice.

A SECOND PRINCIPAL JUSTIFICATION for the position taken by the advanced capitalist nations is that "raw germplasm only becomes valuable after considerable investment of time and money, both in adapting exotic germplasm for use by applied plant breeders and in incorporating the germplasm into varieties useful to farmers."³¹ This argument relies implicitly on a labor theory of value. It is asserted that only the application of scientists' labor adds value to the natural gift of germplasm. But most plant genetic resources are not simply the gift of nature. Land races and primitive cultivars have been developed by peasant farmers; they are the product of human labor. Indeed, the prominent plant breeder Norman Simmonds has observed that "probably, the total genetic change achieved by farmers over the millennia was far greater than that achieved by the last hundred or two years of more systematic science-based effort."³² Nor is the labor contained in such materials only historical. Plant genetic diversity, which is the real

resource of interest, is even now produced and reproduced through the day-to-day activities of farmers throughout the world. Whatever the contribution of plant scientists, they are not the sole producers of utility in the seed and the unique status of commercial varieties as bearers of exchange value cannot be justified on that basis.

A third principal line of argument defends the appropriation of plant genetic resources as a public good by claiming that "collection [of germplasm] does not deprive a country of anything."³³ When plant collectors sample a population they acquire only a few pounds of seed or plant matter. The vast bulk of the material is left untouched and in place. Unlike the extraction of most natural resources, it is argued, the "mining" of plant germplasm results in no significant depletion of the resource itself. Moreover, collectors customarily deposit duplicates of the collected materials with agricultural officials of the country in which they are operating. If the donor nation is not giving up anything, if it is not losing any utility, why should it demand compensation?

That the logic behind such an argument is not immediately recognized as faulty is testimony to the unique characteristics of genetic information. With most natural resources (e.g., minerals, timber, fish) use-value is appropriated in direct proportion to the volume of the resource extracted. But with plant germplasm the entire utility of the whole is in the part, and this masks the magnitude of the transfer of use-value which is nevertheless occurring. The donor nation is not losing access to genetic information, but in supplying germplasm as a common good it is forgoing the opportunity to receive a reciprocal flow of benefits in return for its contribution—that is, it is forgoing the opportunity to charge a pure economic rent.

Moreover, the alienation of germplasm *can* ultimately result in damage to the economy of those nations that practice genetic largesse. Half a century ago, Hambidge and Bressman recognized that "from its rivals a nation may get the wheat germ plasm or the cotton germ plasm that enables it to supply its own needs or overwhelm those rivals in international trade."³⁴ A more sophisticated, contemporary version of this principle is found in efforts using new genetic technologies to produce tropical-plant products in fermentation vats in the advanced industrial nations rather than in the fields of the third world. Industrial plant tissue culture—the

growing of plant cells in a nutrient medium for the extraction of phyto-products—threatens to eliminate third-world markets for a wide variety of drugs, spices, flavors, dyes, and even such high-volume commodities as sugar, cocoa, and coffee. Thus it is highly misleading to suggest that nations which permit free appropriation of their germplasm suffer no loss of any kind.

Finally, it is often claimed that adherence to the Undertaking is precluded by existing law. The United States Department of State, for example, claims that “the FAO undertaking is inconsistent with plant breeders’ rights as protected by law in the United States and other nations that grant proprietary rights.”³⁵ The provisions of the FAO Undertaking that mandate the unrestricted exchange of “elite and current breeders’ lines” do in fact contradict established legal practice in many of the advanced capitalist nations. Those countries that are members of the International Union for the Protection of New Varieties of Plants (UPOV) have adopted national legislation expressly designed to provide proprietary rights in plant germplasm.* The United States’ Plant Variety Protection Act of 1970 is an example of such plant breeders’ rights legislation. Such laws would have to be rescinded or altered to allow for the operationalization of the concept of “common heritage” for all types of plant germplasm. But the mere existence of such laws does not in itself justify the differential treatment of peasant land races and elite commercial varieties. Law is a social creation, not an immutable reflection of the natural order.

The arguments put forward by the seed industry and representatives of the advanced capitalist nations to justify distinguishing some germplasm as exchange-value-less (and therefore free) common heritage and other germplasm as a valuable commodity and private property are baseless. That such a distinction exists has nothing to do with the essential character of the germplasm itself and everything to do with social history and political economy.

*Members of UPOV are: Belgium, Denmark, France, Federal Republic of Germany, Hungary, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, South Africa, Spain, Sweden, Switzerland, United Kingdom, and the United States of America.

The Politics of Common Heritage: South

THE NATIONS OF THE THIRD WORLD thus have legitimate grounds for demanding to have all types of plant germplasm treated similarly. Certainly they are justified in their pursuit of common heritage. But, given the contemporary structure of the world economy, is the designation of all plant genetic resources as freely available common property an appropriate strategy? If the objective of the nations of the South is the achievement of a truly “new international economic order,” we think not. While the concept of “common heritage” certainly has an intuitive appeal for progressives, the material consequences of the “decommodification” of all plant germplasm might, given the realities of the world capitalist economy, actually work to the detriment of the nations of the South.

