

BIOTECHNOLOGY AND THE ENVIRONMENTAL VISION

In the spirit of Walter Truett Andersen's talk, I hope to provide a responsible contribution to the ongoing debate whose long evolution he has described.

I have enjoyed the opportunity occasioned by this speech to take a some-

what longer view of biotechnology; to reflect on how far it has come and where it might be going. In so doing, I have pondered two questions. The first is the question of my vision of the future of biotechnology. The second concerns the idea of a crossroads—whether, indeed, biotechnology is at a crossroads.

On the question of my vision of the future of biotechnology, I need at the outset to rephrase the question, for I do not have a vision of the future of biotechnology. Biotechnology is a collection of tools, capabilities and products. In my view the vision should focus not on tools, but on how we want to use them.

My vision is not of biotechnology but of a new

kind of agriculture—a sustainable agriculture—with characteristics and objectives different from the industrial agriculture currently practiced.

The important question is whether the tools and products of biotechnology advance us towards that vision.

What is the vision? It centers on prosperous farmers, an abundance of safe food and a clean environment. In it, clean—not polluted—water washes off agricultural fields and percolates through the soil to the groundwater below. Wildlife thrives at the edge of fields, rather than dying from consuming pesticide pellets. Weeds are in the fields, but kept to levels that do not interfere with yields. Cultural practices and intelligent management control the interaction between pests and crops. Agriculture de-

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velops in response not to short term goals—tempting as that always is—but with an eye to long term productivity and prosperity.

Such an agriculture will depend on methods that will be as viable 50 years from now as they are today. It will look for ways to use and reuse materials on the farm. It will put a premium on information and management rather than on purchased inputs.

Such an agriculture will be supported by a revitalized and redirected land grant university system. The new land grant universities will be able to provide information about cultural and integrated farming practices as readily as today's land grant universities disperse information about chemical pesticides. These new land grant universities will command a much larger part of our national research pie because they will be seen as ensuring not only agricultural productivity but a healthful environment, safe food, and a connection to nature for our increasingly urbanized populations. Land grants with this new broader vision of their mission would be at the forefront of our national life rather than in the backwater.

My vision for the future of agriculture also includes a varied, abundant and safe food supply with which people are comfortable. Consumers would not need to wonder whether the carrots they picked up at the market had mouse or human genes in them. Nor would they need to worry about whether the tomatoes they were eating contained a toxin gene inadvertently transferred into the tomatoes by careless genetic engineers.

Where does biotechnology fit into this picture? So far, at least, biotechnology will not substantially advance us toward a sustainable agriculture. Let's look at the four categories of products that are the subjects of workshops at this meeting. Herbicide-tolerant crops, animal growth promotants, transgenic animals and biological control agents. Three of the four—herbicide-tolerant crops, animal growth promotants, and transgenic animals—could easily be dispensed with without retarding our progress toward a sustainable agriculture. The fourth, biological control agents, is an important component of a sustainable agriculture but biotechnology will have only a minor impact on the efficacy and adoption of such agents.

I am not saying that the products of biotechnology have no place in a sustainable agriculture. Some, for example pest-resistant crops, could

be important components of such systems. But right now, in 1991, the available biotechnology products are not contributing significantly to the development of sustainable agriculture. Some, such as herbicide-tolerant crops, are antithetical to that vision.

Biotechnology is dampening our progress towards sustainable agriculture in a more subtle way, meaning that biotechnology is popular with government, universities and private industry because of its potential to generate new products. For example, companies and universities currently spend millions to develop new biological pesticides. In general, these products—although not without problems—are environmentally preferable to existing chemical pesticides. But at the crux of the matter, the new pesticide products are not the best solution to the problem of pests. It is widely agreed that systems approaches—for example, crop rotation and other methods—could avoid the need for the majority of pesticides, both chemical and biological, now and into the future. The problem is that the hype surrounding biotechnology diverts our attention from those solutions by focusing attention on technologically dazzling new products. The bias towards products deprives the systems-based approaches of the research and extension resources that are required to achieve their full potential.

It is vital that agricultural policy put biotechnology in a position to serve and not displace sustainable agriculture. The question should not be whether biopesticides are compatible with sustainable agriculture, but whether, after crop rotations have been employed to their fullest, which pesticides are still needed.

