
Pro Rege

Volume 18 | Number 3

Article 3

March 1990

Trends in Agriculture: Sustainability

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Recommended Citation

Vander Zee, Delmar and Vos, Ronald (1990) "Trends in Agriculture: Sustainability," *Pro Rege*: Vol. 18: No. 3, 19 - 28.

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A quarterly faculty publication of
Dordt College, Sioux Center, Iowa

Trends in Agriculture: Sustainability

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Introduction

Winds of change are blowing over the fields of agriculture in recent years. These winds are influencing not only the fields literally but they are also influencing the research, public policy, and social “fields” that inform and direct thought and action in the realm of agriculture.

American agriculture has just experienced another population shift as many farmers left the land in the early to mid-1980s, a shift which left rural communities impoverished financially and socially. As this was happening, many who had been questioning the foundations of American agriculture for years began to raise their voices louder as the latest agricultural crisis reached another fevered pitch. “Why are so many farmers going bankrupt and leaving the land, and why has one-half of Iowa’s top soil eroded in the last 100 years?” asked C.

Dean Freudenberger at a recent Dordt College conference.¹

Increasingly the agricultural crisis is being seen as not just problems in agriculture but as a basic problem with agriculture—which is to say that the problems are deep and basic; there is something fundamentally wrong with the current model or system of agriculture.² Agricultural practices and techniques must be questioned and also the social and cultural forces and expectations that drive those practices must be re-evaluated and reformed as necessary.

We concur with this view in essence and call for a basic re-thinking of what agriculture is and how it should be directed and practiced in the future. This paper reports on such a dialogue at Dordt College and outlines a current set of challenges and changes in agricultural thought and practice referred to as

“sustainable agriculture.” We do not spend much time honoring or advocating continued study and research into exploitive-production agriculture. That model is nurtured and fostered very well already at many land-grant institutions, not to mention the “wholesaling” of this model by modern agribusinesses! If a Christian approach to agriculture is to endorse the status quo but do it with Christian honesty, neatness, and a sound work ethic, then our task would be fairly brief and our study could be bound up with little more than a benediction.

Context and statement of the problem

Within the last decade, and especially during the last few years, a new concept is emerging in agriculture at both the theoretical and applied levels. This emerging concept has several contexts; one of the broader contexts is the continuing deterioration of earth’s life-support system. Such deterioration is evident in many sectors of human life, often affecting agriculture in particular. The environmental movement and its fostered awareness of human linkage to the natural processes of the planet is central to this context.

Popular culture is being informed of these linkages via several recent publications in the popular and scientific press. These publications are focusing people’s attention on the many planetary environmental problems, many of which impact or are impacted by agriculture. Some recent examples: The December 1988 National Geographic features a high-tech cover showing a hologram of a vitreous earth which appears to shatter when viewed at an angle—a symbolic prophecy if stewardly care does not become a way of life. And several articles deal with agriculture and the food system. *Time* magazine’s planet of the year greeted us in 1989. Its contents underscored the maxim that good planets are hard to find. The entire September 1989 issue of *Scientific American* was devoted to management of the planet and contained several articles dealing with sustainability in general and agriculture in particular.

Of considerable importance in this broader environmental picture is the tragic loss of topsoil and deforestation with its consequent destruction of watersheds and downstream siltation.³ Acid rain is killing forests⁴ and causing thousands of lakes to become uninhabitable to many forms of life.⁵ Acute

toxic waste is affecting not only surface waters, but in some parts of the world whole watersheds are being chronically contaminated by agricultural chemicals.⁶ In still other areas, whole aquifers are being depleted via irrigation, and where river waters are diverted to irrigate marginal lands, salinization is increasing to the point of preventing growth of crops.⁷ The green revolution and cheap fossil fuels have enabled affluent humans to be well fed; but there are signs that the whole system is weakening and that the green revolution is not sustainable for the western world, much less for the rest of the planet.⁸

All of these trends of deterioration have their impact on the mind and spirit of agriculture. Love Canal, the ozone hole in the atmosphere over Antarctica, oil spills in our rivers and ocean bays, and the recent warning of greenhouse warming are not just isolated acute problems of industry; they are symptoms of the larger chronic problem, the disintegration of the life-support systems of the planet. These acute episodes remind us of the very great environmental debts that are coming due—debts which will have to be paid by future generations.

