

## ETHICS FOR WEED SCIENCE

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### ABSTRACT

*Those engaged in agriculture including the sub-discipline - weed science possess a definite but unexamined moral confidence or certainty about the correctness of what they do. This paper examines the origins of that confidence and questions its continued validity. The basis of the moral confidence is not obvious to those who have it, or to the public. In fact the moral confidence that pervades agriculture and weed science is potentially harmful because it is unexamined. This paper advocates analysis of what it is about agriculture's moral confidence and its interactions with the greater society that inhibits or limits agriculture's development and contributions. All engaged in agriculture should strive to nourish and strengthen the aspects of agriculture that are beneficial and change those that are not. To do this we must be confident to study ourselves, our institutions, and be dedicated to the task of modifying the goals of both.*

**Keywords:** Weed science, work ethics, agriculture

### INTRODUCTION

I begin with a story and a conundrum (a puzzle). In his 1999 book, "The Lexus and the Olive Tree", Thomas Friedman, the New York Times Chief Foreign Correspondent, tells about the lion and the gazelle. He said, "Every night lions go to sleep knowing that in the morning when the sun comes up, if they can't outrun the slowest gazelle, they will go hungry. Every night gazelles go to sleep knowing that in the morning, when the sun comes up, if they can't outrun the fastest lion, they will be eaten. The one thing lions and the gazelles both know when they go to sleep each night is that in the morning, when the sun comes up, they had better start running".

My observation is that many colleagues in agriculture are in a hurry; they are running. Everyone seems to be in a hurry to get to work, to lunch, to get home. Life is going too fast. There is not enough time to do all that must be done and very little time left to do what one wants to do. We drive and walk as we speak on our cell phones. We multi-task, work at the office and at home.

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Why are we running? The lion and the gazelle know why they are running. I am not sure we know either why we are running or where we are going. People in developed countries are, on average, 4<sup>1/2</sup> times richer than their great-grandparents were at the end of the 19th century. But, they are not 4<sup>1/2</sup> times happier. Greater consumption and more running have not made consumers any happier.

As we run to do so many things, we are trapped by the Conundrum of Consumption. A conundrum is a puzzle that has no satisfactory solution. The conundrum of consumption is an ethical and environmental problem. The conundrum is: limiting the consumer life-style to those in our world who have already attained it is not politically possible, ecologically sufficient, or ethically defensible.

The puzzle (the conundrum) is that if the life-style of developed nations is extended to all who want it, and many do, it will hasten the demise of the ecosystem that all are dependent on *and* it is ethically wrong to harm the system life depends on.

When you get up tomorrow morning, probably sometime after the sun comes up and you begin another busy day, perhaps with a running start, I suggest you think about where you are going and why you are running. We run in our scientific careers to do the experiments, write the papers, or get a grant. We run in our personal life to balance family and work, to care for others, and provide a good life for those we love. We run in our ethical life as we struggle to determine how to know what we ought to do. I ask myself and encourage you to ask if your running, your haste, causes you to miss important things.

Moving to the ethical realm and ethical assumptions, I ask "Does your running lead to greater happiness for you and others? Is achieving happiness for others something we simply assume will follow from our work? Should happiness for others be a goal of our work?"

I think all people may achieve the greatest happiness for themselves and others when their lives and work develop a capacity to feel the pain of other humans. The ethical position of agricultural science and of your research and teaching has a role in creating more or less happiness in the world. It is up to us.

Agricultural scientists have assumed that as long as our research and the resultant technology increased food production and availability, agriculture and its practitioners were somehow exempt from negotiating and re-negotiating the moral bargain that is the foundation of the modern democratic state (Thompson, 1989). It is a moral good to feed people and agriculture does that. Therefore, we assume that anyone who questions the morality of our acts or our technology simply doesn't understand the importance of what we do. We assume that we are technically capable and that the good results

of our technology make us morally correct. Berry (1981) questions our assumption and reminds us of our obligation. We have lived by the assumption that what was good for us would be good for the world. We have been wrong. For it is only on the condition of humility and reverence before the world that our species will be able to remain in it.

### **How Do We Know What To Do?**

An important question is - In view of the Conundrum of Consumption: "How do we know what to do?"

