In this paper I discuss agricultural biotechnology from an industry perspective, with reference to products and future trends, describing some of the new technologies and what they will mean to the farmer and to the industry as a whole.

In common with other companies, we at Monsanto realize the need to contribute to the feeding of two billion more people over the next 20 to 30 years, while respecting the environment. To rely on the methods of increasing food production that were used over the past two to three decades would be detrimental to the environment and, therefore, not sustainable in the long term. Moreover, we anticipate that increasing demands for improved food quality will influence what agricultural products reach the market place.

CHALLENGES

Those are the challenges for agriculture, but what of the challenges for biotechnology? From an industry perspective, the state of affairs is more complex and less monopolistic than may be immediately apparent from the outside. For those who have invested in the area, there are complex issues related to patenting, for example. It is relatively easy for a small player to develop a significant patent that is required to deliver a new product to the market place. But, regulatory systems, which are still evolving worldwide, must be in place. For example, we were able to introduce new technology into Brazil only after a regulatory system was instituted there.
Consumer acceptance varies considerably from one part of the world to another. Currently, Europe is our biggest challenge and we do not expect to commercialize biotechnology products, including new crop varieties, there in the near future.

There is intense competition in getting biotechnology products to the marketplace, with investment of large sums of money necessary, much of it from other industries. The closest model, for the foreseeable future, is the electronics industry — incredibly rapid developments in technology and capability, with many players involved. I expect increasing competitiveness, a view not shared by everyone.

Changes

During a recent visit to Boston, I asked one of our research laboratory leaders about changes in productivity, regarding the sequencing of genes of agricultural crops. Seven years ago, as a graduate student at a university lab, it took him a year to sequence one gene — extensive work and a great deal of hard labor. He pointed to one of a long row of instruments and said: “That machine will sequence 2,500 genes during this 24-hour period.” What took one person a whole year now can be done 2,500 times over in one day — and that row of machines is in operation 24 hours a day! It is likely that, for the major crops, the complete sequences of their 80,000 or more genes will be known within two years. Clearly, this is a time of great change in the biotechnology industry.

Around the world, government support for crop production is declining, a trend we expect to continue. Just as with industry, growers are consolidating to meet increasing demands for food. As biotechnology brings new opportunities, information is much more available today than it was even five years ago and growers are commensurately more sophisticated. To achieve higher yields, there is a significant shift in emphasis from the chemical inputs of the last decades to crop capability. For example, weed control was formerly limited to herbicide choices with quite distinct criteria involved in the selection of a seed variety. Now these decisions are interconnected — by planting soybean containing the Roundup Ready® gene, the farmer can apply a herbicide that could not previously be used on that crop. Until recently, the chemical, biotechnology, and seed industries were distinct, but this is no longer the case and food is just the next component. Food production, and the ability to improve food quality, will be dramatically affected by biotechnology.

By 2020, there will be about two billion more mouths to feed, largely as a result of population growth in the developing world. Over this time frame, the per capita Gross Domestic Product of the U.S. and Europe are expected to double, whereas those of China and India, for example, will increase five to six fold, bringing new financial capabilities. It is likely that improved quality of food will become a priority in Asia, with shifts in preference from cereal grains to meat and milk products, creating a total increase in demand for food of 75 percent over that for 1990.
**Biotechnology’s Contributions**

Let us consider India further. Increases in per capita consumption of milk and meat requiring more cereal grains will be comparatively higher in rural than in urban areas. Therefore, not only must we produce more food for the growing population, but satisfying demands for higher quality will necessitate increased productivity in excess of projections for population growth.

Increased needs for food must be met using farming practices that are sustainable. Of relevance are the new biotechnological tools for protecting crops from insects, weeds, fungi, and viruses. Products already on the market or in development include the following:

- **Roundup Ready® corn** provides new weed-control options for growers. More than two million acres were planted in the U.S. in 1999; it will be launched in a number of countries over the next two years.

- **Corn protected from the European corn borer**, is, essentially, a replacement for insecticides, although it is also planted by farmers who would otherwise not have sprayed because they could not properly time the spraying or achieve effective insect control. We are seeing a mean yield advantage of 13 bushels across the mid-west.

- A **product in the pipeline for 2001 is corn protected from rootworm**, a major pest. We have obtained dramatic effects: well over 99 percent control.

