View metadata, citation and similar papers at core.ac.uk
brought to you by CORE
provided by eCommons@Cornell

# *Sustainability and Needs of 2050 Agriculture*

## Q&A

Moderator: Francisco Diez-Gonzalez
*University of Minnesota*
*Minneapolis, Minnesota*

*Francisco Diez-Gonzalez:* The speakers will join me on the podium and we'll take questions from the audience.

*Sonny Ramaswamy (Oregon State University):* Dr. Swackhamer, what do farmers say about the Water-Sustainability Framework? They are a significant part of this. Are they buying into it?

*Deborah Swackhamer:* The agricultural community was well represented in the 250 or more people who put the Framework together. A lot of folks with an agricultural perspective participated. If you are familiar at all with the restoration of the Everglades—the Consent Decree—the sugar farmers in Florida were confronted with a judge deciding what they needed to do, and the farmers themselves said they would prefer to decide how to meet the load reductions required by the Consent Decree. We thought that was a great idea. So, we are using the concept developed by farmers for the specific situation in the Everglades. In addition, I had many discussions with people in the agricultural community. It's clear that one size doesn't fit all. That even one farm next to another farm might need a different solution. And I think that the majority of the agricultural community would admit that it is only fair that everyone be part of the solution. I think we are all searching for how to have that solution be a productive one and not bifurcated and full of tension. But the short answer is that although they aren't jumping up and down and saying, "Oh, let's grab that solution," they have not rejected it out of hand.

*Richard Isaacson (University of Minnesota):* It seems as though there are challenges ahead, and that's the politically correct term: challenges. There's also the movement from the other direction, which is dealing with threats due to contamination to trying to grow and consume foods locally. It seems as though they are on a collision course at least listening to what I heard today. How compatible are local foods with the concept of sustainability?

*Jonathan Foley:* That's something I have thought and written a lot about recently. The local food movement has been a cultural movement, rather than a significant food-security movement. If you look at local and organic food on the planet right now—what's labeled anyway as "local" and "organic"—it's about 0.6% of the world's calories. It's not even a round-off error. It's very small, relevant only to upper- and middle-income people in Europe and North America. It's not a solution to world-food security, although some great lessons may be learned from it. The local- and organic-food movements are cultural and aesthetic movements, and if the barrier between that world and the conventional agricultural world could be reduced—if the best ideas of the Michael Pollans and local food-movement folks could be adopted then scaled to the real economy with conventional agriculture and large agrobusiness being at the table too—that would be tremendously beneficial. But, right now, there's a schism between those two worlds which is unfortunate because there are good ideas on both sides and they are creating a tension that doesn't need to be there. Local food has some environmental benefits, but not many. It is based a lot on the false assumption that energy used in transporting food is a significant contributor to climate change. It's not. Actually, for the typical Walmart tomato, let's say, less carbon is used to ship it to you than, lets say, a local CSA tomato. Even though Walmart may ship it a lot farther, they are dealing in so much more volume. I don't like that fact because I like the local farmers' market. But neither of them is really large. It turns out that the big emissions of greenhouse gases come from deforestation, cows, rice and nitrous oxide, so forget about food miles *vis-à-vis* climate change. It's not that important. On the other hand, local food opens up people's eyes to how the food system works. It encourages more education and participation in the food system. Is it safer to have local food than distant food? I don't know. Intuitively you'd think it might have a role to play. There are lessons to be learned here, but there's a lot of mythology out there too, on all sides of the table, and I think we should look for the best from all these different food worlds and bring them together.

*Koel Ghosh (University of Minnesota):* People welcome changes related to improving sustainability if no additional costs are incurred. Changes that are adopted quickly are those that actually save costs for companies. But making the changes that matter often means that additional costs are incurred. In cases where there is an additional cost burden, who will pay?

*Terry Stone:* This is one of the biggest issues we are dealing with right now. I have heard it stated an awful lot in groups like the Sustainability Consortium, which was originally founded by Walmart and a number of other big retailers and food companies, and I can

tell you that things are very different today in comparison to when they started. The awareness of the cost and the resource requirements—and, frankly, the risk—that a lot of growers feel in documenting their performance, making that information available, is much greater than was perceived before and the costs need to be borne throughout the supply chain. There's also a perception that the only way to incentivize a grower is by paying a premium for a product. In reality, over time, premiums haven't really held up because they eventually become the standard and everything that's not gets docked. So, creative ways should be explored to understand how best to incentivize their participation, their documentation, their desire to establish a baseline for their water, energy, and carbon use on the farm and being able to continue to document and implement practices for improvement. What we will find, and it's beginning to happen, is that there will be a shared cost throughout the supply chain.

