PERSPECTIVE

Sustainable Agriculture and Environment - An Ethical Perspective

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Abstract

Agriculture is the largest, most important interaction between humans and the environment. It is an essential human activity. Humans, the Earth's dominant species. Usually, know what we are doing, but we often do not know what we may be undoing. This paper will briefly address some of agriculture's major problems: sustainability, land, production, water, antibiotics, genetic modification, and technology. It asks two questions: How do you know what to do in agriculture and life? How do you know what you choose to do the right thing to do?
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Introduction

In my younger years I tried to develop some expertise as a weed scientist. I studied the kinetics of herbicide degradation in soil and weed control in agronomic crops. It was interesting and enjoyable work but because of the issues raised by the Vietnam War, Agent Orange, the environmental movement, and the development of organic agriculture, I was compelled to begin to study moral philosophy.

Philosophy attempts to achieve a wide perspective of life and reality. We study history and philosophy to find out what man is, which we can't learn from science. Philosophers who study moral philosophy and ethics don't tell us what is right and wrong. They show us how to think about what is right and wrong. Today the family has been weakened, religion has been weakened, our educational system is discouraged by class and race war, public opinion loses force through division, fear, apathy and worship of wealth. Even sex seems to be in chaos.

Whether one lives in a developed or developing country, whether one is rich or poor, male or female, formally educated or not, we live in a post-industrial, information-age society. We live in an era of scientific achievement and technological progress, unequalled in human history, which has created the good life many of us, but not all, enjoy and some of the problems from which we suffer.

The achievements include: waking up in the morning to music from your cell phone, preparing breakfast in your microwave as you review the news on your tablet computer, which gives you nearly instant access to information that is orders of magnitude greater than the resources of most of the world's libraries. Many benefit from medical advances that cure what used to kill or cripple. Immunization prevents childhood diseases. Smallpox has been eliminated and polio may be in the near future. We routinely travel at speeds and convenience that were unknown to our grandparents. Finally, for many, but sadly not for all, there is abundant food.

The problems include global climate change, which affects mean temperature, rainfall amounts, and seasonal distribution. Pollution of all forms; social inequality - 26 people on earth are worth the collective labour of more than three billion; and environmental degradation. Agriculture's additional problems and challenges include maintaining production, managing pesticide resistance, loss of biodiversity, and invasive species, addressing concerns about biotech/GMO's, and sustainability. Many know and benefit from the achievements of agricultural science but are concerned about the problems the science and technology have created

We live in a world where progress is frequently equated with growth, which is generally regarded as good. Many want more of the good things of life. We expect the future to be bigger, better, easier, and faster. Many aspects of our lives are changing faster than we are able to keep up.

We may not always know our destination, but we are going there in a hurry. We believe in the efficacy of science and technology, which promises to solve the problems of society, agriculture, and industry. Many involved in agriculture believe that development and use of more and more energy dependent technology is always good and more will be better. The problems caused by the unintended consequences of technology will, many are certain, be solved by improved technology.

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I do not mean to imply that we should abandon science and technology. We humans, the earth's dominant species, are not just figures in the landscape — we are shapers of the landscape (Bronowski 1973, p.19). Having achieved this power, we should think carefully about whether our shaping of the landscape is desirable and sustainable. Although we often know what we are doing, we should consider what we may be undoing. We must develop in ourselves and our students critical thinking about the moral dimensions of what we do and undo.

With that brief introduction I ask two questions (Zimdahl, 2012) that I frequently ask myself: How do you know what to do in agriculture and in life? And how do you know what you choose to do is the right thing to do? How do we decide what to do?

Norman Borlaug (2000 winner of the World Food Prize and Nobel Peace prize - 1970) cautioned that "…agricultural scientists have a moral obligation to warn the political, educational, and religious leaders about the magnitude and seriousness of the arable land, food, population, and environmental problems that lie ahead..."