Many voices are also expressing urgent concern for agriculture in particular. These voices are not in the main stream of agricultural research and production. They are third world agronomist-theologians like C. Dean Freudenberger who wrote *Food for Tomorrow?*, poet farmers like Wendell Berry who wrote *The Unsettling of America—Culture and Agriculture*, political scientists like Kenneth Dahlberg who wrote *New Directions for Agriculture*, alternative polycrop researchers and thinkers like Wes Jackson who has written several books including *Altars of Unhewn Stone*. Furthermore, dozens of grass roots organizations speak for state or regional concerns in agriculture—like The Center of Rural Affairs in Nebraska, The Land Stewardship Project in Minnesota and the Wisconsin Rural Development Center, and Practical Farmers of Iowa. Most states now have these kinds of groups.

A very significant and recent voice joining the chorus is the National Research Council report, *Sustainable Agriculture*,⁹ which will no doubt be a driving force to propel the issue of agriculture onto the national public policy agenda.

What are these groups and their supporters say-

ing? They are saying that the land is crying out. The land in the words of Wes Jackson, has "expectations."¹⁰ Top soil in the U.S. is being lost at rates that are roughly equivalent to that of the dust bowl years. This is because the land is left exposed to the wind and rain without plant cover for several months of the year, or steep land is not adequately protected by terracing and grassed waterways, or marginal lands have been brought into tillage agriculture. Soil fertility is slowly being lost because in the maximization of production, nutrient cycles are left open—effectively mining the soil of its mineral nutrients. Good farm land is being compacted by heavy machinery. Ground water is being contaminated by nitrates and herbicides. Pests are becoming resistant to pesticides because of genetic selection. And the genetic base of domestic plants and animals is becoming dangerously narrow from a bio-ecological point of view. One can add to this list the problem of desertification when one considers the global agricultural system. The list given here deals mostly with the land as a physical thing; equally important is the loss of rural communities with the steady movement of people from the land to urban areas. This population loss is accompanied by a loss of local cultural information. This is a steadily growing problem in rural society both in North America and world-wide.

This sounds like such a dire list that one may wonder why supermarket shelves are so full. After all, is not the American system so very productive and efficient? Is there not an overdose of doomsdayism in this foregoing litany of planetary ailments?

Not really. It depends whether one looks at part of the system with short-term time horizons, or whether one tries to see the larger system with long-term time horizons. Many of the symptoms listed are masked locally and in the short-term by the continual subsidy to the agricultural system by fossil fuel. For example, 1) loss in top soil and land fertility is offset by fertilizers made from natural gas (anhydrous ammonia), 2) fewer laborers on the land is offset by machinery and pesticides, 3) loss of rural markets is offset by fossil fuel powered refrigeration and transportation from centralized production centers. The link to the future is that fossil fuel is limited. Running a system on fossil fuel (which represents "savings" in the economy of Earth 12) means trouble when the savings account runs out.

This brings us to efficiency and energy. A tool

often used for measuring or evaluating modern agriculture is efficiency. Agriculture is often measured in yield per acre or per hectare (1 hectare = 2.47 acres = 10,000 sq. meters). Another way of evaluating agriculture production is yield per farmer-owner-manager. A third way of measuring production is to measure it in terms of yield per energy input.

An example of the first is to note that corn yields have gone from 25-40 bushels per acre in the 1930s to 100-150 bushels per acre in the 1970s. This is often cited as great progress, which in a sense it is. During this same time 30 million people have left the land to urban centers—one of the greatest human migrations in human history¹²—the cost side of this efficiency and progress report.

Another example of measuring efficiency is to note that in the 1960s it was said that one farmer could "feed" about 60 people; in the 1970s it was said that one farmer could feed 78 people; in early 1989 an ad boasted that the efficient American farmer can now feed 115 people. Although the numbers look and sound impressive, the claims are essentially meaningless.¹³ The fact is one farmer often does not even feed himself or his family, much less another 100 people. He is merely the operator getting the raw product out of the field or getting domestic livestock ready for markets. Maybe an analogy would be helpful here. Suppose our school systems were rated on how many students there were per square meter of classroom, or how many students graduated per school principal; these are roughly analogous to rating agriculture production per hectare or per farmer, respectively. In a book with the interesting title *Eating Oil*, M. B. Green compares the food systems of Britain and America with several third world "peasant village"-type agricultural systems. If one considers all the people in the food system—which includes all the middle people involved in distribution and processing—and subtracts energy subsidies, we are only just a little more efficient than third world peasant village agriculture economies.¹⁴

