

Agricultural Ethics

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This is an informal introduction to a series of essays on agricultural ethics. These essays have been solicited from people who have thought about the choices we face and the decisions we must make as we try to balance feeding the world's expected 9 billion people with the need to preserve the food-producing capacity and the natural ecosystems of the Earth for future generations. The goal of this first article is simply to raise some questions that will be expanded upon by others and to show how complex the issues are.

Ethics is about choices, and agricultural ethics is about choices for people engaged in agriculture either directly as farmers, or indirectly as government regulators, extension agents, researchers, CEOs, industrial workers, lawmakers, technology developers, consumers, or protestors. Although all of us make choices, few of us actively engage in an ethical analysis of our actions or can provide reasons for the choices we make.

Different "definitions" of ethics are in use daily by the general public. Here, right or wrong, are a few to ponder. (a) Ethics is adherence to the spirit and the letter of the law. People who claim that they "have done nothing wrong" after they are caught in a legal but unsavory action often use this interpretation of ethics. (b) Ethics is adherence to a religious belief. (c) Ethics is adherence to "community or cultural standards." (d) Ethics is adherence to my ideas. In contrast, ethicists use definitions that are more complex and may contain elements of all these common notions about what is ethical and what is not. It is not practical here to make a blanket definition of ethics because many have devoted their professional lives to that goal. Each of the authors in this series will make their own views clear on that subject.

This series is designed to encourage us to think about the wider implications that our work has on society. Some of our choices, well or ill considered, ethical or not, are being questioned by people who have visions for agriculture that differ from the prevailing paradigm. We live in a time when many are questioning the priorities of our food production systems and confronting us with our role in it. This essay and the series that follow is intended to help us as professionals in plant biology to listen to them and

examine our own beliefs, values, and morals and then reconsider our choices from this new, more well-rounded perspective.

THE MORAL CONFIDENCE OF THOSE CONNECTED WITH AGRICULTURE

Interestingly, people engaged in agriculture, whether as producers, scientists, administrators, legislators, or protestors, all tend to believe that they are on high moral ground. Because they are part of that most noble of human endeavors, to feed the people of the Earth, they have a "moral confidence" in their profession and often fail to see the need to examine their choices. In the words of Paul Thompson (Thompson, 1998), one of the country's preeminent agricultural ethicists: "Agricultural producers and those who support them with technology may have been seduced into thinking that so long as they increased food availability, they were exempt from the constant process of politically negotiating and renegotiating the moral bargain that is at the foundations of the modern democratic society." Our attitude is "full steam ahead," especially because we are expecting 3 billion additional people by 2050. The discoverers of new technologies, the gene cloners, the lawmakers who support farm subsidies, the plant breeders, the pesticide manufacturers, the organic farmers, and the globalization or protesters against agricultural biotechnology generally are unwilling to accept criticism for their actions, for all "know" that they have made the correct choice.

One reason for our ongoing ethical dilemmas is that society's values are not immutable but change over time. Slavery, once acceptable in many cultures, is not acceptable any longer in developed societies although it still flourishes in many developing countries. Euthanasia, once totally unacceptable in nearly all cultures, is now becoming acceptable under certain conditions in some countries. Capital punishment, unacceptable in other developed countries, still occurs in the United States although the practice is coming under increasing criticism. As our world changes, so do our societal values.

Another reason for ongoing ethical dilemmas is that new technologies have unexpected consequences. Spraying large areas with DDT (1,1,1-Trichloro-2,2-bis(*p*-chlorophenyl)ethane) saved (and still saves) the lives of millions of people in areas where mosquitoes

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spread malaria, but its accumulation in the food chain damages the nervous system of the animals (including humans) at the top of the chain and imperils the reproduction of carnivorous birds. As a result, DDT has been banned in many countries, and the World Health Organization would like to phase it out completely by 2007. The new wheat (*Triticum aestivum*) and rice (*Oryza sativa*) varieties of the Green Revolution increased food production in Asia and Latin America and provided food for hundreds of millions of people, but also marginalized untold millions who lost their access to the land or their employment (Conway, 1997). Do all silver clouds have dark linings that we often don't perceive at first and certainly can't predict?

