

Testing Organic Labeling Laws by the Presence of GMO's in Corn

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Introduction

GMOs, or Genetically Modified Organisms, are the result of a lab taking genes from one organism and placing it in another for desired characteristics. They can be used to engineer crops to create specific traits. These traits could include pest resistance, improved yield, resistance to herbicides, delayed fruit ripening, and increased nutrient content (Bio-rad, 2008). Genetically engineered crops initially were created for the good of production, but because they some crops have been inserted with genes that are herbicide resistant they could produce superweeds ("Are Labeling Laws Being Followed?", 2008). Not only are these crops an issue for the environment, but also possibly for the health of the consumer.

Human studies have shown how genetically modified food can leave materials behind inside the body. According to "10 Reasons to Avoid GMO's" genes inserted into GM soy, for example, can transfer into the DNA of bacteria living inside us. The toxic insecticide produced by GM corn was found in the blood of pregnant women and their unborn (10 Reasons to Avoid GMOs, 2013). The number of many health problems increased after GMOs were introduced in 1996. Americans with three or more chronic illnesses increased from 7% to 13% in just 9 years ("10 Reasons to Avoid GMOs", 2013). These genetically modified organisms are everywhere.

Corn is one of the most genetically modified crops produced today. Today 85% of U.S corn is genetically modified. It is also estimated that 70% of all processed foods on the grocery store shelf contain genetically modified ingredients (Genetically Engineered Crops, n.d). USDA organic has specific laws determining the labeling of products. In the USDA organic labeling laws organic products must be certified, it must state the name of the certifying agent on information panel, but it can have up to five percent non-organic materials included. All natural according to the FDA is not defined. The FDA did state that all natural foods do not contain added color, artificial flavors, or synthetic substances (FDA, 2012).

It is important to know because of the possible health risks if these laws as being followed. Without the assurance that the organic guidelines are in effect, who knows what the consumer could be ingesting.

Purpose

The purpose of our study was to determine if the labeling for non-GMO foods are accurate. We took three samples from each from category of organic, all natural, and unclaimed labeled products to determine if these laws are being followed. Based on the research we conducted on these regulations we believe that the organic products will contain no GMO's. All natural products do not have specific guidelines so we believe that the results from this category will be mixed. Regarding the unlabeled or unclaimed products we believe they will contain GMO's.

Procedure

The Bio-RAD GMO Kit (Bio-rad, 2008) was used to determine whether or not the following products contained GMO corn: three different labels of organic, all natural, as well as unclaimed samples. Additionally, we included two different lotions to see if GMO's were present. We then ground 1 gram of each sample with 10ml of water, sterilizing with hydrogen peroxide between samples. A total of 12 samples were analyzed, including a negative control with no GMO and a positive control with GMO present. The universal photosystem II plant primer was used to determine if the plant DNA was viable. The GMO primer comes from the cauliflower mosaic virus (35S promoter). PCR product was obtained using a Bio-RAD Thermocycler (Figures 1&2).

Step	Function	Number of Temperature	Duration	Cycles
Initial denaturation	Denature	94°C	2 min	1
PCR amplification	Denature	94°C	1 min	40
	Anneal	59°C	1 min	
	Extend	72°C	2 min	
Final extension	Extend	72°C	10 min	1
*Hold	Hold	4°C	Indefinite	1

Figure 1: Thermocycler Settings

We used the 4-20% Mini-Protean TGX precast polyacrylamide gels with a 1X TBE buffer for electrophoresis of PCR products (Figure 3). Gels were stained with SYBRGreen overnight and viewed on a Vernier Transilluminator.