The way to get at fundamental production efficiency is to compare output versus energy input. The key to understanding production and sustainability is energy. David Pimentel from Cornell University, one of the most quoted authorities in agriculture production efficiencies, notes the following: in 1945 for corn production the kilocalorie

return per kilocalorie input was 3.70, but in 1970 it was 2.82—a 24 percent reduction in efficiency!¹⁵

One can also look at the modern agriculture system from a different angle and see the following: If mechanized monoculture leads in the longer term to eroded and compacted soils containing pesticide residues, nitrates in ground water, and resistant pests, then perhaps we are creating more problems than solutions. Agriculture is supposed to provide food and fiber for humankind and feed and fodder for domestic animals. But it is also causing many problems that are not solved or paid for by a given year's income or activity. The environmental, medical, and social costs are not currently being paid. To that extent, modern agriculture is not sustainable in its current practice. These costs are being externalized or written off to the future.

Our debts to the land, e.g., loss of soil fertility and poor water quality, are now—or will soon be—coming due. The specter of large scale famine on a drying and possibly warming planet (carbon dioxide and greenhouse affect) and the specter of increased ultraviolet radiation are not unrelated to agriculture. Developing arable land and the subsequent loss of organic carbon from cleared land is a major source of the increased carbon dioxide in the atmosphere. Added to this is the burning of fossil fuel which subsidizes our agricultural traction, transports our commodities, energizes our refrigerated storage, and serves as raw material for agricultural chemicals.

Seeing the agriculture-food system in the light of the above arguments suggests that the “agricultural problem” is so extensive and comprehensive that it is probably better called a cultural crisis than a set of agricultural problems.¹⁶

This is no mere semantic quibble. Problems are often seen in today's world as local or manageable and solvable with minor adjustments. But if we see this problem as a *cultural crisis*, as many leading thinkers and doers suggest, then it cannot be considered as minor, or local, and solvable with minor adjustments, but may require rather a fundamental transformation in how people view themselves and live through time.¹⁷ That the beginnings of such a transformation may be happening is offered by environmental philosopher J. B. Callicot, “. . . the emergent agroecology movement is less a perennial alternative to conventional agriculture than a

bellwether of a fundamental paradigm shift in modern Western culture”¹⁹

History of the sustainable agriculture movement

In the 1960s and 70s the main “counter cultural” movement relating to agriculture was organic farming and gardening. This was related to the general countercultural movement taking place in society at that time and to the early expressions of the environmental movement. The advocated organic foods and natural remedies were seen by many as a kind of fad that would pass. No doubt some of the claims of the organic movement were oversold and some of its more extreme practices have not survived, but this early stirring of the cultural spirit has gained sophistication. As an example, the Rodale Institute in Pennsylvania has persisted and grown from a somewhat quaint organic gardening advocate to a now respected center for thought and agricultural research. Within this country many other grassroots groups have recently formed which are advocating a change in agricultural philosophy and practice. For the most part, these were not originally funded by any large foundation or agribusiness, but rather by common people on a small scale sacrificing their own time, effort, and money to foster cultural change.

During late 1987 we corresponded with fifty-two rural agricultural organizations to learn of their purpose, goals, and constituencies.¹⁹ Their goals and functions fell into several categories. The following is a synopsis of the nature of the groups surveyed and some examples: 1) self-help groups, supporting family farmers with legal and moral support, e.g., Rural Initiative Center of South Dakota; 2) promotion of alternative methods via example, e.g., Practical Farmers of Iowa; 3) doing independent research in sustainable land use, e.g., The Land Institute of Kansas; 4) public policy and advocacy groups, e.g., Center for Rural Affairs of Nebraska; 5) larger endowed “think tanks,” e.g., Rocky Mountain Institute; 6) community and land use demonstrations, e.g., Wilder Forest of Minnesota; 7) organic grower support groups, e.g., Tennessee Alternative Growers Association. Some groups are involved in more of the above functions such as the Center for Rural Affairs in Nebraska and the Land Stewardship Project in Minnesota.