*Foley:* There's a public roll here too, of course. Agricultural subsidies amount to $350 billion in OECD[1] countries. A billion dollars a day just in western countries. That's a lot of money even for these countries and that doesn't include money for things like food aid and food stamps. So, that's part of this economy as well—a small part, but a part of it that has a lot of influence. We should be using that more effectively, perhaps.

*Stone:* Dr. Swackhamer mentioned the importance of the upcoming Farm Bill. When you look at the conservation programs and other subsidies that are being paid to growers, we need to make sure that conservation programs aren't thrown out because they are increasing the budget, that they are recognized for the broader benefits that they provide.

*Audience Member:* Dr. Stone. You briefly talked about Golden Rice. What are the main barriers to its usage?

*Stone:* A lot of them are regulatory-related. Issues have been brought up regarding food safety that have not been borne out. There have been issues on intellectual property that have been dealt with, and I believe should not be a barrier at this point. But, in the end, it's really regulatory, and influences by non-governmental organizations who are concerned about its proliferation.

*Esther McGinnis (University of Minnesota):* Dr. Stone, is there any strategy for overcoming some of the obstacles? I think there is an obstacle to using a sustainable outcomes-based approach and that is because GM crops must be deregulated by APHIS[2] and they have to comply with the National Environmental Policy Act. The National Environmental Policy Act doesn't look at the totality of outcomes. It focuses on environmental impact, sometimes in isolation. For example, if even just one or two organic farmers have the

[1]Organisation for Economic Co-operation and Development.
[2]Animal and Plant Health Inspection Service of the USDA.

possibility of cross-pollination that is enough to, in fact, be an ecoviolation, and there have been cases within the last five years—alfalfa, and sugar beet—and sugar beet really involved one farmer in the Willamette Valley who was growing a compatible organic crop. So how do you deal with the National Environmental Policy Act to move forward with GM crops?

*Stone:* That's a complicated question because part of the responsibility of the USDA is to perform an environmental assessment to determine whether there is significant impact or not. On the basis of that, they have the responsibility to determine whether they need to perform a natural and environmental impact statement, an NEIS. In the beginning, for APHIS, there was certainly a desire to be able to come to a finding of no significant impact with all of the crops that were seeking deregulation, and they found they were able to do so because they were also regulating under the Plant Pest Act, which is their principle authority to be able to review and deregulate these products. Over time, and this is very similar to many other environmental issues that have occurred and goes back actually to the establishment of the National Environmental Policy Act, which was written very broadly and without a great deal of necessary detail on how an environmental impact or environmental assessment should actually be performed. This is why there have been so many lawsuits under the National Environmental Policy Act and many have gone to the Supreme Court to find resolution. What we are seeing today at USDA is that same kind of process. In the beginning it was new, and a lot of issues had to be dealt with and there were differences of opinion—as far as whether it's safe or not—but at the same time they were able to go forward until it reached a point where there were products that perhaps were deregulated because of their open pollination or other reasons that led to greater scrutiny and, frankly, groups finally decided to use the courts as a way to assess whether these things should continue to move forward. So, it's a process and the USDA is getting better at doing environmental assessments and considering when they need to do environmental impact statements. So that's one part of it from a regulatory piece, and I won't get into the merits of Roundup Ready alfalfa or Roundup Ready sugar beet. From a sustainability perspective, however, when you consider that a lot of technologies take many years to get to the market—it's all part of the developing process—and years that it takes including regulatory oversight and the like are borne by the companies that are developing them and then, of course, after they are commercialized, their desire is to be able to recoup that investment so that they can continue more innovation, develop other products and keep the circle going. So, from a sustainability perspective, I don't see there being any distinction between whether it's a genetically modified crop or whether it's developed by traditional plant breeding. It's part of the process. What is important are the outcomes that we are trying to achieve in developing these products, like reducing water usage, reducing energy usage or improve nitrogen-use efficiency. The means to get there—if we are able to achieve these outcomes given that we are not causing other problems as an offset—are, I think, the more important points. So, I am hopeful that there will be more innovation and that products that require new technologies will find a way to the marketplace more quickly than they have in the past.