During what is called the axial age (900 to 200 BCE) all four of the world's major religions developed (Islam, Christianity, Hinduism, and Buddhism). Geniuses pioneered entirely new kinds of human experiences. Analysis of the time and what was created shows that what mattered in all religions was not what you believed, not your faith, but how you behaved. Religion was about doing things that changed you. It is one way to determine the right thing to do. By doing, by acting in the world, one can commit to an ethical life. Without self-understanding and self-sacrifice that are part of an ethical life, we will not progress toward the mutual goal of peace.

By the 17<sup>th</sup> century the scientific revolution marked the beginning of a whole new cosmology and world view that characterizes modern science. Traditional religious beliefs were not rejected but were seen as only indirectly relevant to understanding the natural world. They were no longer the only way to determine the right thing to do.

Comments about how all religions were concerned with doing things that changed you and determining the right thing to do may seem strange inclusions in a talk about ethics for weed science. But they are a useful example of how to determine the right thing to do, how to behave, how to become ethical scientists.

Ethics is also about doing things that change you. Ethical standards lead to the moral life - to live for others. To look beyond self-interest and extend one's activities to include others are common to all religious traditions<sup>1</sup>.

Ethical standards guide people toward abandoning greed, selfishness, violence, and hatred and accepting an obligation to be compassionate toward their fellow humans. If one's ethical standards compel acting compassionately, to feed the hungry, give drink to the thirsty, welcome the stranger, and visit the imprisoned, regardless of who they are or why they are hungry, thirsty, strange, or imprisoned,

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<sup>1</sup>**Islam** - No one of you is a believer until he loves for his brother what he loves for himself, **Christianity** - All things whatsoever ye would that men should do to you, do ye even unto them, **Confucianism** - Never do to others what you would not like them to do to you, **Judaism** - Thou shalt love thy neighbor as thyself, **Hinduism** - Men gifted with intelligence...should always treat others as they themselves wish to be treated, **Taoism** - Regard your neighbor's gain as your own gain, and regard your neighbor's loss as your own loss.

then such people are good, helpful, and sound. This may be one of the best tests of our ethical behavior in life and in the practice of agriculture.

However, I always ask myself, "How can I determine what to do? How do I know that what I choose to do is the right thing?" My task is to address and perhaps answer those questions. Scientists know what to do through experiments. The scientific **empiricist** goes and looks. We can know **pragmatically**. We test validity by practical results. What works best? Or we can be **skeptical** where the truth must always be in question. Each of these is an acceptable way to determine what is right.

There are other, more common, ways that many people use. We rely on **authority** - the government or a parent (My father says...). We rely on **tradition** - we have always done it this way in my family, church, or community, or in my university or research center. We rely on **legal authority** - it's the law! We can know by **revealed truth** - found in religion. The latter is often done without examination to determine if we think we see the whole world when we tend, often in spite of our best efforts, to see only one aspect and think we have grasped the whole.

Finally, and of greatest importance this morning, we can know what is right by **reason**. Reason is the ability to think, form judgments, and draw conclusions. It requires thought and judgment based on logic and sound reasons. It is not easy.

Many ignore the simple test of their work - their ethical standard. What are the results? If their ethical standard makes them intolerant and unkind, the results are not good, independent of profit, crop yield, or scientific prestige. If, on the other hand one's ethical standards compel acting compassionately toward others (feed the hungry, give drink to the thirsty, welcome the stranger and visit the imprisoned, regardless of who they are or why they are hungry, thirsty, strange, or imprisoned,) then such people are good.

We are all born with a sense of what is right and wrong, but that sense is often unexamined and not supported by careful reasoning. We must strive to be good in our personal lives and in our science.

