

Environmental Impact Assessment of Glyphosate-Resistant Sugarbeet Production

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Project Report:

Glyphosate resistant sugarbeet represents the most significant technological advance in sugarbeet weed management since the introduction of selective herbicides. The primary goal of this Global Perspectives funded project was to collaboratively develop methods to quantify differences between glyphosate-resistant and conventional sugarbeet production systems with respect to their overall environmental impact. Researchers at the Institut für Zuckerrübenforschung (Institute of Sugarbeet Research, IfZ) in Göttingen, Germany, have been developing models and methods that quantify the environmental impact (both positive and negative) of various agricultural production practices. By adapting these models to U.S. conditions and practices, we will be better able to understand the environmental impact of glyphosate-resistant sugarbeet technology, and compare it to conventional sugarbeet production practices. The IfZ develops and promotes sustainable development of sugarbeet production, and is associated with the University of Göttingen.

In February, 2011, I spent three weeks in Goettingen, Germany as a visiting scientist at the IfZ. The trip was extremely productive both with respect to the intended project, but also other potential collaborations to address sugarbeet production issues facing Wyoming and Germany. For the environmental impact project, I worked closely with Dr. Nicol Stockfisch, the primary developer of using eco-efficiency analysis as a tool to monitor the environmental impact of sugarbeet production. We had regular meetings with Doctoral students while at the institute that were working on similar areas of research. At these meetings, we discussed how best to adapt the eco-efficiency concept to compare production systems, especially with respect to pesticide and tillage practices. One of the primary changes I plan to make from previous use of these models is to modify how pesticide impacts are incorporated into the model. The German system used to date simply expresses pesticide use as a percentage of the maximum use rate; consequently a large amount of available toxicity data is not incorporated into this system. We will plan to utilize the Environmental Impact Quotient developed by Kovach et al. at Cornell University to obtain more environmentally relevant impacts of pesticide usage in the systems.

These conversations in Germany led to a framework that will be used to conduct a meta-analysis of all peer-reviewed research comparing glyphosate-resistant and conventional sugarbeet. Since my return to Laramie, I have begun actively recruiting a graduate student to work on this project, and have 2 very promising students who have applied. The goal will be to have the student review all published literature on glyphosate-resistant sugarbeet to determine the relative environmental impact of each system. This data will be valuable to both policymakers and sugarbeet growers.

In addition to the primary objective, I was able to make contacts with many other researchers, sugar industry representatives, and farmers while on the trip. These conversations could lead to additional collaborations in the future, particularly with Dr. Christa Hoffman (plant physiology) and Dr. Mark Varrellman (plant protection). Dr. Hoffman has research interests in cold/freeze tolerance in sugarbeet, an issue also very important to Wyoming producers. Dr. Varrellman has

conducted recent research on disease resistance in sugarbeet, and herbicide resistance in weeds; also areas of concern for Wyoming. These collaborations may lead to synergy with respect to Wyoming and German research programs.

I also had time to tour several farming operations while in Germany. One of the Doctoral students at the IfZ was able to show me around a very large farming operation in which his father was a shareholder. These large farms owned by several families are common in the Eastern part of Germany. This particular operation had a large biogas facility that I was able to tour. Installation of these biogas facilities have been subsidized by the German government for a number of years, and provide a significant percentage of the on-farm energy needs, even for a fairly large operation.

I was also able to spend a day driving around Sudzucker (a sugar company) production region with a recently retired Sudzucker representative. He had impressive knowledge of sugarbeet production practices and limitations, and he was extremely enjoyable to be around. He showed me some long-term tillage and crop rotation research plots that provided me some additional research ideas to initiate here in Wyoming. I was also able to view some organically managed sugarbeet fields. This was especially informative, as the soils under organic management were in very poor shape compared to the conventionally produced fields. This was primarily because the organically managed fields were completely reliant on tillage for weed control, as compared with herbicides in the conventional fields. Consequently, there was very minimal soil structure in the organically managed fields.

Overall, I feel this trip was extremely valuable for my professional development, and I think it will lead to a number of international collaborations as I continue my career at the University of Wyoming. I am eternally grateful to have received this opportunity. Attached to this report are some pictures taken while I was on this trip.



This is one of the long-term tillage and crop rotation trials I was able to see while touring with the Sudzucker representative. Note the difference in soil color on the two sides, and all the wind turbines in the background. These turbines were a very common site in agricultural fields all over Germany.



This lake, which is now a park and bike/running trail, is actually a “reclaimed” mine. The water table here is so high that when the mine was active, they constantly had to pump water out. Once mining operations ceased, they simply stopped pumping the water out and the mine naturally filled with water.



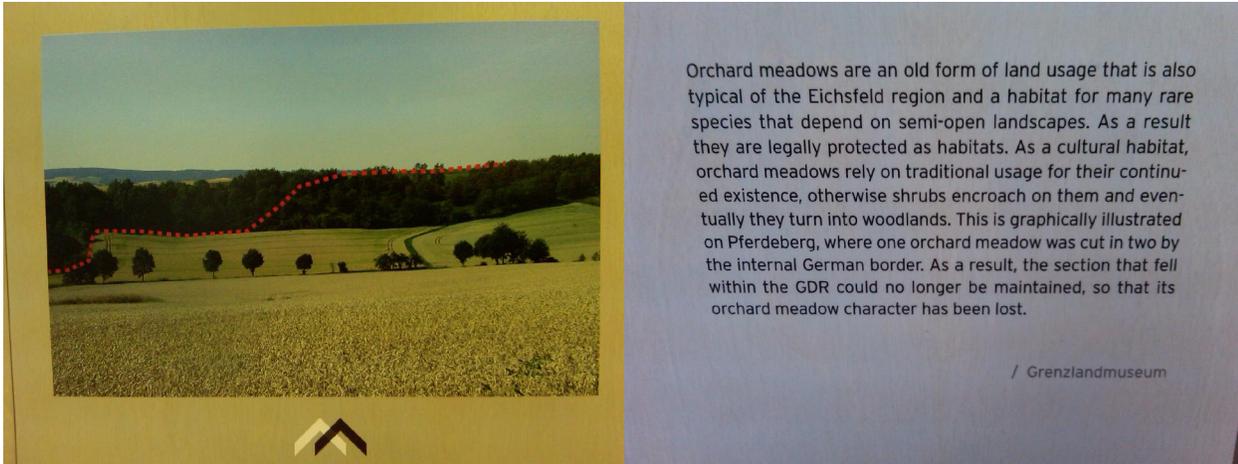
The nutrient-rich 'waste' products from the biogas fermentation products were spread out on fields to aid in fertility.



This was a commonly observed contrast between old and new. Solar panels have been installed on a building that was built in the 1700s.



Even though I was there in February, I was able to see some field trials that were ongoing. This is a variety trial for “winter beet” or sugarbeet with sufficient cold-tolerance to withstand winter weather. This research could eventually lead to discoveries that will help Wyoming sugarbeet farmers.



This photo and caption were in a former border crossing station that had been turned into a museum. It illustrates an interesting contrast between the European and American ideas of conservation. In many parts of Europe, certain types of farmland are legally protected for conservation purposes, as very little land there is in any kind of native vegetation. If this field was not cultivated, it would quickly turn into a forest.