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I've been asked to talk about *The State of Organic Farming Research*. I've added a subtitle: *Notes and observations on the precocious pre-teen years*.

I did this to make it sound more interesting.

After doing that I decided I'd better look up the word "precocious" just to make sure that's the word I was looking for. According to Random House the definition is: "forward in development, especially mental development." And I thought "Great! That's exactly what we're talking about.

OK, so now you're probably wondering about the "pre-teen" part. Obviously...this is a reference to a stage of development. Organic research—and I want to be clear, here, in that I'm referring to organic research as conducted by institutions--universities, USDA and the like--has only been taking place for a short while--maybe five years, ten years--and from the perspective of age alone, hasn't even reached adolescence yet. For the past 20 or 30 years farmers themselves have, for the most part, been the creators and inventors of our knowledge-base about organic farming practices. Our institutions are just now getting involved, or in many cases even beginning to notice that there is something different, and pretty exciting, going on in agriculture.

As my OFRF colleague Mark Lipson has said, "institutional organic research is undergoing rapid proliferation, starting to get a little gawky, but still in the semi-security of being too small to notice. Yet...is looking ahead to major growth spurts and profound identity crises."

Before I talk about research itself, what would a keynote be without some reference to the Big Picture, in this case the role of science and research in relationship to organic and sustainable farming. This past fall I picked up a popular non-fiction book that came out last year, written by Jared Diamond, called, "Collapse: How Societies Choose to Fail or Succeed." It's a complex and at times excruciatingly detailed book, but I liked a couple ideas that it put forward: One is that, throughout human history, managing environmental resources sustainably has *always* been difficult. (For some reason I found this thought comforting).

Another idea is that when we look at 50,000 years of human history—there is no evidence that any one or another group of people have been ignorant, bad managers who deserved somehow to be exterminated or dispossessed, nor were any groups all-knowing conscientious environmentalists, who solved problems that we are unable to solve today. Rather, they were people like us, facing problems broadly similar to those that we now face. Nevertheless, it can be shown that a society's response to its resource problems has *always* proven to be significant, and it can be demonstrated that societies do make more-wise and less-wise decisions in response to resource conditions, and the decisions they make really *do* matter. Finally, different societies respond differently to similar problems,

depending on their own political, economic and cultural values, and their social institutions.

I imagine that's why a lot of us are here...because we feel that our responses to resource conditions do matter, and sustainable and organic farming practices are an important part of our response. But we're still looking at the indicators, and trying refine, given what we think sustainability might look like, what our responses should be. We talk to other farmers, researchers...go to conferences and workshops, read what we can. Above all, it can easily be said that farming organically is an information-intensive enterprise. And we look to science and new research to help our practices evolve.

While I don't want to bore anyone with too much in the way of stats and figures, part of my job here is to at least provide a minor quantitative overview on the "state" of organic research. The good news is that there's definitely more than there used to be. The bad news is that it's still not very much. If we compare organic research activities now with where they were 15 years ago, we've made tremendous strides. For example, when OFRF began funding research, we could practically count on one hand—maybe two—the number of U.S.- published research papers on organic farming. Which is why a group of organic farmers in California decided to start OFRF in the first place—to try to capture and share the knowledge already being developed by organic farmers, and to encourage the universities and USDA to bring their expertise to the table. Fifteen years later, OFRF has funded 213 grants through our competitive grants program, totaling \$1.3 million.

Meanwhile, at our nation's 69 agricultural university research institutions, also generally known as the land grants—as of our last inventory about two years ago—there are now about 500 certified organic research acres. However...that's out of an estimated 886,000 total research acres available in the system. But those 500 acres are more than there used to be, and to be fair, there are probably even more that have come on line in the past two years. Congress has appropriated \$3.5 million out of the USDA's ARS research budget for organic, but that's out of a total budget of \$1 billion, or just 0.35 percent. USDA also has an organic transitions grant program, that has been allocated \$4 million in 2006. And in fact, the University of Illinois currently has a research project funded by the USDA transitions program. Congress has also directed small amounts of funding in a variety of areas such as organic data collection in the ag census. So, things are happening, if in a small way. As a final example, organic is also infiltrating the professional research societies, such as the Tri-Societies (which consist of American Society of Agronomy, Crop Science Society of America - Soil Science Society of America), which now has a Committee on Organic and Sustainable Agriculture to help coordinate and promote organic research activities.