Agricultural scientists pride themselves on the achievements of the green revolution, but they have not addressed the existing moral problems. The reason for ignoring them was that the costs associated with pollution, environmental damage, and harm to human health were justified by the production benefits. The problems caused by pesticides were unintentional developmental problems (Atreya et al., 2011). Since the mid-20th century the quality of agricultural science in the US has been evaluated almost exclusively in terms of its ability to deliver technological innovations. Agricultural scientists have improved crop production. However, when they claim credit for improving production and keeping the cost of food low, they must also accept society's right to hold them responsible for problems they have regarded as externalities[1]. Agricultural people need to ask and be prepared to respond to what they have not asked often enough—what could go wrong?

Agriculture, the essential human activity, is our most widespread interaction with the environment. We live in a post–industrial, information age society, but no one will ever live in a post-agricultural society. Continuing to justify all of agriculture's activities and technology by the necessity of achieving the moral obligation and the production challenge of feeding a growing population has not been and will not be a sufficient defense for agriculture's negative environmental and human effects (Mann, 2018).

[1] An externality is a cost that is not reflected in price, or more technically, a cost or benefit for which no market mechanism exists. It is a loss or gain in the welfare of one party resulting from an activity of another party, without there being any compensation for the loss. From a self-interested view, an externality is a secondary cost or benefit that does not affect the decision-maker.

Humans, the world's dominant species, are no longer just a part of nature; we are a force of nature "…that is disturbing and changing the climate and our planet's ecosystems at a pace and scope never seen before in human history…" (Friedman 2016, p. 87). "…We cannot rebuild the Greenland ice sheet, the Amazon rain forest, or the Great Barrier reef or the Koalas. When the macaws, the rhinos, and the orangutans are gone, no 3D printer will bring them back to life…" (Friedman 2016, p. 183).

I am compelled to add at this point that cultural diversity challenges the Western, particularly American belief, in the universal relevance of Western culture (Huntington 1996, p. 310). This belief holds that people in all societies want to adopt Western values, institutions, and practices. It suggests that people throughout the world should embrace Western values and culture because they embody the highest, most enlightened, most liberal, most rational, most modern, and most civilized thinking of humankind. It is my view that the Western belief in the universality of Western culture suffers three problems: it is false, it is immoral, and it is dangerous.

Concerns about Agriculture

1. Sustainability

Everyone is in favour of sustainability. Within the agricultural community to sustain usually means protecting the productive resource (soil, water, and gene pools). It is not clear why that legitimate goal always outranks sustaining environmental quality. Agriculture has a major responsibility because it is so widespread and has the potential to care for or harm so much land. This is a different view from protecting only the productive ability of land. Because of increasing urbanization, there will be less land to feed the expected 9+ billion who will soon be here. We create places for people to live and simultaneously destroy agricultural land. Concrete is the land's last use.

Land must be regarded as something more than other productive resources (fertilizer, machines, irrigation water, pesticides, or seed). To harm or destroy the land is to destroy something essential to life, and that certainly raises a moral question.

The pursuit of agricultural sustainability is commonly viewed as mainly or wholly a technical problem that simply requires changing farming methods and adopting new, alternative technologies. Agricultural system sustainability will not be accomplished by tinkering at the fringes with new technology. It will require re-thinking how we practice agriculture and emphasizing more than production.

Some believe that current agricultural practices may threaten future global food security and will have negative effects on global food production (Liu et al. 2015). The total agricultural area has decreased since 2000, pesticide consumption has increased, water use efficiency has increased. Available water sources are already being used for irrigation. In the US, 60% of irrigated crop production depends on groundwater (Siebert et al., 2010). It is forecast that agriculture's demand for water could rise to 10 to 13 trillion cubic meters by 2050, which is two and a half to three and a half times greater than the total human use of freshwater today (Fox and Fimeche, 2013). Water use for agriculture peaked in 1980 and has decreased every year since due to improved irrigation system efficiency, in spite of an increasing number of acres irrigated (Donnelly and Cooley, 2015).

Economic growth has acquired the power and scope of a new religion and it drives agricultural expansion (Worster, 2016, p. 147). Should there be limits to agricultural expansion?