The truest test of the moral condition of any scientific or other discipline is its willingness to examine its moral condition. As one explores agriculture's dilemmas to determine what ought to be done rather than just what can be done, one finds surprising agreement about the standards used to decide what ought to be done. When we know the right and wrong things to do, there will still be conflicts, and there will still be choices as we seek answers to agriculture's complex problems. There are often no easy choices between what is ethical and clearly not ethical. The choice is between two alternatives, neither of

which is all bad. And the end result of choosing is often not clear when the choice has to be made. Moral dilemmas are common and we need an ethical foundation to guide decisions between two choices where each has strong supporting arguments. For example: (1) Should we increase agricultural production, to feed more people, regardless of the environmental harm the technology that creates the production causes?; (2) Should we raise animals in confinement if it is harmful to the animals but makes meat cheaper for consumers?; (3) Should we mine water from deep aquifers or the Indus river to maintain irrigated farms in dry land areas even though the production system is not sustainable?; (4) Should we change soybean production systems to decrease soil erosion?; (5) Should we decrease nitrogen fertilizer use to reduce effects on fish and ecological stability?; (6) Should family farms be protected or allowed to die because they are economically inefficient, that is, they can't make sufficient profit?; (7) Should the US give more or less food aid to developing countries?; (8) Should we accept or reject agricultural biotechnology?; and (9) Should we reduce herbicide and other pesticide use?

All the things in this partial list are difficult dilemmas for agriculture and each has a moral dimension. They are not just scientific questions. It is time for all involved in agriculture to think about and address the ethical dimensions of these and similar questions. It is our responsibility to provide the next generation of agriculture's practitioners, scientists and teachers with the intellectual tools required to guide decisions about agriculture's existing and future ethical dilemmas (Chrispeels, 2004).

However, my task today is not to comment on weed management. My task is to provide reasons for moral examination of our science and comment on how it can be done. I begin with three points about science and agriculture, *viz.* (1) Those engaged in agriculture are certain about the moral correctness, the goodness, of their activity; (2) The basis of that moral certainty (the supporting reasons) is not obvious to those who have it, and (3) In fact, agriculture's moral certainty is potentially harmful because it is unexamined by most of its practitioners.

Moral certainty and lack of moral debate inhibit discussion about what agriculture ought to do. Discussions of moral dilemmas will lead to foundational moral theories that provide a guide for change. These theories are guides, not absolute rules. They are the invisible, foundation on which our actions rest. Exploration of the moral certainty posited for agriculture will reveal several principles that can be used to answer important questions about agricultural practices.

### **The Benefits and Costs of Modern Agriculture**

The success of modern agriculture may be the greatest story never told (Sidey, 1998). Few segments of the world's scientific-

technological enterprise have such an impressive record. Developed country agriculture is a productive marvel and is envied by many societies where hunger rather than abundance dominates. Science and technology have created steady yield increases through development of higher yielding cultivars, synthetic fertilizers, better soil management, mechanization, and improved pest control (including weeds). Without yield increases since 1960, 10 to 12 million square miles would be required (roughly the land area of the U.S., the European Union and Brazil) to achieve present food production (Avery, 1997). Modern high yield agriculture may not be one of the world's problems but rather the solution to providing sufficient food for all, sufficient land for wildlife, and protecting the environment.

Agricultural producers are proud of these achievements. In the USA, the food production system is part of a large, vertically integrated commercial system (Blatz, 1995). The family farm as an independent and self-supporting entity is dying. As the number of farmers decreases, land in agriculture remains nearly constant because farm size increases. I suspect a similar, slower process in Pakistan: agriculture accounts for 25% of GDP, supports 3/4 of the people, and employs 1/2 the labor force.

When small farms and farmers disappear it is usually regarded as progress. There is little concern for the effects of the profit driven system that harms small farmers on the environment on which agriculture and life are dependent. The monetary rewards of the modern agricultural system have been good for the survivors. The social rewards of belonging to a caring community, the spiritual satisfaction of serving a larger public purpose, the communities and the businesses they need and support have been sacrificed to the bottom line (Goldschmidt, 1998). This is neither necessary nor desirable.

Successful agriculture has become a business in which producers seek high production at low cost. Agriculture in developed countries has become industrialized in terms of its size and methods of operation and in its values. The purpose is to produce as much as possible at the lowest cost of capital and labor to generate maximum profit (Blatz, 1995). Production is agriculture's and weed science's single, dominant ethical principle. We have a produce as much as possible ethic

Claims of agricultural abundance are true in many societies. No society should assume its agricultural abundance is assured. The system that produces food should not be treated as one that can manufacture abundance at will (Blatz, 1995). As you know, the weeds will always be with us.