These groups and their constituencies form the real social and political fabric that is causing the

more conventional institutions to rethink and reorient their agendas.

The conventional institutions that have been in place to promote research and extension for agriculture have been the land grant university system which was established in 1862 by the Morrill Act, and the associated agricultural experiment stations, established in 1887 by the Hatch Act. The above listed rural grass roots groups are not a part of these conventional institutions, and because of their origin and advocacy, they face a credibility problem. Their credibility, however, is growing because of the general misgivings in the rural and agricultural sector of society to the methods of orthodox agriculture as advocated in the past by land grant institutions and agri-businesses.

Evidence of this rising credibility and sophistication is the recent origin of several new journals and magazines—*Agriculture and Human Values* (1984), *Journal of Agricultural Ethics* (1988), *Journal of Alternative Agriculture* (1987), *The New Farm* (1978). Conventional magazines that have stressed orthodox high-input agriculture are now running features and editorials—and even sponsoring major conventions—that are promoting alternative agricultural methods and crops.²⁰ Even journals not usually dealing with to agrarian matters are picking up the debate.²¹ The fact that the sustainability of modern agriculture is being questioned at the national level is evidenced by the study and 1989 report of the National Research Council titled, *Alternative Agriculture*.²²

This is not to say that conservation was ignored prior to the 1970s or 1980s. Many articles in the *Journal of Soil and Water Conservation* have supported conservation, and the federally supported Soil Conservation Service, which was founded following the dust bowl days,²⁴ also attests to a long history of conservation. The approach and emphasis of earlier conservation, however, is not the same as that of sustainable agriculture. It is fair to say that conservation was more focused to adapt to industrialized high-input agriculture. But the evidences of soil erosion and the consequent downstream effects since the dust bowl are now all too clear. One difference in the thinking within the recent movement for sustainable agriculture is that industrialized high-input agriculture is seen both as the cause and cover-up of much environmental damage. High agricultural yields can be maintained

for a time with massive inputs of nitrogen, phosphorus, and potassium to cover up the fact that soil fertility is actually declining in the process.

A change in thinking at the highest agriculture institution in the United States, the U.S. Department of Agriculture, is evidenced by its adoption of the acronym LISA which stands for Low Input Sustainable Agriculture. LISA is now recognized and is beginning to receive some funding for research from the USDA.²⁴ This is a tremendous shift in thinking from the “farm fence row to fence row,” “feed the world,” and “use agriculture as a weapon” advocacy of the USDA of the 1960s.²⁵

A recent shift in thinking is also occurring in the conventional land-grant agricultural college system. Several leading universities have added or are modifying programs to recognize and support this growing trend in the country.²⁶ In this case the conventional universities are following an existing movement. Whether or not this change in the conventional education and research system can provide uncompromised leadership remains to be seen.²⁸

The foregoing is a brief look at the social, environmental, and planetary context of modern agriculture. In light of such a systems view, to ignore the links in the system is to live a false witness. To hope the problems will take care of themselves in the face of exponential world population growth is naive. To put faith in technology as a future savior is to confess the faith of Babel’s builders.

Not finding false witness, naivete, or Babel to our liking, we have opted to listening anew to the Scriptures and the many who have also tried to find new meaning from the Judeo-Christian tradition. We are also struck by the fact that many who are calling for meaning and sustainability in our society and culture are not motivated by deep Christian convictions or confession, but are responding to the land itself. That is what W. Jackson calls “meeting the expectation of the land.”²⁸ The Lord himself said that if his people did not cry out in praise, the very stones would cry out. The cry being heard now, however, is more of a groan as in travail.

It seems to us that two expectations need heeding: 1) the expectations of the land, and 2) the expectations of the land’s Lord!

Sustainability—the concept and definitions

During the last decade many labels have emerged

from the re-evaluation of modern agriculture: *regenerative agriculture*, *organic agriculture*, *low-input agriculture*, *conservation-tillage agriculture*, *sustainable agriculture*, *alternative agriculture*, and *agroecology*. Each label identifies or reflects a particular nuance or emphasis. The terms *organic*, *low-input*, and *conservation-tillage* suggest a method or approach to farming. The terms *regenerative* and *sustainable* suggest an outcome or ideal that is more comprehensive than just changes in method. The term *alternative* is relative and time bound. At this time, “alternative” refers to any method or goal that replaces or modifies conventional (or orthodox) agriculture, that represents a softer approach to the land. *Agroecology* identifies the ecological framework—the processes and system connections—within which agriculture operates.

