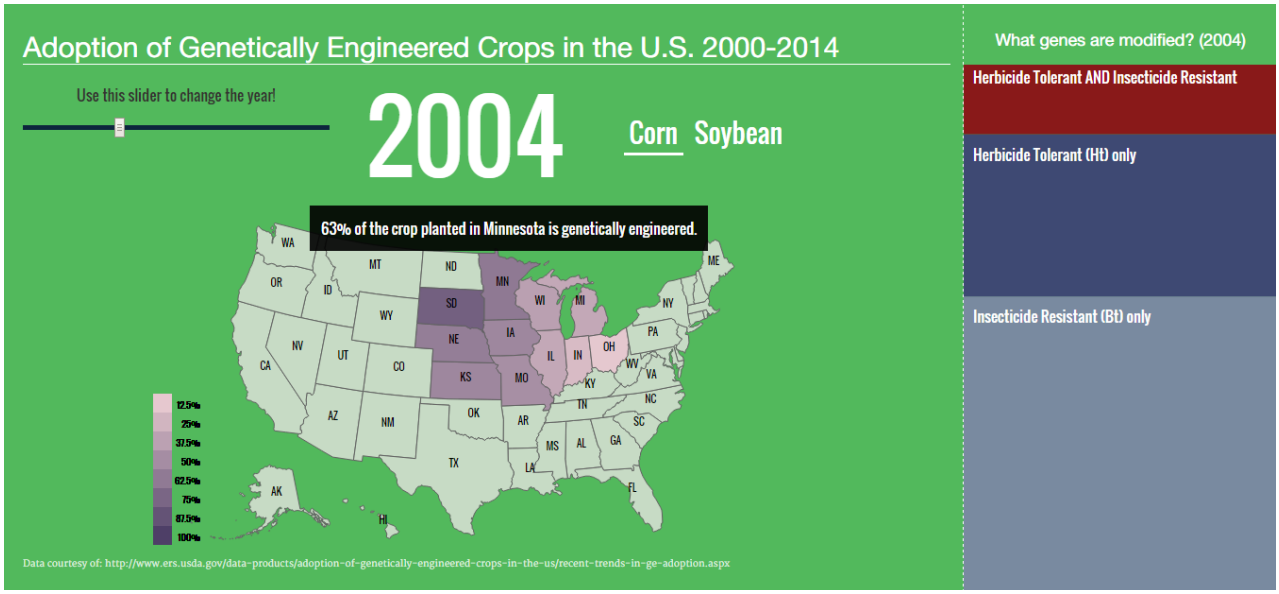
Jared Hoffman and Jing Zhang
Interactive Visualization - Project 2 for INFO 3300
April 24, 2015

I. Overview

What is the state of agriculture in the USA -- and more specifically, what role do genetically modified crops play? Are GMO foods really bad for your health, as some Lulu-lemon toting yogis may claim?

We aim to expose the absurdity of the debate over GMO foods by illustrating that, in a sense, the debate has already been won: genetically engineered crops are already here, and in force. We show how the prominence of genetically modified corn and soybeans in the United States has increased dramatically in the past fifteen years. Simultaneously, we show increasing adoption of “stacked gene” varieties -- crops with multiple genetic changes.

Although we only had two partners, we are pleased with how much we were able to accomplish. Our project is visually appealing, interactive, and uncovers an intriguing trend that is not often considered.



Screenshot of our final visualization

II. Data

We used data from the US Department of Agriculture that focuses on genetically modified crops. The data offers state-by-state metrics of what percentage of a given crop is planted from genetically engineered seeds. For example, one data point might be that 89% of corn

planted Illinois in 2013 had modified genes. We considered two crops: corn and soybeans, which are the most prominent crops that are genetically modified here in the USA.

Our data is collected from 2000 to 2014, so we are working on an up-to-date dataset.

We also had data on the types of genes modified during any particular year in any state. There are three options: HT, BT, and ST, which translate to Herbicide-Tolerant, Insecticide-Resistant, and Stacked-Trait. The percentage of GE crops that are Stacked-Trait (both genes modified) goes up considerably as the years go by.