- **Bollgard® cotton** provides significant control of insects, saving farmers an average of approximately four sprayings, depending on location. In the mid-west, Roundup Ready® soybeans have received broad acceptance. In 1999, more than 50 percent of the U.S. soybean acreage was Roundup Ready®.

- **Roundup Ready® rice** is showing promise. It will give farmers a new weed-control option, and, in many places, will preclude the need to flood fields to kill weeds, presenting the opportunity to conserve water.

- **Roundup Ready® wheat** is expected to be available in 2003, and our data show great promise.

- **Wheat with a protective gene** remained healthy in laboratory tests after infection with head scab, a major disease in North America and Europe. These results promise reduced need for fungicide application, and significant yield benefits in parts of the world in which spraying is not an option.

A great deal of effort on the part of several companies is going into improving oil quality, with potential human-health benefits, and there are opportunities also to improve the seed-protein and oil values of corn to provide a better, more balanced livestock feed.
We have the ability to improve the starch content of potatoes. As french fries are cooking, the water is replaced by oil; the higher the starch content, the less oil in the finished product. So, for the fast food industry, fries with one-third less oil are possible, which, combined with improved oil quality, would be attractive to those concerned about fat and/or cholesterol. Although it would never be a recommended food, the product is more nutritionally sound, clearly, the permutations and capabilities now feasible present many new possibilities.

Lack of β-carotene in the diet results in night blindness and, ultimately, blindness for millions of people in developing countries. The technology exists to increase the β-carotene content of canola oil, which is used widely in India and China. It is hard for industry to justify investing in a product without the promise of a return on the investment. Through USAID, Monsanto found the opportunity to donate this technology to provide significant health benefits to people in many parts of the world. So I would argue that technologies developed by Monsanto will actually make it easier for other companies to introduce new products from minor crops to the market place.

PLANTS AS FACTORIES
We believe that many products that have pharmaceutical value, will, in the future, be more economically produced in plants. Although farmers are excited about this, I do not foresee vast areas planted to pharmaceutical crops; however, the acres that are planted will be very valuable. While I believe the larger value for the farmer will accrue from grains with improved protein and oil quality for human consumption, the growing of crops with pharmaceutical applications will be increasingly important. Compounds produced by fermentation today will be produced in the future by moving the appropriate genes into plants.

NEW CHOICES
Biotechnology will provide new choices for farmers. They will “vote” every year on whether to use the technology or not, which is the best competition of all. As mentioned above, conventional use of chemicals is being pre-empted by the choice of seed. The farmer will increasingly make decisions about pesticides through their purchase of seeds.

The cotton grower who would have had to spray three times, and possibly up to seventeen times in a single growing season, now can choose a product with which he is virtually assured that spraying will be necessary only once or twice, thus reducing personal exposure and environmental exposure.

We expect:
• greater production of value-added crops by contract,
• identity preservation of crops, if they have unique characteristics that have value,
• global competition, and
• intensification of farming and the farm-supply industries.
KEYS TO SUCCESS
Success requires the right product in the right quantities at the right price. Most of the food products of biotechnology are substitutes for others that meet current demand. Ability to produce does not guarantee a market. Economical pricing is essential, and high quality and efficient production are important. By sharing value with people in the system, their participation is encouraged.

Monsanto has entered a joint venture with Cargill. Monsanto brings the technology and Cargill brings knowledge of end-uses and how to extend the system all the way to the consumer. Cargill also has the financial resources to help fund this expensive research, which takes six or seven years from project inception to the marketplace. Thus, by combining efforts and sharing costs, the risks involved in developing new products are shared. However, even when two such large entities combine, other players must be included in the collaboration because no two companies possess the wherewithal to invent all the necessary components or reach all the markets. Therefore, cross licensing of technology and capability, and product sharing will be increasingly common.

Monsanto has invested in seed companies because seed is critical for delivering the technology to the grower. For the same reason, DuPont has invested in Pioneer.

GENOMICS
Having sequenced whole genomes, the next area of emphasis will be the linking of specific genes to phenotypes. Information in this area is already exploding, and the race is on to deliver new desirable traits to the market place.

We are excited because we currently use only about five percent of available corn races, whereas this technology will allow us to choose genes from any corn genotype, and other species of crops, and move specific desirable traits into commercial corn. With genomics, we could have brought Roundup Ready® soybeans to market two years earlier, and we will probably commercialize corn with rootworm protection two years earlier than initially projected.