Global acceptance of the principle of common heritage for all plant germplasm would actually alter existing patterns of plant genetic resource use and exchange very little. Equality of access to this particular natural resource does not necessarily imply equality in the distribution of benefits. Given the genetic vulnerability of their high-performing agricultures, the advanced capitalist nations have a greater need to utilize plant genetic diversity than do the countries of the third world. They also have a much greater financial and scientific capacity to do so. Formal institutionalization of common heritage will simply legitimate the differential abilities of North and South to appropriate, utilize, and benefit from plant genetic resources. Implementation of the principle of common heritage would not only allow the advanced capitalist nations to “mine” plant genetic resources with increasing intensity, it would also preclude donor nations from realizing any return benefit—financial or in-kind—from the extraction of the genetic information contained within their borders. Given the substantial economic benefits accruing to the use of plant genetic materials in crop improvement, these forgone rents are very large indeed.

Under a regime of common heritage the South would gain access to genetic material it previously has been unable to obtain. But is access to advanced breeding lines and other elite germplasm developed by commercial seed firms in the industrial North actually a benefit? Such lines are developed for use in industrialized, capital-intensive, energy-intensive agricultural production systems and will not be appropriate to the needs of the bulk of third-world

farmers. For example, does the Sudan really want access to a Funk Seed Co. sorghum line that, through recombinant DNA transfer, has had a bacterial gene added that provides resistance to a proprietary herbicide produced by Funk's corporate parent, the transnational agrichemical giant Ciba-Geigy Corporation? Access to the elite lines developed in the advanced capitalist nations might simply reinforce processes of social differentiation among peasant producers, facilitate the global elaboration of factor markets, accelerate environmental degradation, and deepen relations of technological dependence between North and South.

DESPITE THE DISADVANTAGES associated with implementation of common heritage, there is an important argument in favor of the principle. The FAO's Undertaking on Plant Genetic Resources does in fact constitute a direct challenge to private property and the commodity-form. The designation of proprietary breeding lines as common heritage would actually reverse the thrust of capitalist development. And though such an achievement may pose no immediate threat to capitalism in a global sense, a small challenge to the institution of private property sets an example and may provide a starting point for broader and more systematic opposition to the extension of capitalist social relations.

Yet, the desirability and ultimate effectiveness of such an unambiguously confrontational strategy is not entirely clear. What makes the Undertaking a challenge of unique potential is the broad support it has garnered among third-world nations and the more or less unified front they have so far posed to the advanced capitalist nations. Maintaining such unity is already difficult. The terms "third world" and "South" do not necessarily imply unanimity of interest on all matters. The developing nations are a very diverse set of countries with heterogeneous economic systems and ideological orientations. Few governments are socialist. Most are more or less committed to capitalism, even if of the dependent variety. All are committed to national development, and such considerations may outweigh what may be, for many nations, a provisional or conditional commitment to common heritage. At the 1985 biennial conference of the FAO, Mexico, India, Brazil, and Argentina expressed serious reservations regarding the Undertaking, and the representative of socialist Ethiopia declared that "the jurisdiction of all affairs relating to policy on genetic resources belongs to the country concerned," and that anyone desirous of gaining

access to plant genetic resources should "agree on a mode of acquisition with the proprietor."³⁶ It is by no means clear that the political will exists for a sustained international assault on private property in plant germplasm.

What is clear is that the elite and breeders' lines of private-sector seed companies are now private property and that capital intends to do all it can to ensure that they remain so. There is no indication that the advanced capitalist nations are willing to begin dismantling the institutional arrangements that confer proprietary rights to genetic information. Indeed, current developments are bearing in the opposite direction. The recent decision of the United States Board of Patent Appeals in *Ex parte Hibbard* has established the patentability of plant germplasm in the United States, and similar decisions will probably be forthcoming in Europe.³⁷ Given the uncertain unity of the South on the issue and the tenacity with which capitalist interests are likely to defend the sanctity of private property, the prospects for actually achieving common-heritage status for all types of plant germplasm are not bright.

On balance, the pursuit of common heritage is not a strategy likely to enhance the possibilities for improving the lives of most of the world's people. The South's demands are legitimate, but misplaced. It makes little sense to permit access to a vast storehouse of plant genetic diversity in exchange for access to genetically narrow lines of great technological sophistication but dubious utility. And, given the current realities of political-economic conditions, there is little probability that such access can be achieved. In any case, the real problem for the South is not access to the elite lines of the North, but establishing control over and realizing some benefit from the appropriation and utilization of its own resources. We believe that this requires a political strategy other than common heritage.