2. Pesticides

The agricultural enterprise uses a vast array of synthetic organic chemicals to manage insects, weeds, fungi, and other organisms that sometimes just bother, and other times may cause significant yield losses and harm to humans. Pesticides have made it possible to feed a growing human population and protect millions of people from malaria and other insect- borne diseases. Of the pesticides used in the world, 80% are used in agriculture: approximately 40% are herbicides — (Kraehmer et al., 2014), 33% insecticides, and 10% fungicides. Sales and use have been expanding rapidly throughout the world, although the development of new modes of actions has become rare (Lamberth et al., 2013).

There is no question that pesticides increase crop yields and may harm the environment, people, and other creatures. For example, there are 42% fewer species of invertebrates in streams with severe pesticide contamination and 85% fewer new queens in beehives exposed to pesticides. Pesticides have been aggressively promoted and are generally accepted within the agricultural community, as

essential to maintaining yields and feeding a growing world population. There are also legitimate global human rights concerns because of their detrimental effects. The UN General Assembly (2017) report denies the claim that pesticides are necessary to feed the world and regards them as a short-term, unsustainable solution.

A common view among the general public is that synthetic, organic chemical pesticides are dangerous, overused, and should not be present in food, soil, and water. It is also widely acknowledged within the agricultural community that they have made our lives easier and more enjoyable by reducing mosquito, ant, and cockroach populations (Enserink et al., 2013). In spite of the 2015 conclusion of the International Agency for Research on Cancer that glyphosate probably causes cancer, more than 94% of soybeans and roughly 90% of cotton and corn grown the United States are resistant to glyphosate. In 2000 in the US, 287 million pounds were sprayed - 20 times more than in 1992. Roundup's sales have proved resistant to lawsuits.

Modern pest management is highly dependent on pesticide science. Weed science has been slow to "catch up" with progress toward precision agriculture that has been made in irrigation and fertilizer management (Reddy and James 2018). It is clear from any current issue of Weed Science and Weed Technology that herbicides continue to dominate weed science research and lead to one of agriculture's moral dilemmas. True integrated weed management requires a high level of plant ecological and biological knowledge, technological machinery, and decision-making algorithms that can respond rapidly to changes in weeds and the environment Young (2018).

3. Antibiotics

There is great concern about the increasing incidence of poor performance of antibiotics for treatment of human diseases due to bacterial resistance because of their use in livestock enterprises. It is estimated that approximately 80% (a disputed number) of all antibiotics used in the US are fed to farm animals.

There is disagreement about the quantity and patterns of antibiotic use in food animals. These very effective, necessary medicinal products originally developed to protect human health, have become less and less useful as resistance to them has become more common due to widespread use in animal/poultry production for disease prevention and growth promotion and over-prescribing for human problems. It is estimated that global antimicrobial use in food animals could increase 67% by 2030 (Van Boeckel et al., 2015) One can argue that antibiotics helped to create modern agriculture and changed the way we eat (McKenna, 2017)**.**

4. Loss of biodiversity

There is a well-documented, continuing loss of ecological biodiversity, species, and genetic diversity. Between 0.01 and 0.1% of all known species become extinct every year. If the low estimate is correct, we are losing between 200 and 2,000 species every year. If the high estimate is correct, the earth is losing between 10,000 and 100,000. The earth is undergoing a sixth extinction (Kolbert 2014). Between 1.4 and 1.8 million species have been identified. We don't know how many more there may be. One estimate is 8.7 million species on our planet. The high estimate is 100 million. It is important to know that we don't know how many species the earth has. Therefore, it is hard to know how many are being lost. Scientists estimate that we are losing species at a rate 1,000 to 10,000 times higher than the natural extinction rate, the rate that would occur if humans were not involved.