Furthermore, in the past, it was necessary to grow out and test every line of soybean for a desired phenotype. We can now perform 10,000 tests per day to check for resistance to cyst nematodes, for example, for just 10 percent of the traditional cost. This efficient type of screening allows us to bring products more quickly and more efficiently to the market place.

PATENT PROTECTION
In the U.S., newly commercialized products have patent protection, of which growers are aware. In many developing countries there is no such safeguard. In countries like India, the use of hybrids protects our technology — cotton for example. In China we have a trademark license that the Chinese support, and, in return, we provide seed of a quality higher than they have seen before. Likewise, in Poland, we provide better seed-potato quality than previously available.
Chinese cotton growers buy seeds in 1-kg quantities. Over 500,000 of them are planting our insect protected varieties on fields as small as a tenth of an acre. They are excited about reducing their pesticide applications and increasing the productivity of their family farms.

**QUESTIONS FOR THE FUTURE**

I conclude with some questions:

- Can we help consumers worldwide understand the benefits of biotechnology?
- Will the benefits from biotechnology be shared appropriately with farmers?
- Will the rewards stimulate continued investment?
- Can appropriate linkages or networks be formed?
- How fast will demand for high-quality food increase?
- Can biotechnology help us to make increased production a more sustainable process?
One of the central questions that any new technology poses for farmers is whether or not it will benefit them. Will it either benefit them directly by solving management problems or improving profitability? Or will it benefit them indirectly by enabling them to achieve some social goal that they wish to support?

Such a pragmatic assessment of any technology is, of course, made difficult by the cultural love affair with technology that we have nurtured in our society since the dawn of the industrial revolution. But farmers must know by now that not all new technologies will be friendly to them. Indeed, Willard Cochrane made a compelling case for the opposite view when he coined the phrase “technology treadmill.” Even when a technology appears to be beneficial to farmers, like tractors replacing horses for greater labor efficiency, it will put a good number of farmers out of business (Cochrane 1958).

Whether or not such systematic elimination of farmers from farming has been, or continues to be, a social benefit is a subject of debate that we have never had in any democratic forum. But to argue that every new technology is a sign of progress and bound to benefit farmers is a proposition of mythology, not sound business or social policy.

While it is clear that every new technology benefits someone, it is equally clear that not every new technology benefits everyone. Accordingly, with respect to genetic engineering, the question farmers need to ask is whom this technology will benefit. The likely beneficiaries are the corporations developing the technologies and their investors. They wouldn’t be investing billions of dollars unless there were a strong likelihood that the objectives (at least the financial ones) can be achieved.

The question that farmers must ask is whether or not the technology will benefit them.
The biotechnology industry claims that farmers will benefit — directly by solving management problems and increasing profitability and indirectly by solving social problems with which farmers can identify. These claimed benefits can generally be subsumed under three categories:

1. That the technology will increase farmers‘ profitability and make them more competitive in the marketplace: This claim promises direct benefits to farmers.

2. That the technology will simplify farmers‘ pest management problems and do so in an environmentally benign way: This claim promises to benefit farmers directly and enable them to achieve a social goal.

3. That the technology will enable farmers to feed a world of expanding human population: This claim mostly promises farmers an opportunity to achieve a social goal, but it is generally assumed that it would also provide them with economic opportunities.

Are these claims true? I will argue that the probability that farmers will experience any of these benefits, given the way the technology is currently being applied, is very unlikely.

Let’s analyze each of the claims from a farmer’s perspective.

**That Genetic Engineering will feed the World**

There is a fundamental flaw with this claim that is exposed in the conclusion of several decades work by the Nobel Prize winning economist, Amartya Sen. His simple, unassailable conclusion, based on his study of the classic famines of the world, is that hunger is not caused by food availability, but by food entitlement. In other words, hunger is not caused by an insufficient quantity of food, but by insufficient access to food. Feeding the world is therefore largely a social, not a production, problem (Sen 1981, 1986).

Continuing to assume that hunger is a production problem without wrestling with the difficult problem of entitlement ironically ends up exacerbating the problem of hunger. And, in the process, it ends up hurting farmers economically. Brazil stands as a clear example. The production of soybeans in Brazil has increased dramatically in recent years. But the soybeans are produced primarily for export to Europe and Japan where they are used for animal feed, thereby denying local Brazilians entitlement to the food production capacity of their own country. Consequently during the same time that soybean production has exploded, the number of malnourished in Brazil has increased from one third to almost two thirds of the population. And Brazil’s increased food requirements will not be supplied by U.S. exports for the simple reason that malnourished Brazilians can’t afford them.