When the foundational values of the any production system ignore protection of the land, maintenance of water quality, and, biodiversity its values are questionable. These are essential parts of production and maintenance of life. When we and the agricultural

system regard food as just another industrial commodity that can be purchased by those with money, then the ethics of the system ought to be, and will become, a subject of societal concern.

It is not surprising that the endless pursuit of production and the associated technology conflict with societal values (Thompson, 1989). Agricultural and weed science technology have exposed people to risk. In the past most of the risks of agricultural technology were borne by the user. Now many risks are borne by others. Technology developers, and users, in their moral certainty, have not secured or even considered how to secure the public's consent to use technology that exposes people to involuntary risk (Thompson, 1989). Agricultural producers and the scientific community that supports them by developing technology have been seduced into thinking that, so long as they increased food availability, they were exempt from negotiating the moral bargain that is a foundation of modern democracies. Thoughtful people will not entrust their water, their diets, or their natural resources blindly into the hands of farmers, agribusiness firms, and agricultural scientists. Agricultural people must participate in the dialog that leads to social consensus about risks. They must be willing to understand the positions of their fellow citizens. For most non-agricultural segments of society, these are not new demands. For agriculture and weed science, they are. All who practice agriculture (e.g., farmers, scientists) have been so certain of the moral correctness of their pursuit of increased production that they failed to listen to and understand the positions of other interest groups (e.g., environmental, organic). Agriculturalists have not developed any value position other than the value of production and have not offered reasons why production ought to retain its primacy.

#### **Goals for Agriculture and Weed Science**

Production of abundant food and fiber must remain a dominant goal. However, we ought to ask what other goals should be considered and when and why one or more of these may take precedence over production. I do not have time to present all possible goals and will deal only with social and environmental goals.

#### **Social Goals for Weed Science**

Aiken (1984) suggested that sustainable, environmentally safe production that meet human needs, and contributes to a just social order may be of greater moral importance than profitable production. This is not the dominant view in agriculture or among weed scientists. Few agricultural voices speak of a just social order. There is no objection to achieving a just social order but it is not my job!

Many in agriculture think sustainability can be achieved by modification of the present, successful system. Achieving sustainability is thought of as a scientific problem. However, because agriculture is the largest and most widespread human interaction with the

environment, achieving sustainability will have social and ecological effects.

Agricultural markets are powerful mechanisms, but often they are not just. If they were just, then my country, the world's richest nation, would not have hungry people. Producers need to recognize the connection between what they produce, the market that distributes it, and justice for all. Agricultural and weed scientists speak loudly about production and markets but are usually silent on justice.

As family farms and rural communities disappear, the virtues they instilled in past generations (love thy neighbor, be kind to animals, help those in need, etc.) are still valued by society. One way to encourage these virtues is for them to be prominently displayed in the social purpose of an economically central activity such as agriculture. To accomplish this, all agricultural and weed scientists are going to have to abandon the singular pursuit of production as their only goal and incorporate social goals as part of agriculture. This necessitates developing and then debating the reasons that determine what the right goals are.

#### **Environmental Goals for Agriculture**

Environmental goals for agriculture are linked to social goals. Sustainability is regarded by those in agriculture as primarily a production and secondarily an environmental goal, but others see it as a social goal. The view depends on what one wants to sustain. In agriculture, to sustain usually means protecting the productive resource (soil, water, gene pools) and maintaining production. Others argue the productive resource is important, but ranks below sustaining environmental quality, family farms, rural life, small agricultural businesses, and small communities. This debate goes to the heart of what agriculture ought to be. 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. Land is not simply a productive resource. It is the basis of life. Without the land there will be no agriculture, no life, so land must be regarded as something more than other productive resources (e.g., 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 challenge of social and environmental goals for agriculture is that they involve values. It is generally not recognized in agricultural science that values are not external to the science and technology but its basis (Capra, 1996). Scientists know they are responsible for the scientific integrity of their work and for its intellectual contribution. They do not as readily assume responsibility



for the moral aspects of their work. Science is not value-free, it is value-laden. Moral questions are abundant.