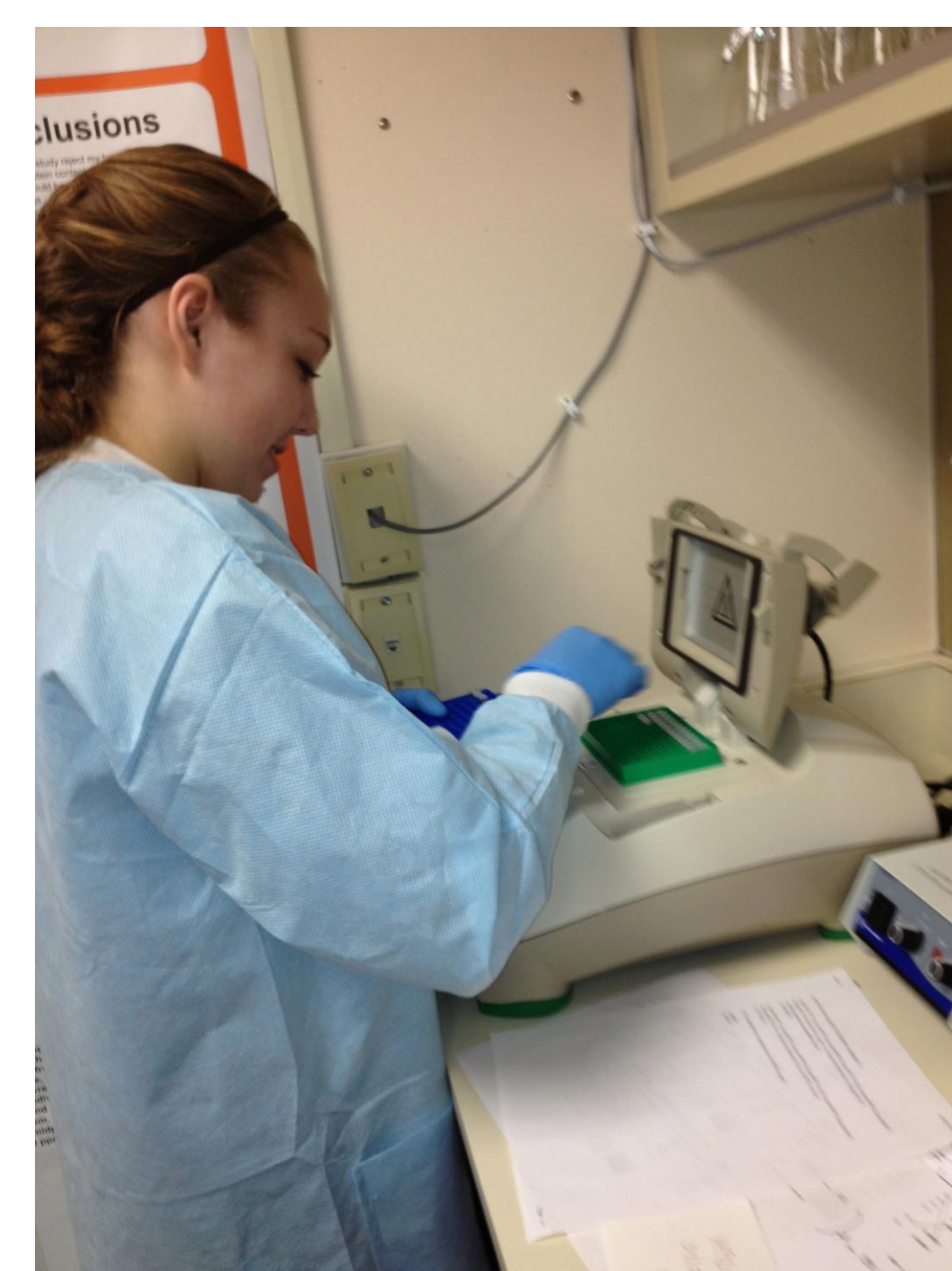


Figure 2: Loading Thermocycler with samples

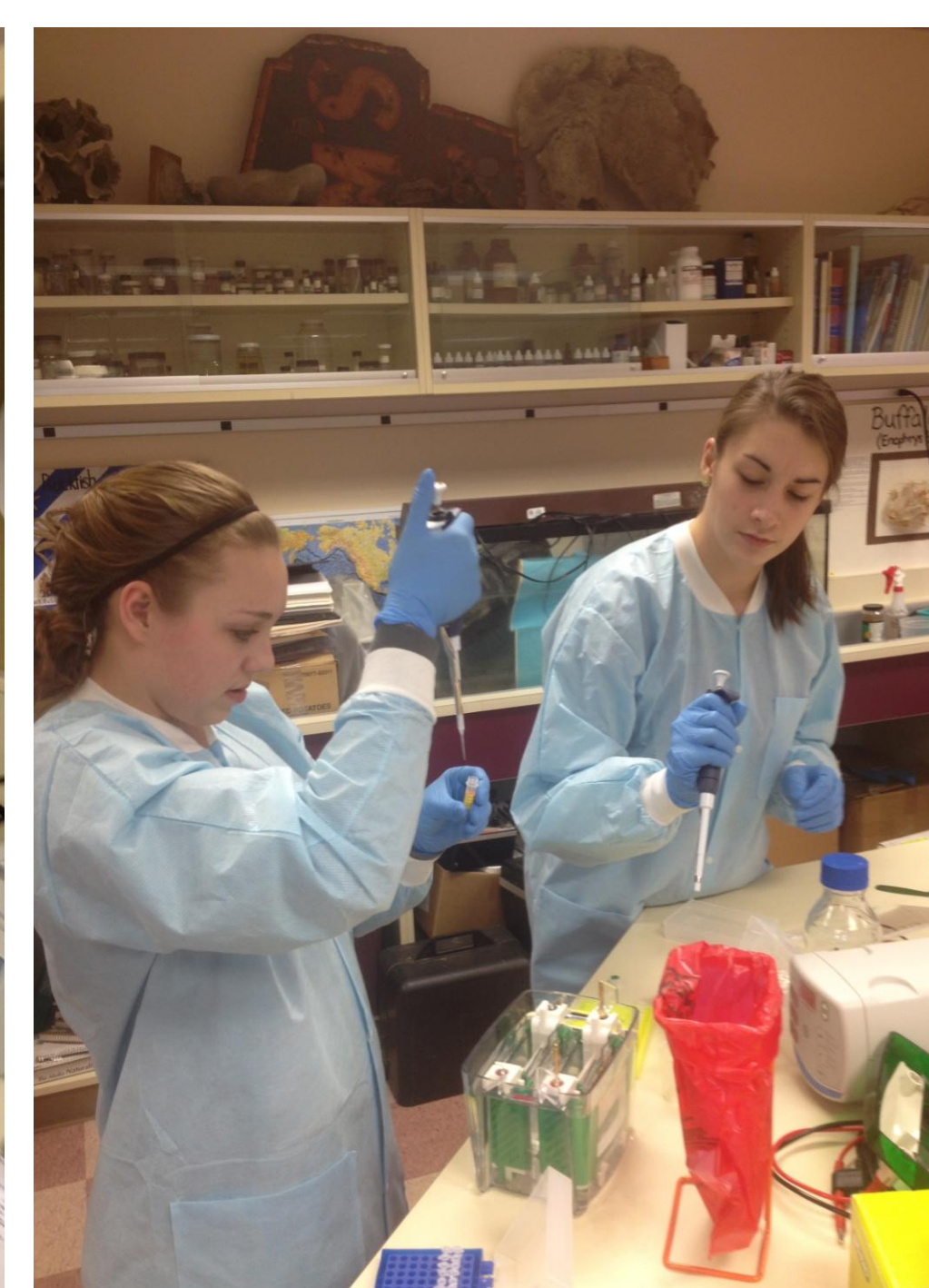


Figure 3: Loading 4-20% polyacrylamide gels with PCR product.

Results

Oats, provided by the Bio-RAD kit, were used as our negative control. They had viable plant DNA and tested negative for GMO's. All food sampled tested positive for viable plant DNA (Figure 4) with the exception of the papaya body butter, which made it inconclusive (Table 1). The oats, organic corn starch, organic sweet corn, natural country style cornbread, best naturals oats and honey blend cereal, organic celery, celery, and the Neal's Yard moisture lotion all tested negative for GMO's. The natural corn bread flavored crackers, jiffy corn muffin mix, la tortilla factory corn tortillas, Doritos, Garden of Eatin Blue Chips, and the positive control all tested positive for the GMOs (Table 1, Figure 5).

Sample	Plant	GMO
Oats (Negative Control)	Positive	Negative
Organic Blue Chips	Positive	Positive
Organic Corn Starch	Positive	Negative
Organic Sweet Corn	Positive	Negative
Natural Cornbread	Positive	Negative
Natural Crackers	Positive	Positive
Natural Cereal	Positive	Negative
Corn Muffin Mix	Positive	Positive
Tortillas	Positive	Positive
Doritos	Positive	Positive
Organic Celery	Positive	Negative
Celery	Positive	Negative
Papaya Body Butter	Negative	Positive
Neal's Yard Lotion	Positive	Negative
GMO Positive Control	Positive	Positive

Table 1: Results of PCR for all samples when determining viability of plant DNA and presence/absence of GMO's.