*Tony Shelton (Cornell University):* Dr. Foley, one of your conclusions was to halt agriculture expansion, especially in sensitive areas, and then in those areas where things can be improved, to adopt technology to try to improve the yield per unit of land. Is that correct?

*Foley:* More or less.

*Shelton:* Terry Stone, you mentioned that, in Brazil for example, agricultural production had doubled in a specific period of time, and so I am wondering if you and Dr. Foley might have a conversation about that example, and also maybe question whether technology makes it easier to adopt a crop in a particularly sensitive area?

*Foley:* I was thinking the same thing when I heard that comment. The productivity of soybeans did not come about through GMOs. It was conventional plant breeding in Brazil to overcome day-length requirements. It's a temperate crop that needs daylight triggers to produce seed and that was overcome just as the demand was exploding in Europe and Asia for vegetable protein. So it's a tremendous economic success story. The land that soybeans are moving into in Bolivia and Brazil primarily was formerly mostly pastureland, not newly cleared rain forest, but almost every soybean field in Brazil today was probably in rainforest within a decade ago. The usual approach is to clear rainforest for a pasture because you just simply can't plow the land due to stumps and hummocks. You leave it as pasture for a while and then the soybean folks move in, who often claim, "Oh, we didn't cause deforestation, it was those pasture guys." So there's a lot of back and forth about that and it's interesting looking at land-tenure patterns. You have to admit the land was cleared recently and whether that led to further deforestation or not is another question. Now there's a question about whether sugar-cane expansion in Brazil for biofuel production will accelerate that further.

*Stone:* Well, technology is a very broad term. Biotechnology is one form of technology, but there are a many other pieces of the puzzle. I think it's a combination or things. There is no doubt that breeding in Brazil was a major influence on the changes as were IPM practices. Markets began to explode in other parts of the world, and, frankly, Roundup Ready soybean had a tremendous impact on adoption as well. There were many factors. On your point of whether technology enables the production of crops in sensitive areas, I think this is a matter of policy. Technology is an enabler. It's a tool. It's not the reason to grow crops in a particular area. It may enable that to happen. But there also needs to be government policy and corporate policy that dictates also whether that is permitted or not. As mentioned—I thought this was interesting—they require buffers between fields in Brazil. We don't have that same requirement here in the United States. That kind of policy enables technologies to be employed with less risk to the environment.

*Foley:* There are some success stories from Brazil although in the last year deforestation rates spiked again due to land speculation, but overall it's been declining recently, thanks

in part to companies like Cargill who work with NGOs. There's a road in Brazil that is very controversial called BR 163 from the Mato Grosso, the heart of the soybean part of Brazil, up north, not south to Rio and Sao Paulo, where most of the soybeans were going, but north to the deep-water port of Santarém on the Amazon River and which could ship soybeans much more quickly to Europe or the Panama Canal. The problem is, if you pave and widen that road, then it would just spur more deforestation and more clearing. So Cargill and NGOs and the governor and others proposed to pave and widen the road, but then create huge parks on either side of the road that cannot be deforested and give them to indigenous peoples and environmental groups and so on, to find a way to have a win-win.

*Abel Ponce de León (University of Minnesota):* Jon, similar to what Tony Shelton spoke about, you indicated that increased productivity will require increased inputs of fertilizer *et cetera*. Another necessity is to reduce water pollution. These seem to be mutually exclusive.

*Foley:* I suspect we are in agreement. Regarding fertilizers, it's the goldilocks problem again. Half the world has too few fertilizers and very low crop production and the fertilizers they are using aren't really getting the job done, and the other half of the world has too much, including the United States, but especially China and India. We are actually using too much. Often, only about a third of applied fertilizer creates plant nutrition, maybe a half if we are lucky. Then the other half or two-thirds is an environmental pollutant whether it is nitrate, nitrous oxide, excess phosphorus, *et cetera*, all potentially affecting water quality. What we don't have anywhere in the world is somebody who is doing it just right. If you look at the distribution of fertilizers and their benefits for food production, it is bimodal—too little or way too much. We all know what the optimum is, but incentives are perverse on one side and on the other side poverty and lack of infrastructure prevail. A lot of Africa would benefit from a lot of fertilizers and a lot of Minnesota would benefit from using less. There's a middle ground that nobody has gotten to yet. I would love to hear what Deb thinks.

