

BIOTECHNOLOGY AND GLOBAL JUSTICE

Tony Smith

Department of Philosophy

443 Catt Hall

Iowa State University

Ames, Iowa 50011

U.S.A.

Agricultural biotechnology is a social pursuit, undertaken by social agents within social institutions.¹ Any attempt to explore the social dimensions of a profound and complex technological development such as biotechnology is bound to be controversial, and any attempt to formulate an ethical assessment of such a development is bound to be yet more complex and controversial. This surely explains why many choose to ignore these inquiries. But the social dimensions of biotechnology are just as real as viruses, bacteria, enzymes, and cells. To refuse to investigate them with the same seriousness that viruses, bacteria, enzymes and cells are investigated is to place an arbitrary restriction on the scope of rational inquiry.

In this paper I shall explore two questions regarding agricultural biotechnology, one descriptive and one evaluative. What role is agricultural biotechnology likely to play in globalization? And is the diffusion of ag biotech likely to move us closer to a just global order? Before we can consider such questions, however, we must come to an understanding and assessment of globalization. Unfortunately, this too is an immensely complicated and controversial topic. In order to make things a bit more manageable I shall drastically oversimplify matters, restricting the debate to just two competing accounts of globalization. The first of these accounts, termed “neoliberalism,” is familiar, consisting of a set of ideas circulating constantly in the business press, trade publications, the popular media, and mainstream academic discourse. Its main conclusion in the present context is reassuring: social mechanisms are in place to ensure that global justice is more or less automatically furthered by the diffusion of agricultural biotechnology. The second perspective, which I shall term the “heterodox” or “critical” perspective, is in contrast relatively unfamiliar. It leads to the disturbing conclusion that under present circumstances the rational development

of biotechnology may contribute to results that are irrational from a social and ethical perspective.

THE NEOLIBERAL PERSPECTIVE ON GLOBALIZATION

The term “globalization” will be used here to refer to four interconnected phenomena: the tremendous increase in the velocity and scale of money flowing through global circuits of financial capital; the extension of production chains across national borders through subcontracting; foreign direct investment in enterprises; and the increasing flows of goods and services in cross-border trade. For neoliberals all four developments are unequivocally positive, and public policies furthering them ought to be pursued as vigorously as possible. Free trade agreements thus ought to be negotiated that dismantle restrictions on the free mobility of capital, including both tariff and non-tariff trade barriers and prohibitions on foreign ownership. International bodies also ought to be established with the power to ensure that all investors are granted the same legal protections whatever their nation of origin, and that intellectual property rights are respected throughout the global economy.

“Ought” statements like these are, of course, normative judgements. Since one cannot legitimately jump from an “is” to an “ought,” neoliberals must appeal (implicitly or explicitly) to normative principles in order to derive these normative conclusions. Two different sorts of normative principles are usually invoked.

The first principle, associated with the Kantian tradition of ethical theory, can be stated as follows: We must respect other subjects as autonomous “ends in themselves.” For neoliberals, respecting the moral autonomy of others requires acknowledging that they have various rights to liberty, and that the legitimate exercise of these rights must be institutionally protected. Investor rights and consumer rights are two important subspecies of liberty rights. *Prima facie*, at

least, investors ought to have the freedom to decide for themselves what sorts of risks they wish to accept when allocating their funds. And consumers ought to be able to choose for themselves which commodities best satisfy their wants and needs. Public policies that restrict the flow of capital and commodities across borders thus infringe the liberty of both foreign investors and the state's own citizens. To remove such restrictions is to move closer to a more just economic global order. While there may be short and even medium-term social disruptions as a result of this economic globalization, they are a necessary price that must be paid for the extension of freedom.

A second normative principle implicit in many neoliberal arguments is associated with utilitarian ethics: We ought to further the good of society as a whole. Calculating the costs and benefits of possible public policies, and then instituting the particular policy most likely to bring about the greatest net gain in benefits can do this. For neoliberals, market mechanisms are uniquely capable of actualizing this principle. Since globalization is a process whereby market mechanisms are increasingly allowed to operate on the international level, it follows that globalization ought to be affirmed and extended.

There is both a positive and a negative justification for the claim that market mechanisms are uniquely capable of insitutionalizing the social good. The positive reason stems from Adam Smith. For Smith, economic agents in the market are generally motivated by private self-interest; few consciously intend to further the good of society as a whole in their actions. The logic of market competition, however, is like an "invisible hand" operating behind the backs of these agents, bringing about precisely this result. It is in the good of society as a whole, for example, to have the wants and needs of individuals satisfied as efficiently as possible. The logic of market competition necessarily pushes in this direction, since

producers know that if their output does not correspond to consumers' wants and needs, or if their products are expensive and of low quality, they will tend to lose market share. Thus the pursuit of private self-interest leads producers to introduce product and process innovations tending to further the general good.

The second, negative, utilitarian argument for neoliberalism is that extensive government interference in economic life is likely to harm the public good. For neoliberals a paradigmatic case illustrating this point is the attempt by government bureaucrats to restrict the free mobility of capital across borders. Such restrictions may allow some local elites to flourish, as the enterprises they own are shielded from international competition. But whatever short-term successes this relatively small group may enjoy, they come at tremendous social cost. Corruption and nepotism ("crony capitalism") run rampant, local industries fall behind rapidly moving technological frontiers, and consumers are forced to purchase second-rate goods and services rather than state-of-the-art products.

This distrust of governments does not mean that neoliberals are all libertarians. Many hold that governments have a number of necessary roles to play in the innovation process, including funding basic research, training scientific-technical labor, setting certain technical standards, and so on. Nonetheless, neoliberals insist that governments should interfere as little as possible with the investment decisions that ultimately determine the direction and pace of technological development. If profound negative consequences are to be avoided, these decisions should be left to individuals in the market.

Neoliberals do not hold that the global economy will become a vast homogeneous space. Regional specialization will continue in various sectors. Nor do neoliberals hold that the mutual benefits from trade are always and everywhere divided equally. However, they do expect that the erosion of barriers to capital

investment and the eradication of crony capitalism will bring about a world where economic opportunities are spread more evenly over the planet. The sharp distinction between “the industrialized world” and “the non-industrialized world” will fade, as state-of-the-art technologies are employed in previously undeveloped regions of the globe. Laborers with specific skills in high demand will be able to attract favorable employment opportunities wherever they happen to be located. Living standards across the planet will diverge less and less, as previously closed economies enjoy a rapid rise in per capita living standards as a result of opening up to foreign trade and investment. Globalization will also bring about a greater “evenness” in consumption, as commodities from all regions of the world are likely to be available almost anywhere at almost any time.