5. Biotechnology and GMOs

The first genetically modified crops were planted in 1996. The initial global area was 1.7 million ha. In 2019, after 23 years, the biotech area is 2.5 billion ha - the most rapidly adopted crop technology in recent times. Agricultural scientists have been using conventional plant breeding techniques to improve food crops for hundreds of years to create plants that have higher yield and are more responsive to fertilizer. However, an intense debate continues about GMOs. Both sides are convinced they are right, and the others are wrong, at least partially misinformed, and don't understand. Many argue that misinformation and over-regulation are stopping or slowing GM foods with the potential to save lives. They claim that the technology is proven, and rigorous safety studies have been done. Partisans on both sides are convinced they are in an all-or-nothing battle.

The proponents have faith that limitless technological progress will finally solve the problem of feeding a growing population. Science will solve the problems. Others deny this and claim that "it is likely that there will be a permanent difference in opinion that cannot be solved with more data or new facts"

(Mampuys and Brom, 2015). Others remind us that many of those who see only the benefits of biotechnology do not remember or refuse to acknowledge, that nature "…requires respect, a kind of reverence, and deference before Nature's ultimately mysterious forms and processes…" (Berry 2017, p. 211).

I suggest this is correct and reflects past optimism about human and environmental safety, which was proclaimed by the agro-chemical industry and, which was ultimately proven to be wrong. The current strategy is unlikely to solve the problems and the focus should shift to "managing permanent different viewpoints and providing a platform for a broader conversation on agriculture and food production" (Mampuys and Brom 2015). Proponents claim that it is not unjust to use GMO's to alleviate hunger and malnutrition and achieve the goal of feeding an expanding population (Toft 2012), a reasonable argument that is weakened because more than half of the US general public (57%) say that GM foods are generally unsafe to eat. It is an enduring gap between the public and scientists and depicts a moral challenge for the agricultural community. It is not an argument to determine who is right and wrong. It should be seen as a discussion that seeks understanding between right and right points of view.

The comment of James Davidson (Emeritus Vice President for Agriculture and Natural Resources, University of Florida) illustrates the agricultural community's optimism and difficulty of responding to past errors (Kirschenmann, 2010). Davidson's comment lends support to those who believe that GMO's portend other problems which agriculture's practitioners will have to recognize and eventually apologize for.

With the publication of Rachel Carson's book entitled *Silent Spring* (Carson, 1962) we, in the agricultural community, loudly and in unison, stated that pesticides did not contaminate the environment— we now admit they do.

When confronted with the presence of nitrates in groundwater, we responded that it was not possible for nitrates from commercial fertilizer to reach groundwater in excess of 10 parts per million under normal productive agricultural systems— we now admit they do.

When questioned about the presence of pesticides in food and food quality, we reassured the public that if the pesticide was applied in compliance with the label, agricultural products would be free of pesticides— we now admit they are not.

The claim that GM crops will feed growing numbers of people in the third world has great moral appeal. It is responsible, even altruistic. But the claim is deeply misleading because it is based on the incorrect but popular assumption that we don't produce enough food to feed starving people.

People are hungry because they do not have enough money to buy food, do not have access to land to grow food, or do not live in a country where the government provides adequate help. Agricultural scientists have essentially said to the public, trust us, we know what we're doing.

6. The environment

Some claim that agriculture encroaches on and harms the natural environment (Berry, 1977; Brei, 2013, Gebhard et al., 2015). Over the last 200 years an estimated 30% of US farmland has been abandoned because of erosion, salinization, and waterlogging. Since the 1960s one third of the world's arable land has been lost to erosion. Some US crop land loses soil, the essential agricultural resource, at an average rate of 5 tons/acre/year from water and wind erosion (Jackson, 2000).

If these are only concerns of a radical fringe of society, they may be ignored. But if they are general societal concerns about agriculture that justifies everything because it increases production, then we - agriculture's practitioners - have a responsibility to ourselves and to society to confront, discuss, and debate the issues of concern - our ethical dilemmas. We must ask and be willing to discuss whether or not production is a sufficient criterion. Does increased production justify all agricultural practices?

Concluding Comments

Within the agricultural community, feeding the 9+ billion is the primary, if not the only, goal that justifies technological innovation. Demographers agree that there will be nine billion inhabitants on the earth. They also agree that while the rate of population growth has and continues to decline the population will not stop growing when it reaches nine billion. Agriculture's practitioners and the agricultural industry must feed 228,000 more people today than yesterday.