Although the above list of ideas may seem too many and confusing, it reflects the diversity of the many areas or facets in agriculture from which this movement is emerging. This diversity in fact represents a basic strength.

The conventional agricultural approach is to maximize production using heavy inputs of off-the-farm resources. These resources are in two forms. One form is based on fossil fuels; included are agrichemicals such as fertilizers and biocides and industrially produced machinery and traction. A second resource is information from “farm experts” on which conventional farming is heavily dependent. This increased dependency for outside capital and information leads to unrealizable expectations. Public policy and loaned capital often do not allow long-term land needs to be considered. Advertising and social pressures to feed the world is another ecologically unrealistic expectation. Farmers are increasingly becoming government subsidized serfs of agribusiness.

By contrast, regenerative agriculture produces safe and nutritious food and fiber without harming the environment using sustainable, yet profitable techniques.²⁹ Implicit in this term is the idea that agriculture can and should add to or actually regenerate soils—and even rural communities. Sustainable agriculture is perhaps narrower than the concept of regenerative agriculture, at least by some definitions; its goal is to maintain and not deplete any parts of the supporting system over time. In that sense, even though movements of resources and products and exports occur locally and worldwide,

no depletion of soil and components of the life-support systems should occur. The goal then is to use on-farm renewable resources, on-farm capital and information as much as possible, (and if not on-farm, then at least local or bio-regionally specific information). Different levels of the hierarchy of agriculture may be more or less sustainable depending on the larger economic and political policy factors that impinge on agriculture.³⁰ For example, the practice of conservation tillage might reduce erosion and be considered sustainable for soils, yet consequently, might require more herbicides (a non-sustainable input). Thus the idea of sustainability can be seen as a long term goal with several short term steps, or points of progress. The direction of the whole system is what is important.

The “umbrella” term that is gaining popularity in the press and among many rural advocacy groups is the term *sustainability*—hence its general use in this paper.

Sustainable Agriculture—its characteristics and new directions

Sustainable or regenerative agriculture may take on many practices. There is no one new method that can be applied as a panacea. This is stressed in the many newsletters published by the rural agricultural groups. Agricultural practice has to be tailored to the local soils, topography, growing season, livestock, rainfall, etc. Diversity and adaptation to local conditions is the key. Lands and soils are not mass-produced and cannot be managed by mass-produced monotكنولوجies.

If there is any model that agriculture must return to and be increasingly patterned after, it is the creational model of the ecosystem. Agricultural systems are in fact highly modified ecosystems. Ecosystems are made up of biotic communities which have the following features:

1. They use solar energy (income), which flows through to
2. reproduce and regenerate the living components, and
3. recycle the raw materials (mineral elements) locally.
4. Raw materials are accumulated and/or held in place by the biotic parts of the system (roots, soils, biomass).
5. They depend on high species diversity to accomplish total function.

6. They do not displace resources over long distances.
7. If changes and displacements occur they occur at a rate and scale that is compatible with maintaining internal integrity.
8. They are internally integrated and informed.

The directions that are called for in the purpose statements of the new groups and in the philosophies of the new journals provide an extended definition of sustainable agriculture. A sustainable agriculture will be characterized by the following:

1. Agroecosystems that are less dependent on external energy and material and nutrient inputs, more dependent on on-farm renewable resources. Efficiency is measured in terms of energy, best run on solar energy (income) rather than fossil fuel (savings).
2. Agroecosystems that have less or no adverse impact on ground water, downstream watersheds, and local wetlands.
3. Agroecosystems that depend on local cultural wisdom and decision making.
4. Agroecosystems that tend toward polycultural and biogenetic diversity. (Some are even calling for perennial polyculture.)
5. Agroecosystems that have greenspace and room for creatures other than humans and their domestic plants and animals.
6. Agroecosystems that depend more on agricultural, biological, and ecological methods of pest control.
7. Agroecosystems that are site or region specific with respect to plants and animals grown, i.e., matching biological adaptations to local climate and soils.
8. Agroecosystems that are less centralized in terms of markets and processing centers (this will reduce the inputs of fossil fuel for transportation and refrigeration).