AGRICULTURAL BIOTECHNOLOGY AND THE NEOLIBERAL VIEW

How does agricultural biotechnology fit into the neoliberal story? One interesting answer is provided by Robert Shapiro, the chairman and chief executive officer of Monsanto, in an article entitled “How Genetic Engineering Will Save Our Planet.” As the title of this article suggests, Shapiro bases his defense of agricultural biotechnology on the principle that the social good ought to be furthered on the global level.

Today there are almost six billion people on the planet, 800 million of whom are severely malnourished. In the next fifty years the population of the globe is expected to grow by several billion more. In Shapiro’s view, when all is said and done there are only three options available to humanity in response to this situation. The first is to stand by and let food shortages lead to the suffering of billions of fellow humans. The second option is to hold this “Malthusian process” at bay by devoting more land to food production and increasing agricultural productivity

through fertilizers, pesticides, and irrigation. This option, however, will also lead to catastrophe:

(C)urrent agricultural practice isn't sustainable. We've lost something on the order of 15% of our topsoil over the last 20 years, irrigation is increasing the salinity of soil, and the petrochemicals we rely on aren't renewable. Most arable land is already under cultivation. Attempts to create new farmland are causing severe ecological damage. So in the best case, we have the same amount of land to work with and billions more people to feed. (Shapiro, 1999:28)

The only acceptable alternative is to increase agricultural productivity in a sustainable fashion. Ag biotech can bring about this result, and this is why ag biotech "will save our planet." For example,

With biotechnology, we know how to genetically code a plant to repel or destroy harmful insects. This means we don't have to spray the plant with pesticides – with stuff. Up to 90% of what's sprayed on crops today is wasted. Most of it ends up on the soil. If we put the right genetic information in the plant at the outset, we waste less stuff and increase productivity. It's not that chemicals are inherently bad, but they are less efficient than biology because of the raw materials and energy it takes to make, distribute, and apply them. (Shapiro, 1999: 29).

For a neoliberal such as Shapiro, agricultural biotechnology provides a textbook case of how the invisible hand operates: the logic of market competition leads self-interested economic firms such as Monsanto to introduce innovations that further the social good by improving both the quality and the quantity of the food supply. Genetic engineering has the potential to lead to nutritious and high-yielding plants that can thrive in diverse environments throughout the globe (for instance, in

soils with high saline content or in near-drought conditions). We can also foresee the development of superproductive animals, able to provide high protein, low fat meat. Agricultural biotechnology thus holds the promise of a world in which agricultural productivity is able to keep pace with increases in population. For the leading spokespersons of agribusiness, this counts as a profound contribution to the social good. Biotechnology also will allow more people to enjoy the diverse diets previously restricted to a very small minority of the world's inhabitants. This too is surely a significant step towards a better global order.

It follows from this that the general prescriptions advocated by neoliberals apply with special force in this area. Governments ought to foster technological development and technological diffusion through the extension and enforcement of intellectual property rights in the biotechnology sector, since firms have a greater incentive to search for innovations the more they are able to appropriate the fruits of successful searches. Further, barriers to the export of agricultural commodities ought to be dismantled, since all countries can benefit when each region in the global economy concentrates on that part of agriculture where it holds a comparative advantage. If, for example, Mexican farmers cannot produce corn as efficiently as farms in the Midwest U.S., while growing conditions for specialty flowers and fruits are superior in parts of Mexico, then social rationality demands that Mexico open its borders to imports of corn, and that Mexican farmers be able to sell specialty flowers and fruits in the U.S. No one holds that free trade in agriculture can be extended across borders without any social disruptions. But such disruptions are the short-term price that must be paid for a long-term future of increased agricultural productivity on the global level. Any other policy would both fail to further the social good and infringe on the liberty of investors and consumers.

The set of ideas I have examined under the heading “neoliberalism” has become so much a part of our common sense that it requires a considerable stretch of imagination even to conceive an alternative account. That is the next task before us. We shall then be in a position to return to the question of the role of agricultural biotechnology in the global economy.

A HETERODOX VIEW OF GLOBALIZATION

In the neoliberal paradigm the market is a neutral site in which individuals exercise their rights and register their preferences. In the competing heterodox paradigm I wish to present now, the market is a site in which certain social groups are able to dominate others through the exercise of economic power. The basic features of the critical perspective can perhaps best be introduced by means of an analogy. Consider the relationship between Rome and its provinces during the Roman Empire, or the relationship between colonizing countries and colonized regions of the world in the so-called “age of imperialism” of the 19th and early 20th centuries. No one would deny that Rome dominated its provinces, or that colonizers dominated colonized areas. No one would deny that in both cases economic benefits were disproportionately concentrated in the “core” regions, where economic power was greatest, while economic burdens were disproportionately concentrated in the “periphery.” Globalization today works in an analogous fashion. There are serious and persistent inequalities between different regions, with the benefits of economic activity being disproportionately concentrated in the “core” parts of the global economy, and the costs of economic activity being disproportionately concentrated in the “periphery.”² Whether we examine economic output, flows of capital, flows of trade, or income distribution, the statistics present a composite picture of a world of “uneven development” comparable to that found in past empires and colonizations.

Today, 15% of the world's population is located in the wealthy countries of the North, yet 80% of economic output is produced there. In contrast, the South, with 85% of the globe's population, claims only 20% of economic output (Moody, 1997: 52). According to some measures this disparity is increasing. The OECD (Organization of Economic Development and Cooperation) nations produced 71% of aggregate gross domestic product in 1980. By 1994 the figure had increased to 80% (Moody, 1997: 56).

The figures regarding flows of capital are almost as striking. In the 1980's businesses in the North exported between 94 and 98% of all foreign direct investment, and received 80% of all foreign direct investment. In the first half of the 1990's, when FDI in countries of the periphery was at unprecedented heights, 70% of all FDI still remained in countries of the North (Moody, 1997: 56). In other words, globalization is much more a process of investment flows from rich countries to other rich countries than a matter of investment flows from the core to the periphery.

The statistics regarding flows of trade are fully consistent with this picture. 80% of the world's domestic sales occur in the core countries of the North. 75% of all exports end up in these regions. While only 20% of the world's population are located here, 86% of consumption in the global economy occurs in these sites of privilege (Elliott and Brittain, 1998: 19).

