

# Response by William (Bill) Liebhardt

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## Response

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My research was initiated because I attended a 2000 meeting in PA where Dennis Avery (father of Alex) was debating GMOs. Dennis Avery made claims in that talk about the yield differential of conventional and organic crops and then went on to say how that yield differential would affect land use. Dennis Avery stated that organic yields were only 55–60% of conventional yields and that 18–20 million acres of wildlife habitat would have to be farmed if high input agriculture were farmed organically. As I listened to his talk I wondered where he got his data or information. I knew of farming systems comparisons around the country and the yield differences were not like that. As soon as his talk was over, I was the first to ask a question and it was this. What is the source of your information showing that organic yields were only 55–60% of conventional? He did not want to answer the question. However, the moderator was a journalist from a Philadelphia paper and he said it was a legitimate question and it should be answered. So Avery said he was told that organic wheat in England yielded only 55–60% of conventional. So that was his source. I thought, this person is going around the country using one data point to suggest how the world should feed itself. I thought that the question of how we feed ourselves is an important one but that it should be based on more information than that. So I decided to gather what information that I could from replicated experiments from around the country and that is what I published. I used numbers that I found in the published reports or what the people running the experiments gave to me. Rather than presenting the actual yield data, I decided to convert everything to a percentage as I thought it would make the comparisons easier to make or see. Alex Avery called me in late December that year and we had a long conversation. I told him that I did this work because of what his father had said and I wanted to present at least some limited information that I knew to exist. I told him that I did not think anyone on either side of this debate should be giving talks about how to feed the world using only one crop in one country. If we are going to propose how to manage the planet, it should be based on more than one crop in one country. I believe it should be based on experimentation in many countries and on many farms in those countries. This is too big a question to be left to what a person hears about one crop in one country.

I would now like to deal with Alex Avery's comments in his letter. In the case of the corn comparison, the data are from replicated experiments in seven locations in the United States over a total of 69 years. Organic corn yielded 94% of the conventional corn. Most of this work is from university sources.

Avery is incorrect here in some of his statements regarding the tomato research. What he says about transplanting is correct. This is a farming systems comparison. The experiment had two conventional farmers and two organic farmers as advisors to address farming practices. From a farming perspective, it put the organic treatment at a disadvantage in the early years by planting very early in the season using the direct seed method. It resulted in more weed problems and less nitrogen in the vetch cover crop. The changes were made to make the system perform better. Using transplants also delayed the planting date and allowed the vetch cover crop to accumulate more biomass and N which helped the system perform. The variety also had to be changed due to using the transplants which reduced the cost of seed. All changes were made with the idea of using the best farming practices for that system as that was the philosophy behind this research.

The higher use of irrigation water in organic treatments was a result of better soil quality in the organic plots. The practice was to irrigate everything the same but because the water infiltration rate and water-holding capacity was higher, it could be irrigated longer without having standing water. There were changes in the irrigation after this was observed later on. In the winter, when there was heavy rainfall, the organic plots would not have standing water; however, the conventional plots did. You did not need a plot diagram to identify the organic plots.

Weed problems were greater in the organic treatment. Research is needed in this area. I do not know about the quality information Alex Avery writes about. I know of work on an experiment that shows that antioxidants are higher in the organic treatments. This research has been published by Mitchell et al. (2007. *Journal of Agricultural and Food Chemistry* 55(15):6154–6159). The work showed that 10-year levels of quercetin and kaempferol in organic tomatoes were 79 and 97% higher than those of conventional tomatoes. The levels of flavonoids increased over

time in the organic treatments, showing that as the soil quality changes so does the tomato quality. The levels of flavonoids did not vary significantly in conventional treatments over the same years.

Finally, the yield differential. Dr Ford Dennison was the PI and I asked him for yield information and told him what

I was trying to do. He gave me the percentage yield information and so I used what he provided.

The economic analysis is done with the organic premium because that is part of the system in the real world and the researchers are trying to provide accurate information about system performance.