Yet a third reason for the near constant need to reconsider our choices is that new ideas can and do enter our moral worlds. In developed countries, age-old ideas about the treatment of nonhuman animals and the protection of the natural environment are gaining acceptance. These ideas are not new, having been espoused throughout human history by different groups of people. Do animals and the environment have defensible rights in the modern legal sense? Should species and ecosystems be saved only because they might be useful to the human species in the future or because we have a moral duty to do so? "Deep ecologists" certainly think the latter, and they aim to create a new moral system that is not utilitarian, meaning that it is not centered on the needs of humans alone. Even if we don't believe that the environment has rights in the same way that people have rights, we are slowly coming around to the notion that we must live within the natural laws that govern our Earth's ecosystems. The realization is dawning that we cannot escape from those laws and that we, especially in the United States, will have to modify our lifestyles accordingly. Similarly, many of us are uncomfortable with the notion that nonhuman animals have rights, but the idea that our food animals, because they are sentient beings, deserve a more humane treatment than they are now getting is slowly permeating our society and changing our cultural values. Witness the rise of vegetarianism in North America and western Europe in the current generation. Hence, new ideas bring with them the need for ethical discussions that may result in new choices either for individuals or for society as a whole.

UTILITARIAN ETHICS

Although this is not the place for a discourse of the ethical roots of our western civilization, suffice it to say that most of us subscribe to "utilitarian ethics," which means that when evaluating an action we judge its outcome and especially its effect on our fellow humans. We ask: Does the action produce the greatest good for the largest number of people? If the

answer is "yes," then the action is deemed good. However, this does not mean that the ends justify the means because actions also have an ethical dimension. We think similarly about introducing a new technology. Are the benefits shared by many people, or are they limited to a narrow segment of society? When applied to crop production, this translates into acceptance of practices that promote productivity because that translates into prosperous farms (and farmers at least in the short run) and affordable food for the population at large.

Seventy-five years ago, U.S. farmers gratefully accepted every technological innovation—for example, hybrid corn—that promised to raise production and increase the economic return of farming. Just a little more production to buy an additional horse and shoes for the kids! Although quite a few of the oldest members of our society grew up in farming families in the 1920s and 1930s and fondly reminisce about the happier moments of their youth on the farm, in reality it was a hard existence. There was nothing romantic about subsistence farming in Kansas or South Dakota during the Great Depression. In contrast, today many farmers have a much higher standard of living, but feel that they are on a technology treadmill: always needing to incorporate new technologies that promise greater yields but that do not necessarily produce greater economic returns as grain prices continue to fall. In addition, consumers now want to know which technologies farmers are or are not using, i.e. consumers are showing a greater interest in the methods of production that generate their food. This healthy questioning introduces a new element in the equation of food production and marketing.

IS PRODUCTION AGRICULTURE THE ONLY POSSIBLE VISION?

Our utilitarian agricultural ethic gave rise to the concept of production agriculture, which has remained the guiding paradigm of North American and European agriculture for the past 50 years. At the end of the Second World War, there was a tremendous need to increase food production both in Europe itself and in the United States for export to Europe. Since that time, agriculture's role has been defined as supplying abundant food that is safe and nutritious at the lowest possible cost to the consumer. Achieving this goal requires farmers to continuously adopt new technologies that enhance production and fiscal policies that externalize most of the environmental costs of food production. However, is this the only possible vision for agriculture?

Farmers and consumers are beginning to question some technologies, especially pest control practices and genetic engineering of crops, wanting to know if they are consistent with human health, stewardship of the land, and the sustainability of the Earth's eco-



Figure 1. Is production agriculture our only vision, and will the agronomic practices that accompany production agriculture and promote cheap agricultural commodities conserve the resource base for future generations? This view shows pivot irrigation of circular fields of wheat, alfalfa (*Medicago sativa*), potatoes (*Solanum tuberosum*), and melons (*Cucumis melo*) near the Columbia River in Oregon. Much irrigation in the United States and elsewhere in the world uses aquifers that are not being recharged at the same rate as they are being used. Photo courtesy of the U.S. Department of Agriculture Agricultural Resource Service.