*Swackhamer:* Everything that Jon just said I would agree with, but I would emphasize that we do know the answers. We know how much nitrogen to apply to get optimum yield. It requires conservation-based agriculture. It requires modern agriculture and that costs money. It needs incentives. It needs support from the government. This is a great segue—I'm going to change the conversation. We could do a far better job on the nitrogen and phosphorus thing. We just don't do it because it costs money. In the United States we could do a much better job. We are a wealthy country and we could actually invest—part of the Farm Bill, perhaps—to protect our natural resources. But much of the conversation today—in fact the three gentleman here spoke on a global scale whereas I spoke at a national scale and the problems globally are far worse than what we face here in this country in terms of producing food and feeding our hungry, *et cetera*. And yet I just heard for the first time just now the word policy. This is all predicated on policy. It's not

predicated on whether we have the technologies or whether we know how much nitrogen to apply. We know all that and we have really the technologies and I would submit to the three of you—and would love to hear your answers—and to the audience, that the biggest barrier here is governmental. It's not the technology. It's not having enough seed. It's not having enough land. It's politics and policies.

*Ponce de León:* So, let me add one more question, and this if for Dan now.

*Swackhamer:* You're not going to answer my question, Abel?

*Daniel Gustafson:* I'll incorporate the answer into my response to this question.

*Ponce de León:* What is the role of FAO and other global institutions in this regard?

*Gustafson:* Let me see if I can combine those two. A lot of what we work on, of course, is policy, but I think—following up on Jon's comment too—that, almost invariably, where there is too much fertilizer use it's a policy issue. The incentives are just all wrong either in formulation or in subsidies or manufacturers or other things. Now—the other side of the equation—where you have too little fertilizer use, I don't think that policy *per se* is the issue in quite the same way. It could be to the extent that it is a policy of lack of investment, but often it is just too expensive to transport fertilizer very far. So the cost of fertilizer in Rwanda, for example, is five times more expensive than it is in Kenya because it has to be transported from Mombasa. It's the same stuff, so the use of technology by really poor farmers is largely one of economics rather than a policy. Why that is the case relates back to policy choices and what was invested in; whether agriculture is seen as a declining sector, with people moving out of it, is certainly related to policy. Or similarly with donors not investing in agriculture for a long time, but instead investing more in social services, health in particular, that have much easier connection between investment and observable outcomes, and so on. Okay, with regard to FAO, policy is a difficult issue. We do a lot of work on policy and we do a lot of work on supporting groups that are working with stakeholders in order to change policies, because governments are not amenable to pressure in that sense outside of longer-term education and awareness and pressure within the society. However, when you look at the renewed interest in agriculture and in investment and policies that would promote agricultural growth and food-security improvement and so on, when you get right down to it, it is really all about the food prices of 2007 and 2008. I don't really see that any of the work on advocacy and policy addressing this issue in a big way made any headway relative to the crisis. And it may be that way here too. If we had a water crisis in Minnesota, I think that a 25-year plan would be developed faster. How to deal with these long-term issues outside of a crisis is a huge challenge.

*Diez-Gonzalez:* One last question.

*Ralph Hardy (National Agricultural Biotechnology Council):* Let me make one comment and ask one question. Michael Pollan was invited last year to be a plenary speaker when the topic was *Promoting Health by Linking Agriculture Food and Nutrition*, right down Michael Pollan's line. He declined to attend the meeting. He basically said that he will not speak with agricultural groups. It's difficult to deal with Michael Pollan who uses the *New York Times* and other sources to distribute his mix of facts and non-facts. Part of it is his lack of familiarity with the reality of agriculture. You can't get him into an open forum such as this meeting which welcomes comments from all sorts of people. End of my comment. Question—agriculture has not many log-step improvements. It's been quite a while since agriculture made a log-step improvement. We've made little steps. Herbicide tolerance was obvious and it was easy and a good way to enter the biotech market. Drought tolerance is going to be a little bit more challenging, but I think that we are saying that we need revolutionary new ways of doing things. We've been talking about the fertilizer area. Nitrogen fertilizer has its problems in the environmental cost, the energy cost, carbon dioxide emissions, all those sorts of things. We need to be putting some effort in terms of high-risk research with huge high-return possibilities. Self-nitrogen-fertilizing crops I think is an area to revisit at this particular time. We've been able to make a synthetic genome. All we need to do for self-nitrogen-fertilizing crops is to put in the genes that enable nodules on the stems of corn, *et cetera*, and replace the energy-wasteful nodules that are on the roots of soybeans. We know that there are rhizobia out there that can directly receive solar energy and can use that energy to fix the nitrogen. A big problem with biological nitrogen fixation in root nodules is the huge energy cost to the plant. So this is the sort of thing I would urge us to start thinking about and I'd welcome your comments. What areas of new technology should academe, should industry, should government be putting a percentage of their bets on—because those are the things that are really going to change the game down the road. Thank you.