All of the above will require more local knowledge, wisdom, and care by people, and will therefore support greater community in the rural sector. The above outlines a sustainable holistic approach (locally and globally) to land, creatures, water, and people.

But the above cannot be done without the political-social support and sympathy of those living in urban areas. The above cannot just happen by changing the collective wills of the remaining 2.5 percent of the American population that lives

on farms. Public policy dealing with tax support, federal farm programs, zoning, land acquisition, for example, *are* a part of the system—because agriculture is not just farming; it is part of the broader culture.

Comment, evaluation, and challenge

Five years ago when discussion first started at Dordt College about altering the approach to agricultural practice at the Dordt Agriculture Stewardship Center, the sustainable agriculture movement was hardly recognizable. This is confirmed by the starting dates of several rural groups, university programs, and journals. A few years later it may be premature to call this a movement. It is admittedly small, operating on low budget, and at this point affecting a relatively small number of acres and units of produce. But the fact that its impetus and growth is in a sense spontaneous and voluntary and not top-down from any government or social agency, and that it is found throughout the country suggests that it is not an episodic fad. Very intelligent, serious, and thoughtful work is being done by these groups as demonstrated in their publications and programs. Many small groups are asking fundamental questions of agriculture and in a real sense are starting a “counter cultural” movement. Following the lead of these groups is an apparent surge of interest in alternative or sustainable agriculture at the conventional land grant university, the United States Department of Agriculture, and National Research Council.

A recent television advertisement called for support of a bill to save the family farm because “it has produced more than food over the years. It has also produced strong values.” This is a simply-stated perception that there is something culturally important about rural families and communities working the land. For years there has been some call to maintain the family farm. The reasons for such a call have been poorly articulated and perhaps poorly understood. Some would claim that such advocacy is fostered by nostalgia or romanticism. Ironically the family farm and the ideals the advertisement and the bill advocate are functionally already gone. What has taken its place is an industrialized, high input farm, possibly run by a family that often cannot muster the capital to keep up with the expectations of modern agriculture.

Wes Jackson suggests a different set of expecta-

tions, those relating to the sustainability of the land itself. Perhaps the most articulate early statement of what is happening in American agriculture has been that made by Wendell Berry in his *The Unsettling of America, Culture and Agriculture*. It seems that the cultural and community disintegration which Berry so clearly senses and documents in his book is being felt by many who are now organizing at the levels described earlier in this paper. A more recent study of the whole western agricultural system is found in Dahlberg's *New Directions for Agriculture and Agricultural Research*.³¹

Even though we note a growing sense of change in agriculture and culture, there is by no means universal acceptance of the ideas advocated by the various sustainable agricultural groups.³² Reactions have characterized these groups and ideas as "suspect," "a threat to production and prosperity," "going backwards," or "succumbing to environmentalists." Following the passage of the Iowa Ground Water legislation, the fertilizer industry lobby threatened to unseat the five Iowa Democrats who co-sponsored this legislation. This is an example of how one agri-business group responded to a more sustainable, responsible way to deal with ground water contamination. This contamination is directly tracable to high-input agricultural practices.³⁴

Some agree in theory to the ideals of sustainable agriculture but argue that it will be all but impossible to change people's ways. Difficult, yes, and long in coming, true; but one has to recall that hybrid corn has been widely used only in the last 40 to 50 years. And heavy application of fertilizers and biocides have been widely used in only the last 25 years. The next agriculture revolution may occur in less time than this, and it may have to if some of the predictions of oil depletion come true. Others argue that meaningful social and cultural change is unlikely, especially given the American frontier exploitive type of capitalism with its nearly total lack of a land ethic.