Meanwhile the over production of soybeans has pushed the price of soybeans in the U.S. down to four dollars a bushel. Simultaneously, it decreased the availability of land for local Brazilian farmers who used to produce food for
local Brazilian populations. This is not a formula that feeds the world, or brings benefits to the majority of farmers. And converting all of the soybeans grown in Brazil to genetically engineered (GE) varieties won't change that.

Furthermore, focusing only on more food as the single solution to expanding human populations detracts our attention from a host of other problems that further overcrowding, by still more humans on the planet, will surely create:

- increased disease,
- destruction of ecosystem services, and
- increased fragility of the entire ecosystem that a further imbalance of humans relative to other species will cause.

Besides, to my knowledge no one ever asked farmers if they wanted to take on the responsibility of feeding the world, or asked them how they wanted to do it if they did.

**That Genetic Engineering will Solve Pest Management Problems in an Environmentally Benign Manner**

Again, there is a fundamental flaw with this claim. The problem is that current applications of genetic engineering technologies for solving pest problems still adhere to the same paradigm that led to futility in pest management with toxic chemicals. Joe Lewis of the Agricultural Research Service’s Insect Biology and Population Management Research Laboratory in Tifton, GA, together with several colleagues, published a “perspective” paper in the National Academy of Sciences Proceedings in 1997 that clearly and succinctly lays out the problem. Our predominant paradigm for pest management, argues Lewis, has been one of “therapeutic intervention.” This approach attempts to eliminate an undesirable element by applying a “direct external counter force against it.” That paradigm is now being widely questioned not only in agriculture, but in medicine, social systems, and business management enterprises (Lewis 1997).

As Peter Senge points out in his work on systems dynamics, externally imposed solutions at the expense of analyzing and understanding the functions of the system, generally leads to creating the problem we are trying to solve. The reason is simple. “The long-term, most insidious consequence of applying non-systemic solutions is increased need for more and more of the solution” (Senge 1990). Farmers can certainly relate to that with respect to pest management. In fact, it is precisely that principle at work that led Robert van den Bosh to coin the phrase the “pesticide treadmill” more than twenty years ago. Applying an external solution to a pest problem generally disrupts the natural balance that keeps pests in check and develops resistance in the target pest, thereby increasing the need for more of the solution. While that certainly benefits the company selling the solution, it hardly benefits farmers.

In other words, not only is the therapeutic interventionist paradigm ineffective in providing sustainable relief from pests, it also makes the farmer
more dependent on the supplier of the intervention. And as Donella Meadows points out “over time, the intervenor’s power grows” over the person who becomes dependent on the intervention. The clear result is less economic empowerment for farmers and more economic power for the provider of the therapy. One can hardly argue that, that scenario is of benefit to farmers. To assess the long-term benefit of any pest management strategy for farmers it must be measured against the “fundamental principle” that Lewis articulates so succinctly:

. . . application of external corrective actions into a system can be effective only for short term relief. Long term, sustainable solutions must be achieved through restructuring the system . . . The foundation for pest management in agricultural systems should be an understanding and shoring up of the full composite of inherent plant defenses, plant mixtures, soil,natural enemies, and other components of the system. . . The use of pesticides and other “treat-the-symptoms” approaches are unsustainable and should be the last rather than the first line of defense. A pest management strategy should always start with the question “Why is the pest a pest?” and should seek to address the underlying weaknesses in ecosystems and/or agronomic practice(s) that have allowed organisms to reach pest status.

Lewis goes on to point out that this principle holds for molecular biology as well as for toxic chemicals. Since genetic engineering conforms to the same interventionist strategies used in the chemical pest control era, farmers should not expect any long-term pest management benefits from the technology. Resistance to Bt will develop, for example, rendering Bt corn and similar pest management strategies ineffective. That, in turn, will complicate future pest management efforts — not to mention destroy an environmentally benign pest management tool that many farmers have used effectively for more than 20 years. And if the recent study reported in Science magazine is correct, (demonstrating that the genes encoding resistance to Bt in European corn borer are dominant, rather than recessive as previously thought) then the high dose/refuge strategy that farmers have been told to use to postpone resistance will be useless (Huang et al. 1999).