Finally, the distribution of income and wealth in the global economy is also profoundly uneven as well. In fact, the gap in per capita income between the richest and the poorest regions in the capitalist global system has worsened over time (Moody, 1997: 54):

1820: 3 to 1

1913: 9 to 1

1950: 11 to 1

1973: 12 to 1

1992: 16 to 1

Other figures reinforce this conclusion. In 1960 the richest 20% of the world appropriated 70% of global income, while the share of the poorest 20% was a mere 2.3%. By 1991 the richest 20% increased their claims to 85%, with the bottom 20% able to appropriate only 1.4% of global income. According to the 1998 United Nations Human Development Report, the 225 richest individuals in the world today have a combined wealth equal to that of the 2.5 billion people who make up the poorest 47% of the earth's population. The three richest individuals alone have assets exceeding the combined Gross Domestic Product of 48 nations (Elliott and Brittain, 1998: 19).

For neoliberals, if certain regions of the world have not enjoyed the benefits made possible by the global economy, local practices are to blame and institutional reforms are required. All vestiges of "crony capitalism" must be eliminated. Rules establishing transparency in accounting must be adopted. Investors throughout the globe must be assured that they will be treated fairly. Sufficient investments must be made in education and infrastructure. If these sorts of reforms are successfully undertaken, neoliberals argue, the efficiency of the market promises mutual benefits to all regions of the global economy.

For heterodox thinkers, in contrast, there are mechanisms built into the global market that systematically generate an unfair distribution of the benefits of economic activity in and of themselves. Six of these structural features of the global economy can be briefly sketched here.

1. *centralization of economic power*

In the standard neoliberal account, governmental officials, who possess the ability to coerce others through laws and regulations enforced by police, courts, and prisons, monopolize institutionalized power. For heterodox theorists, in contrast, there are other significant forms of power besides that stemming from the coercive apparatus of the state. There is also the power over social life stemming from the massive concentration of economic resources. In every major sector of the economy a relative handful of firms are in the process of extending their global reach. Paradoxically, while globalization involves an increased dispersion of money capital and an increased decentralization of production, these developments simultaneously bring about an increased concentration of capital (Sassen, 1998). In 1998 \$2.5 trillion was devoted to mergers and acquisitions, the most visible sign of the centralization of economic power that accompanies globalization.

2. the value chain

One dimension of globalization is the extension of production chains across borders through outsourcing. However, not all parts of these production chains are equal. Some add higher amounts of economic value than others do. Economic power is centralized in order to be used, and one use is to retain control of the parts of the production chain that allow the greatest appropriation of economic value. The increased use of outsourcing across borders is thus generally accompanied by the retention of the highest value-adding activities within the core regions. In this manner the subordinate position of other regions is reproduced over time, even as they receive greater foreign investment and industrialize.

3. intellectual property rights

A crucial dimension of globalization today is the push to extend the definition and enforcement of intellectual property rights (IPR's). Firms possessing such rights are able to appropriate "technology rents" granting them surplus profits

significantly above the social average (Smith 1999). A portion of these surplus profits can then be plowed back into the research and development process. The extension of intellectual property rights thus results in a self-reproducing cycle of uneven global development. Deep, persistent, and growing inequalities in the global distribution of research and development generate deep, persistent, and growing inequalities in claims to intellectual property rights, which in turn generate deep, persistent, and growing inequalities in the global economy. These result in yet further inequalities in the global distribution of research and development, thus beginning the cycle anew.

4. disadvantageous terms of trade

In the global economy producers from the so-called “third world” tend to be located in competitive sectors where no participant has much ability to affect prices. These producers must purchase more and more of their inputs from a small handful of first world multinational corporations (MNC’s), and then must sell more and more of their output to another relatively small set of first world MNC’s. For critical social theorists, producers in competitive markets sandwiched between oligopolical sectors generally tend to suffer disadvantageous terms of trade, since oligopolies generally tend to have greater ability to influence prices than firms in competitive sectors. This means that over time the cost of inputs for third world producers tends to go up, while the prices they receive for their outputs tend to stagnate or decline. The result once again is a global economy that tends to reproduce and exacerbate disparities in economic power over time.

5. debt crises and structural adjustment programs

Increases in the cost of imported inputs, declines in output prices in world markets, corrupt local elites, and first world lenders awash in money capital, all contribute to high levels of debt in many poor regions of the world. A sudden rise in

interest rates, a sudden fall in the prices of commodity exports, the bursting of a speculative bubble in real estate or the local stock market, a rush by local elites to hide their fortunes in overseas banks, or any number of other occurrences can then quickly turn a high level of debt into a debt crisis.

At this point more and more borrowing must be done simply to turn over previous loans. Private investors may then decide to refrain from making further loans. To avoid defaults, the country must then turn to an international agency such as the International Monetary Fund. The IMF can distribute funds appropriated from citizens in the first world to countries in debt so that they can continue to service their loans, a complicated form of public subsidy for first world investors. But in return the I.M.F. will insist upon a “Structural Adjustment Plan” with two main features. First, austerity programs will be imposed that generally result in higher unemployment, lower wages, and cutbacks in social programs providing nutrition, housing, medicine, etc. This means that the very groups that benefited the least from the flows of money capital into the country (industrial workers, the urban poor, rural households) will be forced to bear the greatest burden for rolling over of these loans. Second, any policy measures designed to counteract the effects of concentrated economic power, subordinate positions in production chains, the appropriation of monopoly rents from intellectual property rights, or disadvantageous terms of trade will be dismantled.³ From the standpoint of heterodox thinkers, few prescriptions are more likely to perpetuate the unevenness of the global economy than these are (Kolko 1998).

Nor is it the case that the neoliberal policies of the I.M.F. have overcome the debt crisis. In 1980 the Third World’s debt to the banks of the North stood at \$906 billion; by 1994 the figure was \$2.5 trillion. The total stock of developing countries’ debt increased by 50% from 1990 to 1997 (Elliott, 1997: 19). “Since 1987, the

South has been transferring more capital, in debt repayments, to the North than has been transferred from the North to the South” (Young, 1997: 150). In Mozambique, for instance, the government spends three times more on foreign debt servicing than on health and education (\$100 million/year), despite the fact that 70% of the population falls below the poverty line, 60% lack access to health services, 78% of women are illiterate, and 70% do not have access to drinking water (Southern African Jubilee Debt Summit, 1999).