Is there much reason for hope? After all, lost topsoil is gone and contaminated water sheds cannot be cleaned up and will not naturally purge themselves for hundreds of years. Perhaps some new technological advance will give us continued production. Perhaps biotechnology is the answer.³⁵ Illustrating the technological imperative is the suggestion that modern young people aren't interested

in hard work, and the only way to make them interested enough to stay on the land is to make the production process increasingly high-tech to the point of "covering the land with plastic and green houses." This would provide total control over all environmental inputs and therefore cut the uncertainties which tend to jeopardize profits.³⁵

A few basic answers must be offered in the face of possible skepticism to a softer approach to agriculture. First of all, as Christians we must always be able to be critical and prophetic enough to question the "what is" and suggest another "ought to be" in a broken world. That is part of testing the spirits of the age. Agriculture has not been without its driving spirits which must be tested. Second, acceptance of a new idea or attitude toward the land should not be based on its apparent (im)practicality, level of difficulty, or change in method of remuneration. The land itself has expectations and must be treated with integrity.³⁶ The Christian confesses that the earth is the Lord's and the task of humankind is to care for and keep the earth (Psalm 24:1 and Genesis 2:15).

Finally, if the expectations for the land can be determined by empirical study and from the truths explicit or implicit in the Jerusalem tradition as D.J. Hall refers to it, then for Christians, at least, caring for the land is a matter of obedience. To be image bearers and caretakers in and on the land for the Creator, for the covenanting and sustaining God, we may have no choice. If Christian farming/agriculture is seen in any way as part of Christ's Kingdom, and if the Kingdom is to be first, then caring for the land must be our high priority.

For unless the Kingdom is first, we have no reason to expect any of the other added things. Or as Gordon Spykman said recently, "Nothing matters except for the Kingdom of God, but because of the Kingdom—everything matters".³⁷

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² See C. D. Freudenberger, *Food For Tomorrow*, Augsburg Publishing, 1984, and Wendell Berry, *The Unsettling of America, Culture and Agriculture*, 1977, Sierra Club Books, who suggest that the malaise is not local or technical but rather radical, i.e., at the roots of agriculture. The problem is essentially cultural. This is also echoed in W. Jackson's *Altars of Unhewn Stone*, North Point Press. 1987.

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⁸ The unsustainable aspect of the green revolution is the breeding and selection of plants for fossil-fuel, subsidized agriculture. Selective breeding is nothing new and it will continue; but while green revolution seeds are replacing land races, the gene pool is being depleted for future needs. For additional reading on agricultural dependency on fossil fuel, see M. B. Green, *Eating Oil: Energy Use in Food Production*, Westview, 1978 and John Gever et al. (eds.), *Beyond Oil—The Threat to Food and Fuel in the Coming Decades*, Cambridge, MA: Ballinger Publishing Co. 1986. For additional commentary on the green revolution, see K. A. Dahlberg, *Beyond the Green Revolution: The Ecology and Politics of Global Agricultural Development*, Plenum. 1979.

⁹ National Research Council, *Alternative Agriculture*, National Academy Press, 1989. A report of 450 pages, half of which describe case studies of farms across the U.S. which deal with a wide range of commodities raised/produced with alternative methods.

¹⁰ See *Meeting the Expectations of the Land*, a book of essays in sustainable agriculture and stewardship edited by Wes Jackson, Wendell Berry, and Bruce Coleman. San Francisco: North Point Press. 1984. An essay with the same title appears in *Altars of Unhewn Stone* by Wes Jackson, North Point Press. 1987.

¹¹ Wilkinson, L. (ed). *Earthkeeping—Christian stewardship of natural resources*, Eerdmans, 1980. See especially Chapter 4, p. 51 where Earth's economy is discussed in terms of income—photosynthesis, savings—fossil fuel, and inheritance—minerals.

¹² Freudenberger, *Food for Tomorrow*, p. 15.

¹³ This number is really only a ratio between the total population and the farm population and since the farm population keeps falling, the ratio will naturally keep getting higher. Many would say this ratio is an admission of a failure of modern agriculture with the accompanying rural social decline.

¹⁴ Green, *Eating Oil*, pp. 187-188.

¹⁵ Data from Pimental, David, et al. "Food production and the energy crisis," *Science* 182:445, 1973. The reason this decrease in energy deficiency does not show in the market place is that our economy runs on dollars which have no direct relationship to calories; value is determined by demand and scarcity.

¹⁶ Berry, *Unsettling of America*, pp. 41-48.

¹⁷ Hall, D. J. *Imaging God—Dominion as Stewardship*. Eerdmans Friendship Press. 1986. See his opening chapter for powerful insight into how modern man images himself and how we need "re-imagining."