It depends on who you talk to how science and research are defined-- but a reasonable definition is that research is the acquisition of reliable information about the world. Though I recently heard a physicist define it as, "a way of making what we believe less false." The way I look at it, research is, as much as anything, a dialogue. It's a way of framing our conversation and providing new reference points for the next thing we're going to talk about and work out.

Research questions can be very simple, such as: how can I control weeds in...fill in the blank...any crop? Or the questions can be ambitious, such as what USDA asked in its own comprehensive study of organic farming in 1979: “Under what specific circumstances and conditions can organic farming systems produce a significant portion of our food and fiber needs?”

An important principle of organic research is farmer collaboration. At OFRF, for example, it is a requirement for every project that we fund. Fortunately, researchers at universities and at USDA are increasingly taking this approach as well. Another principle is that publicly-funded organic research information remain open to the public and non-proprietary. Again, at OFRF open access to information is a prerequisite for project funding. However, we find that we’re having to work harder all the time to keep it that way. In the present research climate where more and more information is becoming proprietary, we find ourselves more frequently at odds with university grants administrators who are not comfortable with our open-access to information requirements.

These are important points, when looking at organic research: look for the farmers. And look for open access to information

So, I’d like to talk about some of the work going on “out there.”

A noteworthy aspect of institutional organic research over the past five years has been the focus on the transition to organic agriculture. Studying the 3-year transition is very much in vogue, and, you could even say this too is symbolic of our “pre-teen” stage of development. As I mentioned previously, there’s a transition study going on right now at the University of Illinois, and many others throughout the country. As Ed Zaborski, a project collaborator here with the U of I project, says, “We’re doing the transition anyway...we might as well study it.” This is where the institutions can really shine. Because they have a lot of staff with different areas of expertise that can look at a lot of variables--different agronomic, ecological, soil quality, pest and weed management, and even economic and marketplace factors that happen during the transition to organic.

So, because of the current focus on transitions, I’d like to highlight some of these projects, which is also a way of introducing some of the people and places where things are happening around the country. And also, to introduce some of the things that happen in the research process between farmers and researchers. This will scarcely be exhaustive of everything going on out there, but is a way of introducing what’s happening by way of example.

One project I’d like to share is the work of what is called the “Organic Agriculture Consortium.” This group studied the transition to organic agriculture on research stations at three land grant Universities: North Carolina State, Iowa State and Ohio State, and the work was funded by the first major grant of its kind by the USDA. They studied the transition over not just 3 but 5 years, from 2000-2005. While OFRF and a couple other

groups were part of the Consortium, we performed somewhat different roles in networking and organic market research. But I'd like to emphasize what was happening on the ground at the land grants and a few of my observations from this process.

SLIDE 1: Organic Ag Consortium

The Consortium held their final meeting in Ohio this past August, where researchers came from each of the sites to present their research findings to date. Here is a picture of our group from that final meeting. (As you might be able to see I'm making a specific effort to show the farmers.) For three days, we were regaled with more than 40 one-half-hour presentations, on a dizzying array of topics, like...

Effect of raw and composted manure amendments on rhizosphere, nematode and microbial activity in transitional organic tomatoes, and

Effects of organic nutrient amendments on populations of root-colonizing fluorescent pseudomonads

You could say that the nature of research is that it is, by definition, nerdy. A lot of interesting material was presented, even if at times it was somewhat challenging to the more average brain. Nevertheless, I got the feeling, over those three days, of being on the ground floor of ideas that will be built on over the course of the coming decades. And the researchers debated about the different methods used at the different institutions, argued about plot sizes, discussed the struggle to balance the needs of the farm with the needs of the research being conducted, and the challenge of moving beyond component research and input substitution to more systems approaches. They even joked about their struggle with systems research, with some deciding that their next organic research conference should be titled, "Show me your Holism."