National Sovereignty as a Political Strategy

IRONICALLY, the FAO Undertaking on Plant Genetic Resources conflicts not only with "plant breeder's rights" legislation, but also with the right to "national sovereignty over natural resources" guaranteed by the United Nations itself.³⁸ Third-world nations have little to gain from quixotic pursuit of common heritage in plant genetic resources. But they have a great deal to gain through

international acceptance of the principle that plant genetic resources constitute a form of national property. Establishment of this principle would provide the basis for an international framework through which third-world nations could be compensated for the appropriation and use of their plant genetic information.

Codification of the status of plant genetic resources as national property has a clear basis in international law. Moreover, while capitalist interests are unalterably opposed to decommo- difying their breeding lines, there are indications that they would be willing to provide compensation for use of plant genetic resources.³⁹ An indication of this willingness is Occidental Petroleum's recent purchase of a collection of rice lines from China, and Zoecon Corporation's purchase of a set of soybean land races also from the Chinese. Even given the volume of materials already stored in their gene banks, the advanced capitalist nations still require fresh infusions of third-world germplasm. On the whole, the recognition of exchange-value in land races will prove more palatable for private companies than continued conflict and possible restrictions on the flow of what is, for them, an essential raw material. Unlike attempts to extend the concept of common heritage to cover elite germplasm, the principle of national sovereignty appears to provide the foundation for a politically viable solution to the controversy.

A NATIONAL PROPERTY INITIATIVE is by no means an ideal solution to the plant germplasm controversy. A principal problem with establishing a compensatory framework for plant genetic resources is that plant genetic resources are distributed unequally within the third world as well as between North and South.⁴⁰ For example, while Ethiopia possesses a tremendous amount of genetic diversity for economically important crops, the rest of sub-Saharan Africa is not so fortunate and the continent as a whole is as "genetically dependent" as are the regions containing the advanced industrial nations. With material recognition of the value embodied in plant germplasm, third-world nations might be tempted to charge each other, as well as the advanced industrial nations, for use of plant genetic information. In fact, this may already be happening.* But this does not imply that the institutionalization of national

*For example, "socialist" Ethiopia has restricted its germplasm exports, including coffee. At the 1983 FAO debate the representative of Trinidad and Tobago stated, "We would like to get some germplasm of a particular crop—

property in germplasm is strategically inappropriate. Rather, it points to the conflicting and contradictory pressures under which third-world nations operate in the international capitalist economy, and suggests that these same pressures would have reinforced the unworkability of an expanded definition of common heritage in plant genetic resources.

The extent to which such problems can be avoided will depend largely upon the manner in which compensation mechanisms are structured. Bilateral agreements will tend to produce a market for plant genetic information. A market-oriented approach may isolate third-world nations and press them into roles as competing suppliers of plant germplasm. A multilateral approach might avoid such competition and could be built upon the current willingness of most third-world nations to confront the issue of plant genetic resources as a North-South issue. The FAO's International Undertaking on Plant Genetic Resources appears to provide a useful institutional framework for preserving third-world unity on the matter.

Although mitigating the centrifugal pressures of nationalist interests will be difficult, there are some indications that arguments for a multilateral approach are not unrealistically utopian. The second meeting of the FAO's Commission on Plant Genetic Resources took place last March with some interesting developments. In an effort to break over three years of impasse over implementation of the Undertaking, the CPGR agreed that a "contact group" comprising representatives of both the developed and developing nations should be established. This contact group will explore the possibilities of a rapprochement, "on the basis of three principles: acceptance of free exchange of plant genetic resources; recognition of plant breeders' rights; and recognition of farmers' rights so as to acknowledge the work carried out by previous generations of cultivators."⁴¹ This straightforward mandate signals a major shift in the terrain of debate and embodies some far-reaching implications.

The principles are, *prima facie*, contradictory. Recognition of plant breeders' rights necessarily implies that at least some plant

coffee—and it is such an important issue that if, before I can leave this room, someone can come to me and promise delivery of such germplasm at a reasonable price, I would be very happy." Food and Agricultural Organization of the United Nations, "Transcript of the Twenty-Second Session," Document C8/11/PV/16, 1983, p. 7.

genetic resources—i.e., protected and patented varieties—will not be available for free exchange. Balancing this concession to the advanced industrial nations is the principle specifying that “farmers’ rights” will also be recognized. The CPGR coined the new concept of farmers’ rights expressly to parallel the established concept of plant breeders’ rights. Just as plant scientists are entitled to a reward for their labor in creating breeding lines and elite varieties, so farmers have a right to a reward for creating and maintaining land races and other “raw” plant genetic resources. Further, just as the reward for plant breeders is not moral but material, so should farmers be entitled to material reward for use of the fruits of their labor. In order to provide a mechanism for the realization of such reward, members of the CPGR noted that an “international fund could be a means to compensate farmer communities *through support to the countries concerned*” (emphasis added).⁴² Over the objections of some developed nations, a majority of CPGR members therefore requested the FAO’s director general to “take immediate action for the establishment of a fund to support an action programme for plant genetic resources.”⁴³