¹⁸ Callicott, J. Baird. "Agroecology in Context." *Journal of Agriculture Ethics* Vol. 1(1):1-9, 1988.

¹⁹ Information on these groups was gleaned from responses to a questionnaire sent in late 1987 to 52 rural agricultural advocacy groups. These groups were contacted regarding their purpose, goals, constituencies, etc. Thirty-nine have responded (75%); 19 of these were founded since 1980. Since this survey many more groups have come to our attention, many of which have been founded in the last two years.

²⁰ *Successful Farmer* sponsored a convention promoting alternative agriculture (ADAPT-100) in Des Moines, IA, in Dec. 1987. (A further note, the July/August, 1989 issue of *The Furrow* ends an article as follows, "I have a hunch that what we're calling alternative agriculture—low-input farming today will be well within the mainstream of North American agriculture by the turn of the century." *The Furrow* is published in ten languages!)

²¹ *National Forum* of Phi Kappa Phi devoted its Summer 1988 (Vol. 68) issue to renewable resources—focusing on agriculture and agricultural systems. See also the *Atlantic Monthly* Nov. 1989 issue which features the Land Institute.

²² The National Research Council report devoted approximately one-half of its text to reporting the existing success of 11 sustainable-alternative farmer-operators across the United States, representing a wide variety of commodities.

²³ In its early days the inept policies of the SCS probably did more harm than good. See Paul Bonnifield, *The Dust Bowl: Men, Dirt, and Depression*. University of New Mexico Press. 1979.

²⁴ The acronym appears in the literature in early 1989. The USDA funded low-input research programs in 1988 with \$3.9 million and \$4.4 million in 1989. This is, however, only approximately 0.4% of the USDA total research, education, and extension budget.

²⁵ The "fence row to fence row" and "using food as weapon" talk in the USDA in the late 1960s is what goaded Wendell Berry to write *Unsettling of America*, a very insightful book revealing the rot at the roots of American culture and agriculture.

²⁶ Haney, W. G., Krome, M., and Stevenson, G. W. *Sustainable Agricultural Sourcebook*. Wisconsin Rural Development Center, Inc. 1986. (This is a compilation of current activities on sustainable agriculture at U.S. Universities.)

²⁷ In a paper given at the American Inst. of Biol. Sciences symposium at Ohio State Univ., Summer 1987, David Ehrenfeld very perceptively analyzed the trend toward an agriculture that is intensively informed by ecology. He cautioned that the need for a more informed agriculture could lead to a new "priesthood" of specialists.

²⁸ It might also be noted that this phrase of Jackson recognizes the normativity of studying and listening to the created order. This should be especially understood by Christians who believe

in a providing God who covenanted with the creation following the flood . . . that there would be seed time and harvest.

²⁹ Madden, Patrick. "Can Sustainable Agriculture Be Profitable?" *Environment* 29(4):19-34, 1987.

³¹ Madden, *Environment*, p. 28.

³¹ Dahlberg, Kenneth, ed. *New Directions for Agriculture and Agricultural Research*. Rowman and Allan Held. 1986. An excellent collection of papers supported by an NSF and NEH study on ethical and value choices in national agricultural research goals.

³² Witness articles and letters to editors in magazines such as *Agrichemical Age*, Jan. 1988, decrying "the increased political activity of Rodale-type groups . . . [as] not particularly ethical . . ." Also, the Iowa legislators who supported the 1987 Iowa groundwater bill are fingered for defeat by an agrichemical lobby, (see *Iowa Farmer Today*, Jan. 23, 1988,

front page story).

³³ Hallberg, George R. 1986. "From Hoes to Herbicides-Agriculture and Groundwater Quality." *Journal of Soil and Water Conservation* 41 (6): 357-364.

³⁴ Advocated by the former president of Pioneer International at a recent PFI (Practical Farmers of Iowa) meeting. However, at a biotechnology conference of the Iowa Academy of Sciences, A. D. Kline reports that the goals of biotechnology are in direct odds to rural development, *JIAS* 95 (1):32-34, 1988.

³⁵ Personal conversation with a south Florida horticulturalist, 1987.

³⁶ Schaeffer, F. A. *Pollution and the Death of Man —The Christian View of Ecology*. Tyndale. 1970.

³⁷ Spykman in the 1988 Dordt College Commencement address.