Jing also created a stacked bar graph that showed any particular state's HT,BT, and ST genes over the whole time frame. This was quite a lot of data and we decided to simplify it by generalizing the data to just USA percentages for corn. Then we put this data into a single stacked bar on the right side of the page. We made the data more simple because the country as a whole follows a very strong trend towards ST and away from HT and BT exclusively. This is understood through the growing dark-red bar, which shows how ST crops have increased in popularity in recent years.

We had to reformat the state-by-state data, removing cotton and formatting an excel document into JSON. Jing took the lead on this, sanitizing the data so that we could apply it to a state map (Albers USA projection) that changes based on year.

The data can be found here:
http://www.ers.usda.gov/data-products/adoption-of-genetically-engineered-crops-in-the-us.aspx

III. Visualization

There are two main components of our visualization: a map and a single-bar chart, which both react to an interactive year-range slider. We wanted to show how genetically engineered crops have been adopted in the US over the past 15 years, and we thought the best way would be to put the slider in the hands of the user and let him/her watch that progression happen across multiple dimensions. I believe we succeeded on this front: if you slide from 2000 to 2008 to 2014 it will be painfully clear what the trend has been in just about every state. Furthermore, the bar chart on the right bluntly references a similar trend -- the widespread adoption of Stacked-Gene varieties rather than just single-gene mutations.

The map uses a linear-scale to convert percentages to colors. The darker the color the higher the percentage.

We used tooltips as one way of offering information to the user. If you rollover states on the map you get a specific percentage that refers to: % of GE crops in State X during Year Y. This data changes based on which crop you choose and what year you are set on. We made a

user's "location" obvious by featuring Year and Crop loud and clear at the top of the page. This is very important, as it increases the clarity of the visualization and takes some of the cognitive strain off users seeking to understand the trends. There are also tooltips on the gene-type chart.

The mapping for the gene-type chart on the right is quite simple. The size of the Herbicide-Tolerant portion (HT) of the bar is found by:

(HT / HT+ST+BT)

BT and ST are found with the same process.

In this way, the bar-chart shows the relative deployment of different genetic modifications, whereas the map in the center illustrates the total or absolute usage of genetic modifications of a given crop.

We went through a lot of iterations of both design and data-visualizations. Ultimately we did not use all of the charts we created, which is sort of a shame because of the time spent putting together that code, but we think the story is told more cohesively this way.

From a design standpoint, we employed flat design to create a modern looking site, using a custom CSS stylesheet and Normalize.css. We used three fonts in total: two sans-serif and one serif. Two of those, **Oswald** and Merriweather, are from Google Fonts. (The other one is Helvetica). The colors are happy but muted. We used green and white as our scheme as green is a color that evokes agriculture.

IV. The story

The main thing we wished to expose with this visualization is how ubiquitous genetically modified crops have become in the United States. More than 90% of corn and soybeans in the USA are genetically modified, whereas twenty years ago, that number was around 10%.

The discussion surrounding GM crops has been somewhat contentious, with some people suggesting that Monsanto and other large-scale agriculture companies are at risk of creating a monoculture, and that modified genes could eventually lead to "super-bugs." But another important fact should be realized here: nearly all of our corn and soybeans is genetically modified, and there have been no widespread outbreaks of disease or illness as a result. Indeed, agricultural production in the US is more efficient than ever, thanks in no small part to technological advances like gene-swapping. Many people may be surprised to know that an enormous percentage of our food is already genetically engineered, even though the public debate about the ethics and safety of this practice has not rested into consensus.

There are many intriguing corollaries here. We could investigate how Monsanto political contributions have changed as their patents are put into use countrywide and their web of influence expands. We could look at genetically engineered crops in other countries, or at adoption rates of other important agricultural technologies. We could even relate the rise of GE crops to the state of world hunger--always an engaging topic.

Any discussion on the topic must necessarily address the fact that in the last twenty years, GE crops have proven valuable to farmers looking to increase yield and after widespread adoption show no signs of diluting the overall welfare of the people.