6. dislocation and unemployment

With globalization different systems of production with wildly differing rates of productivity compete in the same markets. Vast numbers of third world producers find themselves unable to compete with first world producers, setting off social dislocations on a massive scale. The austerity policies that are part of IMF-imposed structural adjustment programs exacerbate these dislocations. As a result, the number of poor has doubled in urban areas in the third world in the last ten years. According to the World Bank, around one billion people now face severe malnutrition in African and Asian cities (Vidal, 1998: 5). High levels of unemployment and poverty make it extremely difficult for real wages to rise, which restricts the growth of domestic markets. Everything else being equal, low wages discourage investment in labor-saving technologies. In this manner too unevenness in the global economy is reproduced over time.

As a result of these six structural features of the global economy, heterodox theorists hold that a profound inequality in the distribution of economic resources tends to be systematically reproduced over time in the global economy today. The economic transactions that constitute globalization may not be accompanied by the continuous threat of overt military force, as in ancient empires and modern colonies. But the results are analogous: certain regions disproportionately

appropriate the benefits of economic activity, while other regions have a disproportionate share of the burdens inflicted on them. Some “reforms” advocated by neoliberals would simply leave these structural factors in place (e.g. standardized accounting practices); others would significantly worsen their effects (for instance, the extension of the intellectual property rights system).

As noted above, neoliberals appeal to Kantian and utilitarian principles in their positive assessments of globalization. The normative judgments asserted by critical thinkers can also be articulated in Kantian and utilitarian terms. The essential precept of Kantian normative theory is that the equal moral worth of persons must be respected. But what does that principle mean, and how can it best be instituted? For neoliberals, the principle implies that adults have the right to decide for themselves matters that are of concern to them, so long as they do not infringe upon the autonomy of others. And the best way to institutionalize this autonomy is through defining and enforcing private property rights in the market. Since globalization extends both the scope and the enforcement of private property rights, neoliberals conclude, it is to be affirmed.

For heterodox thinkers, in contrast, respecting the equal moral worth of all individuals is not simply a matter of leaving them to the vagaries of the market. This principle demands that social arrangements grant all persons a real opportunity to develop their essential human capacities. Obviously no social order can ensure a strict equality of opportunity in which any two infants born anywhere in the world with equal potential have exactly the same opportunity to develop that potential. But past some point inequalities of opportunity become so great that the principle of the equal moral worth of individuals is clearly being flouted. According to heterodox thinkers, the uneven development of the global economy has brought us well past this point today (Held, 1996). Many children born in certain regions have

tremendous opportunities, while others find themselves in regions where the chance to develop essential human capacities is extremely restricted. Further, there are at least six structural features of the global economy that systematically tend to reproduce this pattern over time. Such a social order must, *prima facie*, be criticized from a Kantian perspective.

An analogous point holds for a heterodox assessment of globalization from a utilitarian perspective. Within this framework the justice of a global economy can be affirmed if and only if it tends to further the social good to the greatest extent feasible. A global order in which it is technologically possible to provide everyone on the planet with the material conditions required to develop essential capacities, while billions are deprived of such conditions due to economic mechanisms, *prima facie* cannot be justified by this normative principle. To put the idea in slightly different terms, there appears to be considerable empirical evidence that increasing material consumption is correlated with increases in happiness up to a certain point, after which the correlation ceases to hold (Lane, 1991; Scitovsky, 1977). A global economy which limits the material consumption of billions of people below that point, while simultaneously granting vast increases in consumption power to those well above, would not appear to be designed to lead to the greatest net social good, everything else being equal. And this is the basic tendency in globalization today.

We are now, finally, in a position to turn to the heterodox account of the role of agricultural biotechnology in the global economy.

BIOTECHNOLOGY AND GLOBALIZATION: A CRITICAL PERSPECTIVE

The core argument of this paper can be formulated as follows: 1) There are six structural features of the global economy that systematically reproduce uneven development in a way that calls into question the justice of the global order. 2) In

the present social context the global diffusion of agricultural biotechnology is more likely to exacerbate than reverse these features. Therefore, 3) the global diffusion of agricultural biotechnology is more likely to exacerbate than to resolve problems regarding global justice.

Some arguments for the first premise were presented in the previous section. It is now time to turn to the second, and consider agricultural biotechnology in terms of the six structural features sketched above.

1. *centralization of economic power*

In the agricultural sector, as elsewhere, the dispersion of economic activity across the globe has been accompanied by a mind-boggling increase in the centralization of economic power (Marsden and Whatmore, 1994). The global agrochemical market was \$30.5 billion in 1996, and the top 10 agrochemical companies accounted for 82% of this market (RAFI, 1997b: 1). Global mergers and acquisitions are leaving behind a relative handful of companies that are able to use their vast bargaining power to dominate commercial food, agriculture, and health. Monsanto has spent \$8 billion in acquisitions in the past few years; DuPont purchased Pioneer Seeds for \$9.4 billion. In Europe, Ciba-Geigy and Sandoz merged to form Novartis. At the other end of the production and distribution chain, the two largest distributors, Cargill and Continental Grains, have recently merged grain operations. These are the companies that determine which of the possible technological paths are taken and which are not in the ag biotech sector. And each and every one is based in the North.

From an ethical standpoint, the power of such corporations raises fundamental questions of our society's commitment to democratic values. Democracy should mean that exercises of public power are subject to public accountability. In the view of heterodox thinkers it is ludicrous to think that the 10

of agrochemical corporations that control 82% of the global market are engaged in merely private matters, like my decision to use this brand of toothpaste rather than that. The decisions made by these corporations affect the health and nutrition of practically every organism on the planet. And yet the decision-makers in these corporations are accountable ultimately to stockholders only; there are no institutionalized mechanisms that ensure that other stakeholders – farmers, rural communities, and food consumers across the planet – have their interests represented effectively.

2. the value chain

The development of agricultural biotechnology is extremely unlikely to result in third world producers appropriating a greater share of the value added in this sector. Most farmers have been able to appropriate seeds as “free goods” provided by millennia of informal innovations undertaken by their predecessors. Now seed and chemical companies are using biotechnology to take over this section of the production chain. They would not be doing this unless they anticipated being able to appropriate a growing portion of the value of the final product.

Why will farmers acquiesce to this arrangement? Why won't they simply refrain from purchasing biotechnologically engineered seeds? A number of reasons can be given:

* Consolidation in the seed industry, the dismantling of public seed development programs, and the diffusion of so-called “terminator seeds” (see below) may make it difficult for farmers to gain access to sufficient supplies of non-genetically engineered seeds.