systems. Low commodity prices are beneficial for consumers and safeguard our export markets, but our ecosystems and rural communities suffer from some of the policies that encourage specific agricultural practices. For example, our agricultural system relies heavily on irrigation (Fig. 1), continuous monocultures, and purchased inputs (fertilizers, pesticides, herbicides, farm machinery, etc.) but ignores most of the laws that govern natural ecosystems and, by extension, also stable agro-ecosystems. Many of our practices have negative impacts on the environment: fertilizer runoff causes enormous problems in our riparian systems and our cheap meat policies (financial incentives through tax policy for concentrated animal husbandry, cheap grazing rights, and low commodity prices), also have serious negative environmental consequences. According to Zimdahl (2002): "Agriculture has been so confident in its narrow pursuit of increased produc-

tion that its practitioners have frequently failed to listen to and to understand, the position of others (e.g. environmental groups, modern agrarians, organic practitioners). Agriculturalists have not taken the time to articulate any value position other than the value of production." Although production is an excellent goal, the challenge that faces us in the 21st century is to make the transition from production agriculture to agricultural sustainability. This transition will require substantial institutional innovation (Ruttan, 1999).

Those who challenge the production paradigm with its low commodity prices need to consider how their views play out in the developing world. Today, hundreds of millions of subsistence farmers in developing countries are food insecure and the concept of stewardship—although highly relevant to their future—is not relevant in their everyday lives. They feel exactly the same way as our ancestors did: just a bit more production to pay for a small tractor and schoolbooks for the children. In tropical regions where population pressures are high, subsistence farmers are driven to cultivate ecologically fragile areas such as erosion-prone slopes. How should they balance their short-term needs (production) with the long-term needs of future generations? How can we help them and, therefore, ourselves move toward a sustainable future?

THE EMERGENCE OF "SUSTAINABILITY" AS A GUIDING CONCEPT

The publication in 1962 of Rachel Carson's "Silent Spring" (Carson, 1962) was a defining event in our agricultural and environmental thinking. It forcefully brought home the point that agricultural practices are detrimental to the environment (and our health) and that our present methods of producing food may not be sustainable. Agriculture requires not only the replacement of natural ecosystems with crop fields and tree farms (with accompanying loss of biodiversity and massive carbon dioxide release) but results in groundwater pollution, soil erosion, aquifer depletion, soil degradation, pesticide pollution, and other environmental stresses. In the last one-half of the 20th century, a different model emerged from developed countries: sustainable and multifunctional agriculture. In these places, farming is not just about cheap wholesome food but about stewardship of the land, preservation of the resource base, the health of farm workers, the preservation of the small biota that are rich in biodiversity and are interspersed with fields, the value of rural communities, and, in Europe, the value of the agricultural landscape. They are putting into action Rachel Carson's message, which was: "It's about sustainability, stupid!"

Sustainability is a slippery entity because one can define it at so many levels. A widely accepted definition is that of the 1987 Brundtland Report: "sus-



Figure 2. There are nearly 800 million people today who live on less than U.S. \$1 per day, and most of them are food insecure. Whether people live on the streets of Calcutta, as in this photo, or in the streets of Los Angeles, cheap agricultural commodity prices make it easier for governments or non-governmental organizations (NGOs) to feed them. Research and government policies that promote cheap commodities, therefore, have both positive and negative outcomes. Photo by G. Bizzarri, courtesy of the United Nations Food and Agriculture Organization.

tainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987). But what has to be sustained? Only the resources for agriculture (cheap energy to produce nitrogen fertilizer and water for irrigation), or are we also talking about ecological sustainability (carbon and nitrogen cycles, hydrological cycles, and global climate change) or Gaia itself? Beyond these ecological considerations, there is social sustainability, which refers to the sustainability of the rural community structure. What do we mean when we say that we want to make agriculture sustainable?