An important part of the meeting was where the farmers were asked to provide feedback to the research group, as a way of evaluating of the overall project. I'd like to share some things they said, which do well to summarize what we hear from farmers, about research, in many different venues: This is what they said:

1. include on-farm research in as part of the process (not just at the research stations);
2. test what successful farmers are already doing;
3. note that an organic farm is always in transition, it is in a dynamic state all the time, not just during the first three years of transition from conventional practices
4. include livestock in research wherever possible and appropriate;
5. make sure you're doing a project because it's a good organic project, not just because funding is available;
6. remember always to use certified organic methods; and
7. write up the results for the farmer!

My favorite farmer comment was a little more complex. One fellow from Ohio sat back in his chair, folded his arms, scratched his chin and sat there a while. You could see he was really working on his thoughts, and finally he said: "Well, sometimes it seems like

what we need as farmers is different from what you're looking at. But...it's neat to learn how the researchers think. Things that don't seem very important today, if you put it in farmers hands, and put it in farmer terminology...it might just become revolutionary."

So, hold that thought, and I'll briefly share some of the results of the actual transition work of this troupe.

SLIDE 2: North Carolina State University - CEFS

The Center for Environmental Farming Systems, or CEFS, at North Carolina State University is one of the largest organic university research farms, with 40 acres organic and 30 in transition. They've been looking at five different transition strategies, including: "cold turkey" organic, meaning immediate and total conversion of all practices; three different "phased" transition treatments, where fertilizers, herbicides, or pesticides are replaced in the first two years, followed by all organic practices the third year; and finally, gradual withdrawal of all classes of conventional inputs over a three year period. Their results showed that the phased fertilizer treatment strategy showed significant yield and economic advantages. Project Director Nancy Creamer says many farmers in North Carolina are not ready to go "cold turkey" organic, so as a strategy to build confidence she is recommending that the most important thing is to add organic matter and cover crops to the program, and then phase in other aspects of organic management.

SLIDE 3: Iowa State University - LTAR

In 1997, Iowa State University established the first full-time faculty position in organic agriculture at a land-grant university. Kathleen Delate has this position and has been running their transition studies. They have 20 acres certified organic at four different sites around the state, in horticultural and agronomic crops. Kathleen says their most compelling results were that in agronomic crops they determined that organic fields can have the same yields during transition as conventional fields, and that production costs can also be lower. But that management is key—good management practices are essential to success during the transition period.

SLIDE 4: Ohio State University - OFFER

Ohio State has the Organic Food and Farming Education and Research Program, with 32 acres organic and 13 in transition. In the Ohio State transition studies, a key finding was that...contrary to what conventional scientists and farmers say, soil carbon pools were no different between organic and reduced tillage conventional. They also found a positive correlation between addition of organic amendments and beneficial soil nematodes. Deb Stinner, director of the transitions program, also summarized the work at the three separate land grants by noting that plot size DOES matter. She felt their Ohio plot sizes were too small, the ones at North Carolina were too large, but the ones in Iowa—at a quarter of an acre to an acre in size--were just right. "Our farmers told us this," she said, "and we believed them, but we started this project prior to the USDA grant and couldn't do anything larger at the time, and were kind of stuck with it." Such are some of the vagaries of research—researchers too, can have a hard time fulfilling projects the way they'd like due to lack of funding. Dr. Stinner feels a next step is to compare organic with

conventional no till. “For all those passes we are burning carbon,” she says...we’re adding more to be sure from our total budget, but we’re also burning it. We have a responsibility to come up with new systems that are much less tillage intensive. We’d like to try organic ridge till, and integrating livestock, cover crops, and natural herbicides. In the case of changing tillage practices in particular, farmers are asking us to try new things on station to spread the risk.”

That’s the end of the Consortium work, but staying on the topic of transitions, I’d like to use the example that’s closest to home....

SLIDE 5: Illinois - WORT

Here at Illinois, there is the Windsor Organic Research Team, or WORT (showing they apparently have a good sense of humor about themselves), and Catherine Eastman is the director. This project was started in fall of 2002, when they planted their first winter rye cover crop, and they’re working on 6 acres and comparing three transition systems that differ in management intensity (vegetable, cash grain, and perennial ley). Within these systems, they’re looking at three strategies for organic matter and fertility management, including plant inputs alone, i.e. cover crops; plant inputs plus composts; or, plant inputs plus fresh wastes or manure. Among the items they’re measuring are various soil characteristics, cover crop biomass production, emerged weeds and weed seedbank, and pest and disease incidence. Ed Zaborski gave a presentation on their results at this conference last year. A final comparison of their transition pathways will be made after the third year of transition, in 2006.