Anyone can dismiss criticism of weed science by saying "Well, it is not true for me." This makes our personal beliefs, our assumptions, absolutely secure, and provides no reason to examine them (Melchert, 1995). How any idea fits our assumptions, especially one that is critical of our profession, is not a reliable guide. It is best to know the arguments, the reasons that support the criticism. In science the data or theory that best explains the observations usually wins. In ethics the best reasons win. It is wise to avoid the temptation to ignore good reasons that disagree with our assumptions. We assume a lot in science, often incorrectly. Here are a few examples of scientific assumptions that were wrong and led to the wrong conclusion, *viz*: (1) Data on historical estimates of the distance from earth to the center of the universe - Copernicus (1473-1543), 0 Kilometers. Distance from the center of the universe - Galileo (1564-1642), 149,000,000 million kilometers. Current estimated distance from earth to the center of the Milky Way Galaxy is 8,000 light years; (2) Data on the estimated number of earth-like planets in the universe in Europe in 1500 = 7. Estimated number of earth-like planets in 2005,  $3 \times 10^{21}$ ; and (3) Data on the estimated number of species on earth Linnaeus (1758) = 20,000. Now = 1,500,000 to 1,800,000. Estimated total number of species = 3,600,000 to 112,000,000].

When we think of the future of agriculture, it is important that we see that our scientific and moral assumptions and vision of the future affect (Harman, 1976) how we recommend agriculture be practiced. The research and teaching we do now involves assumptions and a view of a future we expect, desire, or fear (Harman, 1976). Do your running and your scientific assumptions lead to greater success and happiness for others? Does your work yield a moral good?

Most of my colleagues in U.S. Colleges of Agriculture are certain that their research and teaching are morally correct. They defend their objective approach to weed science and their objectivity in defending agriculture against emotional attacks from people who don't understand it. The scientist's frequent appeal to the value of objectivity in science is evidence of a lack of awareness of the inevitable subjectivity of science.

### **Re-moralizing Agriculture**

To suggest re-moralizing is not a claim that agriculture lacks moral standards or that all past achievements must be abandoned. I am not going to suggest a new, correct set of moral standards for agriculture. I recommend examining where moral values come from; and what are or ought to be the source of moral values for agriculture.

The emphasis on increasing production and reducing production costs to increase profit identifies agriculture's utilitarian ethical standard:

to provide the greatest good for the greatest number. This ethical position, accepted and largely unexamined within agriculture, has assumed that increasing production and reducing cost optimizes agriculture's social benefits. There has been almost no debate within agriculture about the standard's correctness. One result has been that many scientists, ignorant of their own social context and all results of their technology, have, without questioning, accepted the loss of small farmers and rural communities as part of the necessary cost of achieving the goal of maintaining a cheap food supply (Stout and Thompson, 1991).

The utilitarian standard is evaluated by results. Agriculturalists measure total production, crop yield and profit to evaluate what they do. They conclude that they are acting morally because all increase. The results are good. The cry for justice by the poor and the pleas of those concerned about loss of environmental quality are overwhelmed by achieving increased production.

None of what I have said should be interpreted as an attack on the moral standards of individual scientists. "Agricultural scientists have been reluctant revolutionaries". They have wanted to change agricultural practice and results but have neglected the revolutionary effects of their efforts. They believed that their work could be reduced to their little piece without considering the whole system. Increasing production was the goal, and, it was believed, it could be accomplished without revolutionary effects (Ruttan, 1991).

Intensive farming systems with chemical and energy intensive technology led to major increases in plant and animal production, increased the size of farms, minimized labor requirements, and maximized use of technology. These things allowed many nations to fulfill more adequately than any societies have the most important task in all human history: finding a way to extract from the ecosystem enough resources to maintain life. To do this, natural ecosystems were changed to make them more productive of the things humans need and want. The associated problem is that human societies have had difficulty balancing their demands against the ability of ecosystems to produce and survive. Intensive agriculture has met people's needs and many wants, a high value. But it is made unsustainable demands on the ecosystem, which was less valued. Agricultural scientists, use their success in meeting human needs to support their belief in the universal relevance and applicability of intensive farming. Western agriculturalists believe that all societies ought to adopt modern chemical, energy, and capital intensive agricultural methods and the associated values, because they embody the best, most rational, and most modern, thinking of humankind. This belief has three problems: it is false, it is immoral, and it is dangerous. Part of re-moralizing agriculture is to give up some of our pride about the moral correctness of all agricultural practices and values.