* The development of herbicide-resistant seeds will lead to high levels of herbicide use at certain times. The fear of herbicide drift may force neighboring farmers to purchase these seeds for self-protection (Lappe and Bailey, 1998: 59).

* As more crops are grown under contract to food processors, these processors may insist that genetically engineered seeds be used that extend the shelf life, cosmetic appeal, and desirable shipping properties of crops (Kneen, 1996: 134).

* In the short- term biotech may well lower input costs. If a natural biopesticide such as Bt is engineered into crops, for example, the savings that result from purchasing fewer chemical pesticides may well exceed the increased costs of the engineered seeds. This provides farmers with a strong incentive to employ genetically engineered seeds. But it does not follow that this will enhance the position of farmers in the value chain. The history of agricultural technology suggests that over time oligopolies are eventually able to appropriate benefits that farmers enjoyed when the technologies were first introduced. The increased concentration of power in the agricultural sector suggests that this pattern is likely to be repeated.⁴ Second, in the specific case of biopesticides, massive use of Bt is likely to result in a loss of its effectiveness. At that point farmers will find themselves with even fewer alternatives to the chemical pesticides offered by agrochemical companies than they have today (Lappe and Bailey, 1998: 70-1). Third, one feature of the globalization process is the compression of time; investors who can shift money across the planet instantly want a return on their investment within a shrinking time period. This has led most companies to try to shorten the period it takes to bring products to market, and agrochemical companies are no exception. As a result there is a tendency for risks and testing costs to shift from agrochemical companies to farmers using new seeds in the field (Benson, et. al., 1997: 13). Estimates of farmer savings do not take this trend into account. All of these considerations suggest that in the medium-to-long term rural households

throughout the world will most likely appropriate a smaller percentage of the value of the final product than before the introduction of biotechnology.

3. intellectual property rights

Intellectual property rights are becoming the central weapons in the struggle to appropriate surplus profits in agriculture (Barton, 1996). If there is an unequal concentration of scientific-technical labor in the agricultural sector, we can expect there to be an unequal distribution of patent rights. This is indeed the case. The core regions, with 20% of the world's population, undertake 98% of R&D in agricultural biotechnology; the remaining regions of the world, with 80% of the globe's population, undertake only 2% of this R&D (Herdt, 1998). The global distribution of patents follows this pattern. Corporations of the so-called "first world" own 79% of all utility plant patents; research institutions and universities in the North own 14%, and 1% are claimed by the U.S. government (RAFI, 1995b: 5). Patent rights are rights to monopoly profits. The extension of intellectual property rights in biotechnology thus works as a social mechanism whereby the regions already well off are able to reproduce and extend their advantages.

In the agricultural sector, intellectual property rights do not simply raise questions regarding the systematic reproduction of global inequality. 87% of the global diversity of higher-order plant species and at least 83% of both tropical and temperate forests are located in the South. And around 83% of recent bioprospecting activities explore the South, as opposed to a mere 6% that focuses exclusively on the North (RAFI, 1996: 3). In other words, the regions with the greatest genetic resources are precisely those regions that are almost entirely shut out of the monopoly rents based on these resources. From this perspective the question can be raised whether global "bioprospecting" is really a form of "biopiracy". For critics of the present intellectual property rights system,

(T)he system is fundamentally inequitable because it fails to recognize or reward the contributions of informal innovators—generations of farming women and men, and indigenous peoples who have conserved, nurtured and developed plant germplasm for thousands of years. Informal innovators are effectively marginalized from the rewards and benefits of plant intellectual property systems. No matter how stunning their technological achievements or costly their research, genetic engineers are literally building on the accumulated innovations and success of generations of anonymous farmers (as well as formal sector breeders). (RAFI, 1995: 4-5)

It is true that the Convention on Biological Diversity (CBD) commits the 169 countries that have ratified it to the “equitable sharing of benefits” from this heritage. But there are three major problems here. First, the U.S., the country most engaged in bioprospecting, has not signed this agreement. Second, there is a huge difference between rhetoric and reality. The results of labor that for generations did not take the commodity form are now to have a price tag fixed upon them. This cannot but be an arbitrary process, and one where the interests of groups with superior economic power will tend to hold sway. For example, the U.S. government-financed International Cooperative Biodiversity Group offered indigenous people in Peru one quarter of 1% of sales in royalties for products based on their germplasm, with Monsanto and Washington University appropriating the rest. Typical offers are well under 3%. In contrast, the U.S. government negotiated a deal in which Diversa Corporation will pay the government up to 10% of sales in royalties in return for the right to engage in bioprospecting in Yellowstone National Park, where there has been no informal innovative activity over generations (RAFI, 1997a: 2). Third, the Convention on Biological Diversity has a giant loophole that undermines its explicit intent: it excludes from consideration *ex situ* germ plasm

(that is, germ plasm stored in seed banks), collected before 1992. Two thirds of gene bank collections are controlled by the North (Shand, 1994: 84). As this material is made available to the North's companies and seed banks, much of it will be patented without recompense to the regions from where it came, placing the countries of the South in a yet weaker bargaining position.

4. disadvantageous terms of trade

Whenever a competitive sector is sandwiched between two oligopolistic sectors, producers in the competitive sector tend to suffer disadvantageous terms of trade. Agricultural producers in the third world generally have to purchase inputs from a relative handful of agribusiness oligopolies, and then sell their output to giant transnational firms as well. As a result, the prices they have to pay for their inputs have tended to rise over time, while the prices they receive for their outputs have tended to decline (or rise at a slower rate) over time:

Between 1980 and 1993, prices for non-oil primary commodities fell by more than half relative to prices for manufactured goods. The estimated loss to developing countries over this period was around \$100 billion: more than twice the total flow of aid in 1990 (Watkins, 1995, 130).⁵

Biotechnology extends the range of inputs that must be purchased from agribusiness firms, thereby reinforcing the pattern of disadvantageous terms of trade. While the seeds of the green revolution were developed by public research groups and distributed free of charge, genetically engineered seeds are today patented by private companies and sold to producers. Also, on March 3 1998 a patent was granted to the USDA and Delta & Pine Land Co. (now part of Monsanto) on a technique that genetically alters seed so it will not germinate if re-planted. The USDA and Monsanto have applied for patents on this so-called "Terminator" technology in at least 78 countries, and most of the major agrochemical companies

are developing similar techniques. Eventually self-pollinating seeds such as wheat, rice, soybeans, oats, cotton, and sorghum may enter the realm of private monopoly, exacerbating the problems associated with disadvantageous terms of trade.