The practices that have evolved to support production agriculture (low commodity prices made possible by efficient large-scale farms) are seen by many as unsustainable and inimical to stewardship of the land (for example, see Gliessman, 2000). However abandoning production agriculture, which many consumers espouse as correct, has a flip side: in the global marketplace, low commodity prices certainly benefit the poor—especially those living in the overcrowded cities of developing countries (Fig. 2). Also in developed countries, cheap food permits governments and private organizations to provide food for the poor (for example, in the United States through food stamps and "soup kitchens").

Thus, here are the outlines of an ethical debate: Is the health of rural communities in developed countries and the desire to please certain consumers more important than the food security of millions in developing countries? We can put this differently: From an ethical viewpoint, agricultural sustainability in the developed world may depend also on increasing food production in the developing world, so that the agricultural practices that foster rock-bottom commodity prices become unnecessary. Rapid agricultural development in developing countries would

have enormous economic and political benefits both in the developed and the developing world.

A POLITICAL DIMENSION

Production agriculture as we now know it in the United States and Europe is heavily dependent on government subsidies. Subsidies keep commodity prices low by paying farmers for their products at prices that can be well above those that they would receive on the world markets. On average, European farmers now receive one-half of their income from subsidies. In the United States, the average is closer to 25%. Most of the U.S. subsidies go to corn and soybean farmers to sustain our exports and cheap meat and dairy prices. Therefore, we enter into the political realm of production supports, export subsidies, and tariffs.

All countries have tariffs, but domestic support for agriculture and export subsidies are typical only of developed countries: They can afford to pay their farmers, whereas poorer developing countries cannot. According to the estimates of the Organisation for Economic Cooperation and Development, the developed countries support agriculture annually in excess of US \$300 billion (<http://www.oecd.org/xls/M00022000/M00022536.xls>) with half this amount coming from the taxpayers.

Agricultural subsidies at home often run counter to the stated desire of that country to help agricultural development in the Third World. Agricultural development in poor countries is impossible unless the resulting agriculture is profitable for the farmers. This means that their governments should promote the type of development that allows city dwellers to have access to cheap food produced by their own farmers. Globalization means that that food will have to be sold at competitive prices, and this transition for any country would be painful and slow. Are we doing enough

to help poor countries through this difficult transition to independence in their food production?

What if our subsidies were used to achieve agricultural sustainability here and in the Third World? According to Tilman et al. (2002): "One major step (toward sustainable agriculture) would be achieved were agricultural subsidies in the United States, EU and Japan redirected toward sustainable practices." At the moment, we still invest only modestly in research that will push agriculture toward sustainability, and we do not use our subsidies to bring about this transformation, although the picture may be changing in Europe. The United States supports soil conservation measures, and in the 1980s, more than 10 million ha of highly erodible land were put in the Conservation Reserve. Nevertheless, subsidies now very much reinforce the status quo of farming practices (e.g. monocultures), whereas they could be used to help change those practices. In addition, we could invest in developing agricultural systems for tropical and semi-tropical regions that would raise productivity there in a sustainable way. Because agricultural development in less developed countries is an absolute requirement for general development (see Eicher and Staatz, 1998), it is likely that this would narrow the gap between rich and poor and enhance the security of our country in the long term. There is plenty of room for ethical choices in this area.

HOW SHOULD THE BENEFITS OF NEW TECHNOLOGIES BE CALCULATED?

In deciding whether certain developments or technologies are "good," we look at outcomes—the benefits. But how should these benefits be calculated? Benefits for whom and for how long? Many, especially in Europe, believe that our actions should be guided by the "precautionary principle," which in its simplest form says "when you are not absolutely sure about the consequences, do not introduce a new technology." Should this principle be used as a moral absolute or simply as a guideline for our actions? Those who oppose the new agricultural biotechnologies want to invoke the precautionary principle as a moral absolute. Should we have waited with the introduction of DDT until all outcomes were clear or was the saving of untold lives worth it? Adhering strictly to the precautionary principle stifles innovation and runs contrary to the human desire to innovate so as to better our lot on Earth.

Whenever a new technology is introduced, there will be winners and losers. The introduction of cars doomed the makers of horse-drawn carriages. Utilitarian ethics, which bases its decisions on doing the most good, has its limits. I alluded to one such limit—equity—in mentioning the Green Revolution that benefited many but also marginalized farm workers who lost their jobs because of mechanization or other developments. When introducing new tech-

nologies, government policies must carefully consider the fate of those who invariably are left behind.