The social, environmental, and economic costs of a developed country's capital, energy, and chemically dependent agricultural system, and the challenge of sustaining the environment and other

species are recognized as important, but the necessity of increasing production dominates the agricultural domain. Feeding 9+ billion is undeniably a good thing, but is it only a production problem? The world now produces enough food to feed everyone a minimally adequate daily diet. Feeding all is partly a production challenge, but it is also a distribution, waste, and poverty problem.

It is becoming obvious to anyone who listens to, reads, or watches the news that citizens of many societies are becoming reluctant to entrust their water, their diets, and their natural resources blindly into the hands of farmers, agribusiness firms, and agricultural scientists.

Ethicists and agricultural practitioners must participate in the dialog that leads to social consensus about risks. In the past most of the risk was borne by users of the technology. Now there is widespread concern that the risks and short- and long-term consequences of agricultural technology are borne by others. Agriculturalists must begin to contribute the time and resources needed to listen and understand their positions and those of their fellow citizens. For most non-agricultural segments of society, these are not new demands. For agriculture they are. First, we must listen. Then we learn. Then we help. Only then can we lead.

Because agriculture is the essential human activity, it is essential that it rest on a firm ethical foundation. It is not just about results. The prevailing assumption within the agricultural enterprise is that technological solutions will continue to reduce and eventually eliminate hunger because the productive progress of the green revolution was proof that the key to agricultural success was faith in scientific knowledge and technological know how.

The dominant focus of those involved in agriculture is how to achieve the moral obligation and challenge of feeding the human population projected to be 10-12 billion by 2,100. However, many people throughout the world, in both developed and developing countries, have concerns about agriculture and our food system that have ethical dimensions beyond the central need to feed humanity. Agriculture's manifold responsibilities include the following:

Achieving sustainability.

Addressing corporate farming and the power and lack of transparency of agri-business and corporate food processors, the effects of and public concern about biotechnology and GMO's, the loss of crop genetic diversity, the loss of small farms and rural communities, and the nutritional value of foods provided by the food system.

Assuring future availability of surface and ground water.

Preventing cruelty to animals, exploitation and inhumane treatment of farm labour, habitat destruction, harm to other species, and pollution of water, soil, and humans.

All of agriculture is involved in ethical questions. What should be done? How should it be done? Who should be considered? The way agriculture is practiced, development projects are chosen and conducted, and the kind of research and teaching done involves scientific and ethical values and a view of a future we expect, desire, or fear. Because agriculture is the essential human activity, it must rest on a firm ethical foundation.

What is the right thing to do?

From an ethical perspective, feeding the growing world population is clearly a very good thing, but it does not absolve the agricultural community from critical, ethical examination of the totality of agriculture's effects.

What can our universities do?

A place (Zimdahl, 2000, Zimdahl and Holtzer, 2018) to begin is the classroom. The agricultural curriculum lacks courses in agricultural ethics that focus on general ethical principles, their application to agricultural issues, and ethical expectations of agricultural professionals. Such courses are available at only nine US universities with agricultural colleges. It was fifteen in 1999.

I suggest this is because those who determine curricula and advise undergraduates do not regard studying the ethical values of agriculture as important preparation for agricultural professionals. Classes on agricultural ethics and encouraging students to enrol will not alone quickly increase the emphasis on agricultural ethics. They will be a recognition of the need for agriculture to recognize and discuss its ethical dimensions. Agriculture's economic problems have focused attention on production while our education and practice have ignored agriculture's human dimensions.

I conclude with two questions and a bit of advice. How do you know what to do in agriculture and in life? How do you know what you choose to do is the right thing to do? There is no reasonable moral argument that requires you to do something you are

not able to do. I suggest you are able to do something about agriculture's ethical dilemmas. As you go the way of life, you will often encounter great intellectual chasms. Jump. They're not as wide as you think.

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