5. debt crises and structural adjustment programs

There are a great number of factors underlying the continuing debt crisis. Four of the most important factors are surely the concentration of economic power, relative position in value chains, claims to intellectual property rights, and terms of trade. Since agricultural biotechnology can be expected to heighten the negative effects of these factors on poorer regions of the world, ag biotech can be expected to exacerbate the debt crisis presently afflicting so many poor countries.

In this context it is worth noting that states caught in the debt trap are unlikely to be able to mobilize significant resources to fund research and development programs in biotechnology designed to address local nutritional needs. Nor are such states likely to be able to fund regulatory agencies or ag extension programs capable of regulating, or even monitoring, the diffusion of ag biotech in an effective manner.

6. dislocation and unemployment

It is all well and good to speak of the “creative destruction” of capitalism as a necessary part of its dynamism. But there are no good reasons why we should assume that dynamism in and of itself guarantees a just social order. In the view of heterodox social theorists, in the global economy today there is a systematic pattern in which the benefits of the creative destruction of technological advances are disproportionately appropriated by first world agribusiness corporations, while the burdens are disproportionately inflicted on many of the poorest of the poor in the global community. This pattern calls into question the justice of the global

economic order. There are three tendencies associated with the diffusion of agricultural biotechnology that warrant special mention in this context.

The first tendency stems from the effects of biotechnology and globalization on agriculture in the first world. Only a relatively small percentage of possible lines of development in ag biotechnology are being developed. Not surprisingly, the main focus is on plants with the greatest economic importance. The primary measure of the success of the biotechnology revolution in agriculture, then, will be the increased economic efficiency of agriculture in the so-called first world (Reeves, Pinstруп-Andersen, and Pandya-Lorch, 1998: 101). As a result, far more agricultural commodities will be produced than can ever be absorbed in first world markets, creating tremendous economic pressure to increase agricultural exports. In contrast, relatively little scientific-technical labor is being devoted to improving the productivity of small-scale rural households in the third world. Relatively few of the latter will thus be able to compete with exports from first world agricultural systems. Small-scale producers of corn in Mexico, for instance, will hardly be able to compete with Iowa producers. This will inevitably lead to massive social dislocation, as tens of millions of rural households across the planet are forced off their land in a mass exodus to urban areas. The rapidity and the scale of this urbanization will be unprecedented in human history.

Second, biotechnology also promises first world agribusiness corporations the ability to avoid importing many crops from the so-called “third world” altogether. More and more agro-food products produced in quasi-industrial conditions will be able to substitute for imports (Goodman, Sorj, Wilkinson, 1987; Friedmann, 1994). Examples include sweet proteins, vanilla, cocoa, cooking oils, fragrances, spices, and cotton (Krimsky and Wrubel, 1996: 242). Nations whose economies have been structured around the export of these crops will suffer

extreme economic dislocation. As agribusiness companies disengage from third world producers, the forced migration from rural areas to urban regions will be greatly intensified, exacerbating the trend to increased food insecurity.

A specific example can be mentioned here. Coconut oil has been the major source of lauric acid. Calgene now is developing a genetically engineered rapeseed that can produce lauric fatty acid on large scale in the North. The coconut industry accounts for around 44% of the Philippines total agricultural export earnings, and provides direct or indirect employment for 30% of the population, 21 million people (RAFI 1995a). How much human suffering will be inflicted on these 21 million Filipinos as a result of this technical change? Can a social order that introduces technical change without concern for human dislocation on this scale be said to be rational?

The third point relevant here arises from the fact that not all agriculture will get wiped away in the so-called lesser-developed countries in the age of biotechnology. New niches for specialty crops for exports to the first world will arise, and some small-scale producers will be able to shift successfully to them (McMichael, 1994). But other rural households devoted to producing food for local subsistence will be pushed aside, as cash crops for export to the first world expand. Further, biotechnology holds the promise of developing plants that can flourish in this marginal land (e.g. land with high saline content, or in drought conditions). The more this promise is fulfilled, the more likely it is that socio-economic factors will shift the use of ever-more land from subsistence production for local nutritional needs to more profitable cash crops for exports.⁶ The result once again will be a tendency for rural households to join the ever-growing displaced population seeking jobs in urban areas (Winfield, 1998: 47).

With tens of millions entering cities desperate for work, and little chance of activities in the informal sector of urban economies providing adequate standards of living for sufficient numbers of people, it will be extremely difficult for the wages of displaced rural households to rise. In the absence of massive social struggles it is far more likely that wages will stagnate or press downwards, as foreign and local capital take advantage of desperate conditions in the urban areas of the third world. In a similar manner, the threat of moving to these areas disciplines wage demands in first world countries. The use of biotechnology thus can be reasonably foreseen to be associated with increasing economic inequality, as a greater and greater share of economic wealth goes to global economic elites, while wages stagnate or decline.

CONCLUSION: THE NEOLIBERAL ARGUMENT ABOUT AGRICULTURAL BIOTECHNOLOGY RECONSIDERED

Neoliberals such as Robert Shapiro, the C.E.O. of Monsanto, assert that agricultural biotechnology is going to “save the world” by developing technologies to meet the nutritional needs of a rapidly growing human population. The Universal Declaration of Human Rights, signed by the U.S. in 1948, recognizes food security as a basic human right. The heart of Shapiro’s argument is that in the age of globalization ag biotech can be relied upon to further this basic right.

Ag biotech may well have the potential to contribute to food security throughout the globe. But reflection on the six points just considered forces us to consider whether this potential is likely to be actualized, given the structural features of the global economy today. It is often said that markets are based upon supply and demand. Taken literally, this statement is simply false. Markets are based upon supply and effective demand, that is, demand with purchasing power behind it. The private self-interest of producers in market societies thus leads them to ignore the wants and needs of those without sufficient purchasing power. The

greater the extent and the more intense the needs of this latter group, the greater the divergence between the individual rationality of producers and the general social good.

As paradoxical as it may appear, there is no necessary connection between increases in food production and decreases in level of malnutrition.⁷ Rates of malnutrition are not determined simply by the amount of food available; the question of entitlements is the central issue. If those with the greatest nutritional needs lack socially enforced entitlements, malnutrition can persist in the face of food abundance (Sen, 1981). This is, of course, a specific case of the general point that market supply responds to demand if and only if that demand is backed by sufficient purchasing power.