The goal of modern agriculture has been to produce more without any concern for the welfare of those whose lives were being destroyed. There was little thought about the effects of the system on the environment. Bottom line thinking has become the norm and is one thing we must reconsider if we are serious about our communities, and our agriculture.

As we reconsider the bottom line, there will be conflicting views on the nature of the problem and different views of sustainability (Allen, 1993). It is unusual to find anyone against sustainability. However, there are many views of what ought to be sustained and how to achieve sustainability. Re-moralizing requires that we give up the common agricultural defense against criticism, *viz*: (1) The first defense has been to deny that the suggested problem exists e.g., the loss of small farms is unfortunate but it is an economic not an agricultural matter, and (2) The second defense has been to explain that the reforms advocated (e.g., reductions in pesticide use, humane animal treatment) will make food too expensive and diminish the favorable balance of trade. The argument is that the public will not tolerate higher food costs to save a few small, inefficient farms, or to help citizens of developing countries. Reform may diminish the food surplus, and that is not politically acceptable.

Re-moralizing agriculture asks that we consider challenging views of agricultural practice. For example, in many countries agriculture is heavily subsidized and over harvests the resource. Exploitation of the land is never sustainable. Agricultural sustainability will not be achieved by adjustments to the present system, only by a new system. (Not all agree - See Federoff, *et al.*, 2010). It is a challenge that must be considered by the agricultural community.

### **CONCLUSION**

I conclude that while agricultural scientists are ethical in the conduct of their science (they don't cheat, don't fake the data, give proper credit, etc) and in their personal lives (they earn their wages, take care of family, respect others, are responsible for their actions, etc.), they do not extend ethics into their work. Agricultural scientists are reluctant revolutionaries that Ruttan (1991) identified, but also realists. Realists run agricultural research and the world; idealists do not. Idealists attend academic conferences and write thoughtful articles (Kaplan, 1999). The action is elsewhere. The reality may be publish or perish in academia, but it is produce profitably or perish in the real agricultural world. Realism rules, and philosophical and ethical correctness are not necessary for useful work in science (Rorty, 1999).

I find that true, but I want more. I want us to accept the difficult task of analyzing the results of our science. We must strive for an analysis of what it is about weed science, agriculture and our society that limits our aspirations and needs modification. We must strive to

strengthen features that are beneficial and change those that are not. We must be sufficiently confident to study ourselves and our institutions and dedicated to the task of modifying both. People don't want their assumptions about their science, its results, or their lives challenged, they believe their assumptions are correct and they want to use them.

A comment by the Russian author Leo Tolstoy<sup>2</sup> about art is relevant. Tolstoy urged us to question and debate the correctness of our scientific and moral assumptions. We need to examine our ethical foundation and our values. Tolstoy said: "I know that the majority of men who not only are considered to be clever, but who really are so, who are capable of comprehending the most difficult scientific, mathematical, philosophical discussions, are very rarely able to understand the simplest and most obvious truth, if it is such that in consequence of it they will have to admit that the opinion which they have formed of a subject, at times with great effort, - an opinion of which they are proud, which they have taught others, on the basis of which they have arranged their whole life,—that this opinion may be false".

To preserve what is best about modern weed science and to identify the abuses modern technology has wrought on our land, our people and other creatures, and begin to correct them will require many lifetimes of work (Berry, 1999). We ought to see agriculture in its many forms -- productive, scientific, environmental, economic, social, political, and moral. It is not sufficient to justify all activities on the basis of increased production. Other criteria, many with a clear moral foundation, must be included. We live in a post-industrial, information age society, but we do not and no one ever will live in a post-agricultural society. Societies have an agricultural foundation within their borders or elsewhere. Those in agriculture must strive to assure all that the foundation is secure.

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