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Challenges in Measuring the Benefits of Organic Foods

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Today, I want to talk to you about some research I have been doing at Tufts University. One thing that I would like you to remember from this presentation is the website organic-center.org. This is the website of the Organic Center, an exciting new venture. The focus of the Center is to look at the issues being addressed in this panel. How do we compare organic versus conventional food and agriculture? What are the benefits of growing and eating organic food? These are areas that funders are starting to dip their toes into, and we hope that federal funding will also start to loosen up to address these issues. Right now, however, the most interesting work is being privately funded by the Organic Center.

The Organic Center has recently released three "State of the Science Reviews" (SSRs). Chuck Benbrook is the chief scientist for the Center. The first SSR addressed pesticide residues and was really capstone work for Benbrook, because he has been working on these issues for 20 years. The second SSR concentrated on antioxidant and polyphenol flavonoid comparisons. The third report just came out this fall and focuses on mycotoxin comparisons.

My work at Tufts University has been funded by the Organic Center. Tufts University has one of the five USDA nutrition centers, the Human Nutrition Research Center. They have a wonderful antioxidant laboratory there that provided an opportunity to do some research on antioxidants and the comparison between organic and conventional food. Within this research, my job is to do the farm pairings and bring the product to the lab for analysis. We are currently in the final stages of writing a paper on the methodology that we have been following.

I want to talk today about the challenges of doing these comparisons. A lot of the information has already been discussed here today, but I wanted to give you my experience. I will go over some of the major questions and challenges. First: How do you pick which crops to study? USDA has several databases that tell us which crops are antioxidant rich — blueberries, for example. So, we first looked at the crops that are antioxidant rich and were already of interest in the scientific community. We then focused on those that are grown in our region, leaving us with blueberries, tomatoes, cranberries, and then also dairy for a variety of reasons.

During our next step, we called organic certifying agents to help identify possible farms. We also talked to Cooperative Extension and the Natural Resource Conservation Service. We tried to get the farm pairs as geographically close as possible because of weather patterns, water sources, and soils. We found that often when we called to ask farmers to take part in

the comparative research, the conventional farmers were immediately on the defensive.

How many farms do you need for these comparisons? When I talked to John Reganold at Washington State University, generally the convention is that you want four pairs. But, you really have to start with more than that, because when you get into your research, you will find that what the farmer tells you about his crop on the phone may be really different than when you have driven 15 hours to that farm. You may lose that pairing. In addition, the question is how long do the comparisons need to last? We found out that for the data to be published in the literature, they really want two years of data.

In terms of implementing the study, it was amazing what farmers did not know about their own farms when we got there. We found that, in general, organic farmers tend to know more. Ideally, you would be taking soil samples, but we didn't do that in this study. Some farmers had soil analysis and all kinds of data that they shared with us. Some knew what kind of soil types were on their farm. But then, in any field you have many types of soil, so this can be a challenge.

Farmers also didn't know much about their operation. Maybe they been farming the organic farm for 10 years, but what if the blueberry bush is 30 years old or if the cranberry bog is 100 years old? To obtain the historical data and make those comparisons is very difficult. In addition, some farmers fell out of organic production during the study. For example, we had a cranberry operation fall out in the middle of the study – cranberries are very difficult to operate organically.

There were numerous other challenges we faced. There are all kinds of organic, and all kinds of conventional. For example, on the one end, you might have industrial organic, and I use that phrase not in terms of size, but in terms of the number of inputs; these may be farms that are as conventional as organic can get. On the other hand, you may have a conventional guy using Integrated Pest Management (IPM) methods that are very close to organic production. Then, you may have the farmer that is doing organic by neglect. The hypothesis with antioxidants and polyphenols is that they are produced as a plant defends itself. Thus, possibly, on this farm where the plant is neglected (which is not the ideal organic in my mind), these plants may be the ones with the highest antioxidant capacity. So, you have that sort of farm versus the industrial conventional – and maybe that is where you will find your biggest differences. Thus, the important issue is how you portray these comparisons and when you write it up, how you describe these farms. For example, I find that when I compare small non-organic dairy operations in Vermont with some organic dairies, they have a lot in common.

Another major challenge is varieties. If your blueberry bush is 30 years old, or the cranberry bog is 100 years old, it is difficult to discern their variety. Many times, organic farmers are doing completely different varieties than the conventional farmers. For instance, with tomatoes, the organic farmers are growing Brandywine tomatoes, the delicious two-pound heirloom tomato that most of us know. The conventional farmers are not doing that. If I do find the conventional farmer growing Brandywine heirloom tomatoes, which we were able to do, he is likely selling it at a farm stand or a local market in a different type of system than the ordinary conventional farmer because Brandywine tomatoes don't travel well over long distances. Thus, trying to match varieties between organic and conventional systems takes out a number of varieties from consideration.

The parameters are also important. We were trying to match soils, irrigation, inputs, planting time, ages of the bush or the bog, how long the farm may have been organic, rotations, and the list goes on and on. We haven't succeeded yet in getting a perfect match. We also leave room for farmer speculation on the comparison of conventional and organic when we

talk to them and in follow up with the paper. I found some of the richest discussions and important insights coming from the farmers themselves because they have thought a lot about this. I would urge researchers to allow for some free-flowing conversation beyond the interview protocol to get these insights.

What do you do for sampling? The guys in the lab coats said, "Bring back 20 units." Well, they meant 20 tomatoes per farm or 20 cranberries per farm. This did turn into a magnitude problem, however. These lab technicians were pretty surprised when we came back with 20 2-pound tomatoes. We also tried to sample so it was representative of the field. For example, who pulls the sample? Initially I had the farmer pull the sample. Later, I decided that it was better if I, as the researcher, pull the sample because I do the same thing on every farm, and farmers individually will do things differently.

We also try to pull the sample as close to harvest time as possible. It is great if I have two farms that are 10 miles apart. However, maybe their harvest time is different because they planted at different times. As a researcher, I've decided I want to collect the samples on the same day. Which factor trumps the other is really what this brings up. In addition, if you are pulling samples at harvest time, you have farmers who are very busy. Those are some of the challenges we are dealing with in my current research. I think we will have some interesting results to publish next year. What has been really great about this research is that it has really excited some of the scientists in the laboratory. This kind of research wasn't in their scope previously. Now they really want to learn about it — they are reading the literature differently, they are scanning the literature more, and they are thinking about NIH money. So, the little bit of money we got from the Organic Center is paving the way for bigger things. For those of you that have research ideas about comparing organic and conventional, the Organic Center provides up to \$5,000 in small grants to do the groundwork to prepare proposals.