It cannot be denied that globalization is leading to an unprecedented concentration of economic power in the handful of a few agribusiness corporations, or that they are devoting immense resources to controlling the highest value-adding sections of the production and distribution chain through intellectual property rights. And it is extremely likely that this development will contribute significantly to a world in which most agricultural producers in poorer regions of the world face rising prices for their inputs, while the prices they receive for their outputs stagnates or declines. In this world food consumers in poor regions continue to bear a disproportionate share of the burdens of structural adjustment programs, and social dislocation and unemployment persist. But all this, neoliberals might still argue, does not contradict the assertion that biotechnology will feed the world. In a global economy with higher levels of agricultural productivity, poorer regions will be able to import basic grains more cheaply than it could produce them. This will tend to keep grain prices down, allowing nutritional levels to improve in these regions.

This response can be questioned in at least three ways. First, it fails to account for the scale of the problems likely to be set off by the diffusion of agricultural technologies. Consider the foreseeable impact of so-called “terminator” technologies:

Up to 1.4 billion resource-poor farmers in the South depend on farm-saved seed and seeds exchanged with farm neighbors as their primary seed source. A technology that threatens to restrict farmer expertise in selected seed and developing locally-adapted strains is a threat to food security and agricultural biodiversity, especially for the poor . . . Far from improving plant breeding, the Terminator could drive hundreds of millions of farmers out of plant breeding and, since no one else will breed for their needs, out of agriculture altogether. This represents an enormous threat to world food security. Half the world’s farmers are poor and can’t afford to buy seed every growing season, yet poor farmers grow 15 to 20% of the world’s food and they directly feed at least 1.4 billion people. (RAFI, 1998: 3,5)

Second, we also must take into account the fact that income opportunities in either the formal or informal economy are likely to be quite precarious for many urban residents. And structural adjustment programs imposed by the IMF on countries in debt will continue to dismantle food subsidies to the poor (Walton and Seddon, 1994). So the mere potential availability of grain does not at all imply that food security is attained.

Third, this neoliberal argument also overlooks the food insecurity arising from fluctuations in prices in international markets:

Food-importing countries have sought to implement the ‘Marrakesh decision,’ a compromise reached during the Uruguay Round to protect least developed nations whose food import bills might increase as a result of the

1994 Agricultural Agreement. The IMF and WTO have objected to its implementation, on grounds that real increases in their food bills are not a direct result of the Uruguay Round, despite a study by the FAO estimating that price increases in basic commodities could lift the food import bill of least developed countries by some \$10 billion by 2000, of which \$1.4 billion may be attributed to the Uruguay Round provisions (Ritchie and Dawkins, 1998: 4).

The net effect of all these factors is paradoxical: increases in agricultural productivity may lead to increases in food insecurity and malnutrition among significant numbers of people under the present form of globalization.

In conclusion, in the present social context agricultural biotechnology does not automatically tend to further a world in which the equal moral worth of all individuals is respected, or a world in which the social good (the greatest possible net gain in social benefits relative to costs) is attained to the greatest extent feasible. There are good reasons to think that the distribution of the benefits and burdens of the biotechnology revolution are not going to be distributed in a socially neutral fashion in the global economy. Certain groups will be able to appropriate a disproportionate share of the benefits of this set of innovations, especially first world agribusiness corporations and local elites in the third world. Other groups will have a disproportionate share of the burdens of the technological change imposed upon them. These include the “surplus” rural workers of the third world, forced to move to urban areas where jobs are scarce and low-paid, and the working men and women from first world countries, who find the threat of capital flight to low-wage areas in the global economy used as a weapon against them. Those who wish to see biotechnology’s full potential for addressing social needs met should support social movement struggling for a quite different form of globalization, one

in which the systematic tendencies towards uneven development that exist in the global economy today are removed.⁸ As long as neoliberalism reigns, the diffusion of agricultural biotechnology is not likely to bring us closer to a more just global order.⁹

¹ I would like to thank Mike Bell, Gary Comstock, Fred Evans, and Michele Svatos for many helpful comments on an earlier draft of this paper.

² The terms “core” and “periphery” must be used with care. There are pockets of the core in poorer regions of the globe, and pockets of the periphery in rich countries. Mexico, for example, now boasts 24 billionaires, while one out of five children in the U.S. lives in poverty. Nonetheless, the distinction brings out a clear pattern in economic geography. Terms such as “North” and “South,” or “first world” and “third world” have their own difficulties, but also point to the same pattern. I shall use all three pairs of terms interchangeably here.

³ This is despite the fact that all presently developed countries made use of such policies. For example, the U.S. was thoroughly protectionist until the Reciprocal Trade Agreements Act of 1934, and Japan today continues to protect its industries by blocking imports.

⁴ “Economic benefits arising from these technologies are likely to be taxed away by those holding the patents” (Gertler, 1998: 139).

⁵ It should be noted that half of the Third World’s exports today are in primary goods, while 82% of the OECD’s exports are in manufactured goods (Moody, 1997: 61).

⁶ This has a gender dimension as well: agricultural labor in cash crops tends to be male, while across the planet female agricultural labor is concentrated in the production of crops for the subsistence of the household or for local markets. The

more priority given to export crops, the greater the social and economic pressures on women.

⁷ It should also be recalled how little research in ag biotechnology is directly concerned with increasing food productivity: “(V)irtually none of the newly engineered seeds are designed to meet world demand for increased food supplies. Instead, they are designed to meet existing and projected markets *only* in those countries with an ability to pay for the expensive infrastructure needed to support transgenic crops” (Lappe and Bailey, 1998: 88).

⁸ See Moody, 1996 for examples of such struggles and Held, 1995 for an attempt to construct a model of a quite different form of globalization from that occurring today.

⁹ Shapiro made two claims in his neoliberal defense of agricultural biotechnology: ag biotech will feed the world, and it will do so in a manner that is environmentally sustainable. The question of the long-term environmental consequences of ag biotech is beyond the scope of the present paper. But two points should at least be mentioned. First, ag biotechnology surely involves significant environmental risks, such as the development of herbicide resistant weeds, the loss of effectiveness of biological means to control pests due overuse of genetically engineered biopesticides, the loss of genetic diversity due to the extension of monoculture, and so on (Krimsky and Wrubel, 1996). Second, the global distribution of environmental risks associated with agricultural biotechnology will not be random. A significantly greater level of risk will accompany the introduction of agricultural biotechnologies in the so-called third world countries, raising another set of issues regarding global justice. In wealthy countries groups of citizens have sometimes been able to muster the political resources to force environmental restrictions on

companies, and the legal resources to sue companies that inflict environmental harms on society. In poorer countries, such political and legal resources are far scarcer (Hawtin, 1998: 116). Also, many so-called “third world” countries where biotechnology is being introduced lack state regulatory apparatuses and extension agencies with the scientific training, political authority, and economic resources to oversee and monitor the introduction of genetically engineered organisms into the environment. Finally, economic pressures from the debt crisis and structural adjustments programs have led poorer countries to expand export crops, in order to attain the hard currency needed to pay back first world banks and international lending institutions. The greater such pressures in third world countries, the greater the pressure to ignore environmental risks (Buttel, 1992). In this area too the assertions of neoliberals ought to be examined critically.