That it Will Increase Farmer Profitability and Make Farmers More Competitive

This claimed benefit is even more questionable. The reason farmers are not likely to see much profit from genetic engineering is not rooted in the cost of planting refugia to postpone resistance, or the yield drag of some genetically engineered varieties, or even the technology fees that farmers are required to pay. Some mainline farm magazines argue that GE crops could still pencil out despite these down sides, if one takes a long-term view (Holmberg 1999). I’m skeptical, but perhaps they are correct.
But there is, again, a more fundamental principle that farmers need to consider when assessing the profitability of any technology.

Stewart Smith, an agricultural economist at the University of Maine, perhaps articulated that principle most clearly almost 10 years ago. For most of this century, farmers have been taught to believe that profitability is strictly a matter of price and yield. Indeed, Paul Thompson at Purdue University has suggested that farmers have been so indoctrinated into the higher yield school of profitability that they now operate out of a single ethical principle — “produce as much as possible, regardless of the cost” (Thompson 1995). But Smith suggests that while farmer’s fortunes are, to some extent, linked to price and yield, those factors ultimately do not determine farmer profitability. Profitability is determined more by the share of the agricultural economic activity that farmer’s command then by the quantity of commodities they produce or the price they get for them. And Smith points out, rather graphically, that the farm sector’s share of the agricultural economic activity has steadily eroded for most of the 20th century. According to Smith’s study, farm sector economic activity shrank from 41 percent to nine percent during the period from 1910 to 1990. Coincidentally, during that same period of time the input sector economic activity increased from 15 percent to 24 percent and the marketing sector from 44 percent to 67 percent (Smith 1992).

And technology plays a key role in determining who gets what share. Smith points out that “technology is the primary cause of farming activity loss.”

The problem is that the kind of technology that has been promoted by both the private and public sector is technology that shifts economic activity away from the farm sector to the input sector. For the most part the technologies developed over the last 100 years have been technologies that exert an external corrective action on a problem, rather than technologies that develop self-regulating systems. Those technologies increase economic activity for input companies but decrease economic activity for farmers. The reason that the private sector develops that kind of technology is readily understandable. It increases the profitability of the corporations producing the technologies. The reason that the public sector promotes this paradigm, according to Smith, is because it is strongly influenced by private funding.

Genetic engineering advances this scenario another quantum leap. Not only does the technology conform to the same paradigm of exerting an external corrective action on the problem, but the technology is instrumental in speeding up the merger mania that is now merging the input and market sectors. Bill Heffernan predicts that by the time the mergers and acquisition process is complete, there will be just four food clusters that will control most of the nation’s food supply. These developments portend a future wherein farmers become contract workers forced to contract with one of these four input/market sector clusters. The farmer’s only role will be to grow out the firm’s seed, into the firm’s crop, for the firm’s market. As Bill Bishop puts it,
“Farmers will not farm; they will fulfill contracts . . . biotechnology gives new meaning to tenant farming” (Bishop 1999).

If anyone thinks that farmers will become economically empowered in this system, they haven’t looked at the broiler industry lately. In this scenario, the only hope farmers may have of retaining any voice at all in their own economic welfare will be through some kind of universal collective bargaining. That may actually not be a bad idea since farmers are already paying their union dues in the form of check-off dollars, but the funds are misdirected. Farmer check-off programs seem to be based on the flawed notion that farmers can produce their way out of this problem. Airline pilots never use their union dues to get more people to fly. They use them to get a fairer share of transportation profits.

A more immediate way to empower farmers economically, however, is to implement Smith’s suggestion regarding the use of public funds and the way farmers must do business. Public funds, Smith argues, must be directed “away from technologies that shift activity from farmers to non-farm firms,” and toward farming systems that “displace purchased inputs.” Such technologies would create self-regulating pest management systems, and on-farm nutrient cycling systems, that displace purchased inputs. Such shifts would also tend to replace economies of scale with economies of scope, and it would, to a much larger extent, put farmers in control of their own costs.

The way farmers do business has to shift from farmers being the suppliers of undifferentiated mass-produced raw materials into a global economy, to becoming the marketers of identity preserved products and marketing those products as directly as possible. Such enterprises need to be owned and operated by farmers, with direct retail links that provide consumers with identity preserved products that conform to consumers’ changing demands.