Moving away from transitions, I’d like to share just a few other examples of what organic research can be about...

SLIDE 6: USDA-ARS Salinas –ARS goes organic

About breaking the mold

Because organic research is new at the institutional level, these days there are a lot of “firsts.” This is the USDA Agricultural Research Service station in Salinas, California, directed by Eric Brennan. Eric is the first USDA-ARS researcher assigned to do organic research exclusively, and his work is taking place at a certified organic USDA research farm. What Eric wanted to highlight from these photos was the picture of the lettuces, demonstrating the effect of cover crops. These are from two plots that were fertilized, composted, etc. at the same rate, except that the plot with the larger head—on the right--included an addition of a legume/rye cover crop. I think it’s great to have have an ARS researcher demonstrating this. In particular I like the photo of Eric standing in his bell bean field. I think that’s something we’d like to see more of—ARS researchers showing off their fields of cover crops.

SLIDE 7: Grant Family Farms and Jessica Davis

Organic research is about breaking new ground...finding those nuggets of information that lead to the next question...

Grant Family Farms in Colorado is a diversified vegetable farm, and has been using organic practices for 30 years. To look at the effects of organic practices over such a long

period of time, Jessica Davis at Colorado State University reviewed 15 years of soil tests from their fields. The Grants have conducted soil tests every year and carefully documented all fertility activities in each field, which have largely consisted of cover crops and applications of dairy manure. By analyzing through this documentation Jessica determined the rate in the increase of soil phosphorous over time, in this system. A seemingly small thing perhaps, but to her knowledge no other research has identified this rate of increase in organic systems.

From the data, she also suggested that P levels from dairy manure in some fields were on the high side, and that the farm managers should keep an eye on P levels in these fields. We know that nutrient management is as important for organic as conventional systems, including management of excess nitrogen and phosphorous. In response to this, my question to Jessica was...does it matter what the source of phosphorous is, whether it is more or less likely to run off? Her reply was that conventional wisdom is that it does not matter. But, she's had a grad student conducting run-off comparisons from manure that is raw, composted or vermicomposted--actually simulating rainfall and collecting the runoff. The results showed that composted and vermicomposted manures resulted in much less phosphorous runoff, and that therefore the source does make a difference. This is something they want to look at more, and also look at the question of "why"?

SLIDE 8: Ron Rosmann

One aspect of research that I think is often overlooked is the importance of the relationships that research projects can help develop. What organic farmers often say they need most is a support network—logistical support and information and people they can talk to. Research projects can be a great opening to new relationships between people at institutions and farmers that can ultimately benefit the farmer in a variety of ways. But I'm going to use an example that turns this idea on its head, because sometimes it also goes in the other direction. I think a lot of farmers are not aware of their potential influence and the impression they can make on researchers.

The example I'd like to use is the case of Ron Rosmann and his research collaborator, previously at Iowa State, Roberto Sonon. What they were trying to do was see if they could get the product-quality benefits of pastured beef—high omega 3 and conjugated linoleic acid content—if they mostly pastured the cows but fed a small amount of grain so that they could grade to USDA Choice and meet consumer demand for that product. The project results showed that they could do that. Ron described the project as a great success. Dr. Sonon did too, but when I asked him to describe the most important element of their work, he said, "I got to meet Ron Rosmann, and to work with Ron and the other farmers. I was very apprehensive at first. I am not a native of this country and was concerned about the difference in culture and was not at all sure about how well things would go. It turned out to be an incredible experience."

SLIDE 9: Dickinson ND Research & Extension Center

Sometimes research is about finding out something you already know

Patrick Carr at the Dickinson Research & Extension Center in North Dakota has had a project working with organic farmers to select small-grain cultivars for organic systems.