SELECTED BIBLIOGRAPHY

- Barton, K. 1996. Biotechnology: Catalyst for Change in Agriculture. *Agricultural Biotechnology: Novel Products and New Partnerships*. Ithaca: National Agricultural Biotechnology Council: 47-57.
- Benson, S., Arax, M, and Burstein, R. 1997. Genetically Engineered Cotton fails to Live Up to Its Hype. *Genewatch* 10 (6): 12-14.
- Buttel, F. 1992. Environmentalization: Origins, Processes, and Implications for Rural Social Change” *Rural Sociology* 57(1): 1-27.
- Elliott, L. 1997. Brown Can Shape World of Opportunity. *The Manchester Guardian Weekly*. December 21: 19.
- Elliott, L., and Brittain, V. 1998. The Rich and Poor are Growing Further Apart. *The Manchester Guardian Weekly*. September 20: 19.
- Friedmann, H. 1994. Shaky Foundations of the World Economy. In McMichael.

-
- Gertler, M. 1998. Biotechnology and Social Issues in Rural Agricultural Communities: Identifying the Issues. *Resource Management in Challenged Environments*. Ithaca: National Agricultural Biotechnology Council. 137-45.
- Goodman, D, Sorj, B., and Wilkinson, J. 1987. *From Farming to Biotechnology: A Theory of Agro-Industrial Development*. Oxford: Basil Blackwell.
- Hawtin, G. 1998. Biotechnology in the maintenance and Use of Crop Genetic Diversity. *Resource Management in Challenged Environments*. Ithaca: National Agricultural Biotechnology Council. 113-21.
- Held, D. *Democracy and the Global Order: From the Modern State to Cosmopolitan Governance*. Stanford: Stanford University Press, 1995.
- Herdt, R. 1998. Agricultural Biotechnology in the 21st Century: Promises and Pitfalls. *Resource Management in Challenged Environments*. Ithaca: National Agricultural Biotechnology Council. 33-40.
- Kneen, B. 1996. Constructing Food for Shareholder Value. *Agricultural Biotechnology: Novel Products and New Partnerships*. Ithaca: National Agricultural Biotechnology Council: 127-36.
- Kolko, G. 1998. Ravaging the Poor: IMF Indicted by Its Own Data. *Multinational Monitor*, June: 20-23.
- Krimsky, S., and Wurbel, R. 1996. Agricultural Biotechnology and the Environment. Chicago: University of Illinois Press.
- Lane, R. 1991. *The Market Experience*. New York: Cambridge University Press.
- Lappe, M, and Bailey, B. 1998. *Against the Grain: Biotechnology and the Corporate Takeover of Your Food*. Monroe, Maine: Common Courage Press.
- Marsden, T., and Whatmore, S. 1994. Finance Capital and Food System

-
- Restructuring: National Incorporation of Global Dynamics. In McMichael, ed.
- McMichael, P. (ed) 1994. *The Global Restructuring of Agro-Food Systems*. Ithaca: Cornell University Press.
- Moody, K. 1997. Workers in a Lean World. London: Verso.
- RAFI [Rural Advancement Foundation International], 1995a. Genetically Engineered High-Lauric Rapeseed (Canola): What Threat to Tropical Lauric Oil Producers? *Communique*. March/April: 1-9.
- 1995b. Utility Plant Patents: A Review of the U.S. Experience (1985-July, 1995). *Communique*. July/August: 1-10.
- . 1996. The Geopolitics of Biodiversity: A Biodiversity Balance Sheet. *Communique*. January/February: 1-6.
- . 1997a. Biopiracy Update: The Inequitable Sharing of Benefits. *Communique*. September/October: 1-14.
- . 1997b. The Life Industry 1997. *Communique* Nov./Dec.: 1-11.
- . 1998. The Terminator Technology. *Communique* March/April: 1-8.
- Ritchie, M. and Dawkins, K. 1998. WTO and Food Security. Minneapolis: Institute for Agriculture and Trade Policy.
- Reeves, T., Pinstrop-Andersen, P., and Pandya-Lorch, R. 1998. Food Security and the Role of Agricultural Research. *Resource Management in Challenged Environments*. Ithaca: National Agricultural Biotechnology Council. 97-102.
- Sassen, S. 1998. *Globalization and Its Discontents*, New York: The New Press.
- Scitovsky, T. 1977. *The Joyless Economy*. New York: Oxford University Press.
- Sen, A. 1981. *Poverty and Famines: An Essay on Entitlement and Deprivation*. Oxford: Clarendon Press.

-
- Shand, H. 1994. Agricultural Biotechnology and the Public Good. *Agricultural Biotechnology and the Public Good*. Ithaca: National Agricultural Biotechnology Council: 73-86.
- Shapiro, R. 1999. How Genetic Engineering Will Save Our Planet. *The Futurist* April: 28-9.
- Smith, T. 1999. Marx's Theory of Technological Rents. *Readings in Radical Political Philosophy*, A. Light, ed. Amherst, N.Y.: Prometheus Books.
- Southern African Jubilee Debt Summit. 1999. Declaration. *International Viewpoint* No. 312, June: 32-3.
- Vidal, J. 1998. Rural Poor are Overtaken by Urban Underclass. *The Manchester Guardian Weekly*. December 20: 5.
- Walton, J., and Seddon, D. *Free Markets & Food Riots: The Politics of Global Adjustment*. Cambridge, MA: Blackwell, 1994.
- Watkins, K. 1995. The Oxfam Poverty Report, Oxford: Oxfam.
- Winfield, M. 1998. Agricultural Biotechnology and Sustainable Development. *Resource Management in Challenged Environments*. Ithaca: National Agricultural Biotechnology Council. 41-8.
- Young, E.M. 1997. World Hunger. New York: Routledge.