To offer a metaphor for nature of the choice we have before us—biotechnology can be considered an elephant standing in front of two tents. One tent is large enough for the elephant, but it is also somewhat rickety. It has stood for a while, but will not last much longer. It is the tent of industrial agriculture.

The other tent is smaller, not as glitzy, but sturdy. It will last as far into the future as we can see. But it will not hold the biotechnology elephant. If the elephant charges in, the sustainable agriculture tent will come tumbling down. What is needed is to put the biotechnology elephant on a diet, to cut it down to size so that it will fit into the sturdy tent. Specifically, the

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United States Department of Agriculture (USDA) should not be distributing buttons emblazoned with "Biotechnology is the Future of Agriculture." Biotechnology cannot be the future of agriculture. Technologies have no values; they embody no goals. And yet they are not neutral in their application. Technology can influence outcomes, particularly if the tools themselves are mistakenly regarded as goals.

It is time to articulate a vision of sustainable agriculture and ask how best to achieve it. Our goal should not be merely more new pesticides but a 75 percent reduction in pesticide use. By setting the proper goal, we will avoid the danger of spending millions trying to genetically engineer ten "better" pesticides, when for far less we could have taken our agriculture systems off the pesticide treadmill forever.

My second point concerns the idea of a crossroads. Is agricultural biotechnology, specifically the industry sector concentrated on transgenic plants and animals—really at a crossroads? In some ways, I would say not. The molecular biological and genetic sciences underpinning the technology are advancing at an accelerating pace. New scientific discoveries are leading to a stream of new products. The pace is slower than promised by the optimistic early entrepreneurs—but as the numerous field tests demonstrate, new products, especially engineered crops, are coming. A meandering path, perhaps, but not a crossroads.

A crisis looms for agricultural biotechnology in the area of product commercialization. This crisis could constitute a genuine crossroads. If the products now in the pipeline can make their way soon to the marketplace, the industry will develop confidence and attract new investors. On the other hand, if the early products are delayed in getting to the marketplace or are received unfavorably, the whole industry would be set back. The key is the federal review system. Without credible government review to assure safety, the pioneer products of biotechnology will never make it to the marketplace.

Despite almost a decade of federal level effort, the biotechnology regulatory system is in shambles. With regard to animals, such as fish, regulation is non-existent. With regard to food, authority exists and the government is aware that policy is needed, but it is proceeding at a glacial pace. Even where it appears to be functioning, the government is sometimes at

the edge of its capabilities. In the crop plant area, for example, the USDA has overseen more than 200 field tests of engineered crops under the Plant Pest Act. While those tests generally have been conducted efficiently and safely, the Agency is facing an impasse in providing approvals for commercialization. The impasse is primarily attributable to limitations in the Plant Pest Act. Whatever the reason, the USDA has failed to describe a program for commercialization approvals. Open issues are legal authority for regulation, data requirements and opportunities for public comment. Lacking risk assessment protocols for large and commercial scale release, it is not surprising that the small scale tests done so far have not yielded many data on environmental risks. New rounds of small scale tests will probably have to be done to generate those data.

This is just one of the uncertainties facing those who want to commercialize transgenic crops. For example, later this month Environmental Protection Agency (EPA), USDA and the Food and Drug Administration (FDA) will meet for the first time to discuss the potential statutory overlaps on herbicide-tolerant plants. If the agencies are just beginning to address these issues, it means that proposed and final rules are years away, at best. This regulatory quagmire is beginning to assume crisis proportions. The issue of when, if ever, a reliable regulatory road map will be ready is becoming the rate-limiting factor in product development.

I am of mixed mind about the slowdown in the rate of the technology's development. If it were to result in a shift of resources to the system approach of a sustainable agriculture, I would consider it a boon. But I doubt that would be the outcome. More likely scientists will become impatient and like Gary Stroebel, will go ahead with releases on their own. That prospect is one of great concern.

To finish, let me summarize my two points. First, the agricultural biotechnology industry appears to be approaching a genuine crossroads in the area of commercialization. If the government cannot come up with protective, credible regulatory programs soon, transgenic products will not reach the marketplace and agricultural biotechnology will suffer a major setback. Second, our vision should focus on a low-input sustainable agriculture, not the course of a particular technology. I hope that under the leadership of the land-grant universities, biotechnology will be made

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to play second fiddle in the orchestra of sustainable agriculture. If it does, we can look forward to a symphony of environmentally and practically sound agricultural practices.