They selected a variety of wheat, oat and barley cultivars, to look at competitiveness in organic systems--in particular to outcompete weeds and get good yields. Patrick did all the right things: he talked with the farmers about what they wanted and the farmers said we want to look at all these different growth traits...seedling vigor, mature plant height, canopy closure, etc. While they *did* find certain varieties that performed better--and well-- in organic systems, they *didn't* find particular *traits* that were closely correlated with competitiveness and yield, in this case. In a post-project review with the farmers, the farmers said, "Yeah, we could have told you that." Dr. Carr called this a "post-intuitive" response.

SLIDE: Mark Schonbeck

Sometimes organic research can be about challenging long-held theories and orthodoxy
Mark Schonbeck, with the Virginia Association for Biological Farming did an experiment changing soil base saturation ratios at five organic farms in Virginia, and the subsequent effects on crops. For those of you unfamiliar with base saturation theory, it is based on the work of William Albrecht who was a soil scientist at the University of Missouri from the 1920's into the 1950's. Albrecht's theories on soil nutrient balancing remain influential in ecological agriculture throughout the world today. Clay and humus particles in soil carry a negative electrical charge, which can attract and hold positively charged atoms, or cations, on their surfaces. The cation exchange capacity of a soil measures the strength of this negative charge, and represents the amount of cations it can carry. Calcium, magnesium, potassium and sodium are the most common cations in most soil systems and are referred to as the "base cations." Albrecht theorized that there is an optimum base saturation ratio, or proportion of sites occupied by these cations, for ideal crop yields and soil structure, and that optimum ratios can support various qualities such as longer product shelf life, fewer weeds, higher soluble solids, and greater crop resistance to pests.

So, Mark tested this theory over three years and found, that while a few of these claims held true, many of them did not--that a strict Albrecht interpretation was not applicable in the soils he tested, but held kernels of truth in certain circumstances. What was possibly more interesting was the effect of these results on those who already believe in Albrecht's theory, and were challenged by this information. Mark presented these results at several meetings where some attendees were notably upset by the results.

The take-home message of this example, for me, is not whether his tests were valid or invalid, but that it is important for us to look carefully at the evidence before us and keep an open mind.

SLIDE: Steve Jones, Washington State University

Sometimes research is about principles

I'd like to highlight the work of Stephen Jones, who is head of the wheat breeding program at WSU. OFRF has supported his work to develop wheat varieties for organic systems, and his department has a breeding program that works actively with both conventional and organic wheat producers throughout the state. In addition, their program will also work with wheat producers anywhere in the U.S. who have small quantities of wheat varieties they've developed and would like help establishing a viable quantity of

seed for planting out. Dr. Jones has been a leader in the public breeding movement, and has made headlines by refusing to work on development of proprietary, GMO wheat varieties. Their department has established a mission statement concerning their position on GMO's and I'd like to share it with you:

We represent a public wheat breeding program that has been in existence at Washington State University since 1894. To our knowledge we are the only wheat breeding program in the United States that has declared itself GMO free. We believe that there should be no patents on life, DNA, genes, ideas or anything related to discovery and invention in the biological sciences. We have never and will never accept money or partnerships with agro-chemical or life sciences corporations. We believe strongly in farmers' rights. We also believe strongly in the general public's right to demand our overall accountability and access to our science.

END OF SLIDES

Before closing I'd like to address the question: Is organic research different from conventional research? This past year OFRF conducted an assessment of our grantmaking program, and in our interviews with researchers, 70% said yes, organic research is different. Of course this often has to do with the requirement of complying with organic standards, but there's more to it than that. Here is how one researcher describes it:

First, I don't take my life in my hands. I found it a much more hazardous environment, doing conventional research. The major difference—in particular when you're working for a corporation—is that your bottom line is making money for the company. In organic research, the bottom lines are helping organic family farms thrive, taking care of the earth, and looking after the health of the consumer. I always feel much more unequivocally that I am the farmer's friend when I'm doing organic research. And it's much more fun, and more systems-thinking. There are many more opportunities for creativity to serve the grower.

I'm going to close by saying that, as far as growing organically, and doing research about it, we need to just keep doing it, and continue to make it grow. What we are doing does make a difference. And you never know—especially when we put new knowledge in the hands of farmers--when it might turn out to be revolutionary.