*Swackhamer:* As the non-agricultural person up here, I will start. Thank you for your comments. Terry talked about where do you want to get to, what do you want the outcome to be, and then back out, what are the solutions to those problems? What are the technologies that would be needed? So if you want to reduce nitrogen, figure out how you are going to do that and implement those strategies. I hear you. We need transformational strategies. These little tinkerings around the edges—as much as I really like buffer strips, I think if we put 50-foot buffer strips across every stream in the United States, it still wouldn't work. We need transformational changes, but we have to decide what the outcome is going to be and then back calculate what needs to happen. That's my two cents.

*Foley:* I would echo the same comment in a lot of ways and I like Terry's comment too—outcome-based performance rather than prescriptive. We need to deliver more food with more nutrition with less environmental harm, bottom line—however you can do that, that's great. The way you are talking about it is really fascinating. Wherever he is, Michael Pollan's ears are burning right now. He's a good guy actually, I wish he would come to meetings like this. But, what we call GMOs today are going to be obsolete pretty

soon as a result of synthetic biology and computational capabilities. We will compute the genome and then go make it. Some incredible tools are coming on line. There's a legitimate concern that people in this room need to think about: most of this technology is being developed in the private sector. The private sector has a huge roll to play in innovation, as it did in the IT revolution, but the calculus of where to invest and where to deploy is a business model that has to provide return to the shareholder, as it should. There ought to be some places where the public good is put first too. And that is where public investment in universities, nonprofits, foundations and so on comes in; that needs to be there and be a partner to the private sector. Let them be partners together to make sure those kinds of technologies are deployed. I hear all this talk about, "Oh, we're going to create crops that are drought-resistant and perennial and nitrogen-producing," yet that would be a terrible business model for Syngenta or Monsanto. They would be out of business if they were successful. Why would they do that? So, I'm a little skeptical. I think that these things should be done, but who is going to really do them?

*Hardy:* The IP from self-nitrogen-fertilizing crops would be substantive.

*Foley:* But should that be in the public domain? People like me would say that that should be given to the world. That's a lousy business model.

*Hardy:* I think it should be government doing that because it's high risk. And maybe too high risk for a university and probably it's too high risk for industry.

*Stone:* Think about all the budget issues that are going through Congress right now. People are fighting over pennies. We deal with similar things in our business too. Every decision we make essentially should take into consideration return on investment. So, does that mean that we don't fund or don't do high-risk research? No, but we tend to place our bets in areas where the risk is acceptable. For areas where it's not, we fund a tremendous amount of research in academia and in small start-up companies and the like. We have to determine where our best bets are, frankly, and maximize our core competency. I would like to come back to something that both Deb and Jon said that's relevant. Where do you begin? I like Deb's analogy of a bank account. Most growers are really not good record keepers from the perspective of understanding what they've used or what they've applied versus what they've received in terms of whether its yield or return on their investment. Growers need to be able to develop their own bank accounts—call it a sustainability account, in terms of things like energy per bushel, water use per bushel—so they know where they can improve. Companies are getting into lifecycle assessment, and when they do the work to understand their carbon footprint or energy footprint, they realize something incredible: they save money. Walmart is a great example. They are saving millions of dollars a year because they turned off the light bulbs in their Coke machines overnight. There are so many examples of that. Farmers need to get to the same point. It's one of the biggest challenges we have. In my mind, if there's a place to start it's educating growers on the importance of being able to document what their practices are, what their inputs are

and the impacts those things have on their outcomes, not just in bushels but in resource efficiencies. By doing that, it's a tremendous starting point. Growers won't cut down on the amount of fertilizer they are going to use because it's an insurance policy. They can't predict the weather, so they can't take a risk of not applying more. So there has to be some way to be able to inform that decision that, right now, is not readily accepted by growers. So, document, benchmark, establish a baseline, identify improvements, continue to document and adapt to be able to continue to improve, and focusing on the outcomes that allow that to happen. And then the technologies come along.