WHAT KIND OF FUTURE SHOULD FARMERS CREATE?

As we contemplate what kind of future farmers should create for themselves, it is important to recognize that the farm sector is developing into two very different kinds of farmers. By some estimates, there are now approximately 200,000 farmers who mass-produce 85 to 90 percent of the undifferentiated commodities that are sold as raw materials into the global market. These are the new wave of industrial farmers. We will likely see these farms dramatically increase in size and decrease in number as they become vertically integrated into the food system through contractual relationships. Some anticipate that the number of these farms will decrease to 25,000 in the next decade. That seems like a reasonable projection.

The production paradigm of these industrialized farms is not likely to change. Genetic engineering will increasingly be the “direct external counter force” used to solve farming problems. In the short-term, these technologies will be successful in solving some production problems. Eventually, we will see the technologies become ineffective and increasingly ecologically worrisome.
But even if they question their long-term effectiveness, these farmers will be required to use these technologies because their contractual relationships will mandate it. But industrial farmers should not expect to generate great profits, with or without genetic engineering, unless they can develop some kind of effective collective bargaining to claim a larger share of the food system profits.

Then there are the 1.5 million farmers who make up the balance of the farm sector. Increasingly, these farmers are developing ways of differentiating their product and shortening the distance between farm gate and consumer table. These are farmers who generally fit the description of the new economy described in detail by futurists like Alvin Toffler and Peter Drucker. Instead of mass producing an undifferentiated commodity in ever increasing economies of scale, these farmers will remain smaller, more flexible, and more innovative, using systems to produce a variety of highly differentiated products produced for specific markets. In other words, they will use “mind” instead of “muscle,” as Toffler puts it. These farmers will increasingly shift to new production paradigms that internalize costs, and develop self-regulating and nutrient cycling systems. These shifts will take place not only because consumers demand them, but because energy efficiency and the demand to end public subsidies will require them. Most will eventually gravitate toward whole systems management in their production, as well as in their marketing.

These farmers are not likely to benefit much from the present applications of genetic engineering technologies. In fact many, like the Sinners in Casselton, ND, will gear up to fill market niches created by the consumer backlash against genetic engineering (Jamestown Sun 1999). The Sinners have long differentiated their production by certifying and selling seed. For them, identity preserving genetically natural crops is simply another way of differentiating a premium product that consumers want. Of course there are some applications of genetic engineering that this generation of “new economy” farmers can use. Genetic engineering, for example, might help us to better understand and implement self-regulating systems. However, since that application of the technology will result in few product sales, its development will have to be undertaken by public research institutions.

The industrialized farms, in my opinion, will fail in the long run. There are three fundamental reasons for their failure:

1. These farms will be highly centralized, routinized, and specialized. That means there will be little room for flexibility, diversity, or innovation. History does not give us many examples of farming systems designed on those principles that have succeeded. Increasingly these production systems will attempt to force the market to change (witness efforts to get Europeans to accept genetically engineered food, and hormone fed beef) rather than adapting to changing markets. That is not likely to succeed. As Nature magazine put it recently, “consumer acceptance” must be part of the equation (Nature 1999).
2. The routinization of these farms will dictate that the preferred technologies will be those that serve as a direct external counter force to solve problems, rather than those that make systems changes. There is no good reason to believe that molecular biology, used in that paradigm, will be any more successful than chemistry in creating sustainable pest management systems.

3. Genetic engineering will increase the specialization and routinization of these farms and they will therefore continue to dramatically reduce the biodiversity of farms and the ecosystem in which the farms exist. This further reduction of both genetic and species diversity will make these farming systems increasingly vulnerable to new pests and diseases.

**Eventually the System Will Collapse**

For farmers who choose to create their future in the new paradigm, there is hope for a brighter tomorrow. There will, however, be many challenges along the way. Precious little research and technology development has been done to support this alternative direction. Market infrastructures have not been developed, and public policies, for the most part, favor the old paradigm. Public policies that put that alternative on a level playing field would help farmers gain a foothold in this “new economy,” “new paradigm” future.

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For additional reasons why genetic engineering will not help feed the world, see the 28-page briefing entitled “Food? Health? Hope? Genetic Engineering and World Hunger,” prepared by The Corner House, PO Box 3137, Station Road, Sturminster Newton, Dorset DT10 1YJ, UK.