THE SEED WARRIORS are groping toward a new dispensation. At one level, the principles on which the contact group will base its negotiations reaffirm the standard commitment to free exchange: to common heritage. Yet this may be mere lip service. At another level, the principles appear to encompass a move toward more pragmatic perspectives: the practical abandonment of common heritage, acquiescence (at least at the current conjuncture) to the commodity status of elite lines and varieties, compensation for the use of other categories of germplasm, and national sovereignty over plant genetic resources.

We believe that such movement is, on balance, in an appropriate direction. Of course, many difficulties remain to be overcome. The question of farmers’ rights will be of pivotal importance. One of the next tasks of the CPGR is to sponsor a study that will give definition to the term. While FAO/CPGR documents seem to envision the indirect compensation of farmers through provision of benefits to national governments, the term “farmers’ rights” has potentially quite narrow connotations and seems a poor substitute for a straightforward declaration that genetic resources are national, social property. While farmers’ rights may provide a useful rhetorical foil to breeders’ rights, the parallel should not be over-

emphasized. A narrow interpretation of farmers’ rights could lead to personal property in plant genetic resources. Moreover, legitimating “rights” strictly on the basis of labor performed provides no rationale for requiring compensation for wild plant genetic resources the development and maintenance of which are not attributable to the activities of farmers.

Structuring some compensatory framework will require much negotiation and compromise, both within the third world and between the developing nations and the industrialized countries. Although the CPGR has requested that the FAO director general establish a fund for support of plant genetic resource activities, the creation of such a fund needs to be formally connected to farmers’ (or, preferably, national) rights. Moreover, the Commission now feels the fund should be voluntary,⁴⁴ which is to say it would be worse than no fund at all. Here, the parallel with breeders’ rights may be of use. Breeders do not accept voluntary compensation for their activities with germplasm, nor should farmers or nations. The objective of the initiative in FAO must be to achieve a real redistribution of the flow of benefits between North and South, not to gain mere verbal recognition of “rights.” Arrangements need to be made for the advanced industrial nations to make payments to the proposed fund in return for access to global collections of plant genetic materials collected and stored by national governments in cooperation with the FAO. The size of these payments could be determined by considering a number of factors such as size of national seed industry, value of national agricultural production, and frequency and size of drafts upon the FAO’s network of cooperating gene banks.

Realization of an effective “International Plant Gene Fund” of this type will require a high degree of cooperation among the nations of the South. Countries relatively rich in plant genetic resources will be tempted to capitalize on their advantage. One way of reducing such temptation would be to negotiate with the North not for cash compensation, but for scientific assistance and technology transfer in support of plant genetic conservation, construction of gene banks, and the training of plant breeders in the FAO system. Real control of genetic information is knowing what it is and how it can be used, and it is in these areas that most developing nations are sorely deficient. Such an arrangement also has the advantage of placing the determination of compensation in a political rather than market setting. This provides the basis for

"noncommodified" political struggle which is not necessarily reproductive of capitalist social relations.⁴⁵ Avoidance of the market mechanism mitigates the centrifugal forces that tend to separate competing suppliers of a good, and avoids implicit acceptance of the necessity of markets for structuring access to resources. In the absence of cooperation among developing nations, international stratification will be exacerbated rather than reduced as nations poor in germplasm find themselves at an additional disadvantage in a world economy in which genetic information is becoming a strategic resource. While they provide no fully adequate model for managing the exchange of plant genetic resources, a variety of existing international arrangements, from commodity agreements to the Law of the Sea treaty, provide evidence that multilateral arrangements can be constructed.⁴⁶

Conclusion

THE ADVANCED CAPITALIST NATIONS will not passively accept the extension of common heritage to corporate breeding lines. At this particular historical juncture, it makes no sense for third-world nations to continue to pursue acceptance of FAO resolution 3/83 as long as the Undertaking's principal *raison d'être* is the achievement of common heritage. There are serious problems involved in recognizing the applicability of national sovereignty to plant genetic resources, and abandoning the traditional principle of "common heritage" with which they have been so long associated. Failing this, however, the advanced capitalist nations will be able to continue the free and uncompensated appropriation of a third-world resource that will be of increasing utility as the world economy moves toward a new regime of production that uses genetic information as its essential raw material.

The current impasse benefits no one and threatens the world's food supply. National sovereignty, not common heritage, supplies the potential solution to the current geopolitical deadlock. It provides a viable means by which the current conflict can be resolved in a manner that enhances the position of the nations and peoples of the third world.

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