To the extent that our work as research scientists contributes to agricultural development, we have a moral responsibility to explore the social and societal implications of our research. Will the genes we discover simply help production agriculture because of the nature of our agricultural-industrial system, or will they be used to make agriculture more sustainable? Again, engaging in the dialogue is central to guiding our way and to defining the most ethical path possible.

INTELLECTUAL PROPERTY RIGHTS

Intellectual property rights and patents are another subject of dialogue with ethical dimensions. Society encourages investment in research and development by allowing inventors to protect their discoveries with patents, giving them a specified number of years to recoup their investment. The reason controversy surrounds the patenting of genes and of seeds is that our relationship to food and farming is very different from our relationship to our telephone and the plant where it was manufactured. We readily understand our cellular phone is an "invention," but we balk at the notion that an entire gene family or a plant species constitute a patentable invention. Does the practice of patenting genes when we barely grasp their utility (although we may understand their biochemical function) encourage or inhibit research? It certainly encourages research in the industrial sector, but has the preoccupation of many universities with patent protection and licensing agreements become a distraction to researchers and an impediment to the free flow of ideas and materials?

The issue of equity also arises with respect to intellectual property rights and the ownership of genes and genomes. When industry or university researchers use germplasm from developing countries to isolate important genes, are they free to patent those genes without rewarding the indigenous peoples who have propagated the germplasm for centuries? Do those genes and the seeds that contain them belong to the indigenous people or to the person who "found" them and commercialized their use? Some argue that genes and genomes belong to all humankind and are too important to be restricted from free access and use by all. Perhaps the best example of this was the race to publish public databases for humans and *Arabidopsis* so that companies could not patent the basics of plant and human genomes: These dedicated scientists voted with their feet and made a united ethical stance for humanity.

WHERE DO WE GO FROM HERE?

The American Society of Plant Biologists (<http://www.aspb.org>), its two journals, and its Education

Foundation have all come out strongly in favor of genetically engineered crops. Other societies such as the Society for Developmental Biology (<http://sdb.bio.purdue.edu/>) and Federation of American Societies for Experimental Biology (<http://www.faseb.org/>) have come out with ethics statements on cloning. These professional societies inform legislators about these issues and have ethics statements on the technologies that their members employ. However, the ethical issues that face plant scientists are much broader than "Genetically Modified or Not Genetically Modified" but pertain to the entire complex of agricultural practices and to the transition from production to sustainability. Are professional societies the right ones to lead the way to a more ethical stance, or are they "in bed" with the biotechnology firms and, therefore, narrowly focused on certain issues? If not us, then who?

How to maintain a balanced perspective? We are outraged when Zambia rejects our (genetically engineered) corn in the midst of a drought-induced food security crisis. "Don't they understand risk benefit analysis?" we say indignantly. However, are we equally outraged when policies of our own governments promote production with subsidies but fail to address the larger issue of sustainability? In other words, is our concern limited to actions and outcomes in our limited sphere (the laboratory and our discipline) or can our ethical view be broader and our vision international, even global? Should the public relations efforts of our professional societies be limited to lobbying for more research funds, and if not, how do we ensure that they act with a broader ethical vision?

So far, the American Society of Plant Biologists Education Foundation has educated people about biotechnology and genetically modified crops.

Maybe the time has come to move to the bigger picture of where agriculture must go in the 21st century to feed 9 billion humans (see Tilman et al., 2002). In this regard, it is appropriate to remember the four food security goals of the International Food Policy Research Institute (Washington, DC), which envisions food security for all humanity. These goals are: (a) Every person has access to sufficient food to sustain a healthy and productive life; (b) Malnutrition is absent; (c) Food originates from efficient, effective, and low-cost food systems; and (d) Food production is compatible with sustainable natural resource use. In the final analysis, in addition to working on tangible enforceable policies and educating both ourselves and the public, we all must evolve our own personal social consciousness to be equipped to deal fairly and ethically with our changing world.

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