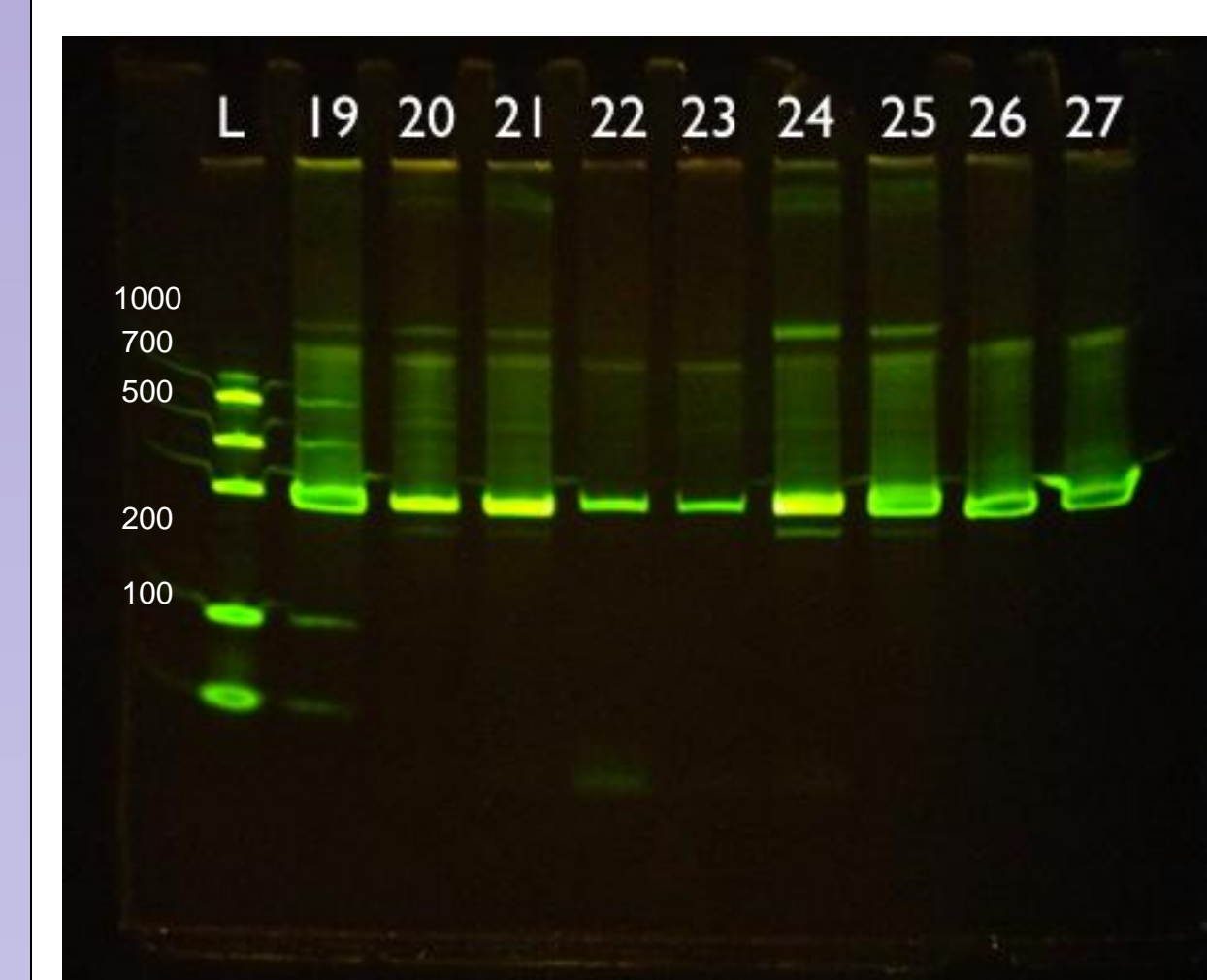


Figure 4: Photosystem II Plant Primer Gel at 455 bp.

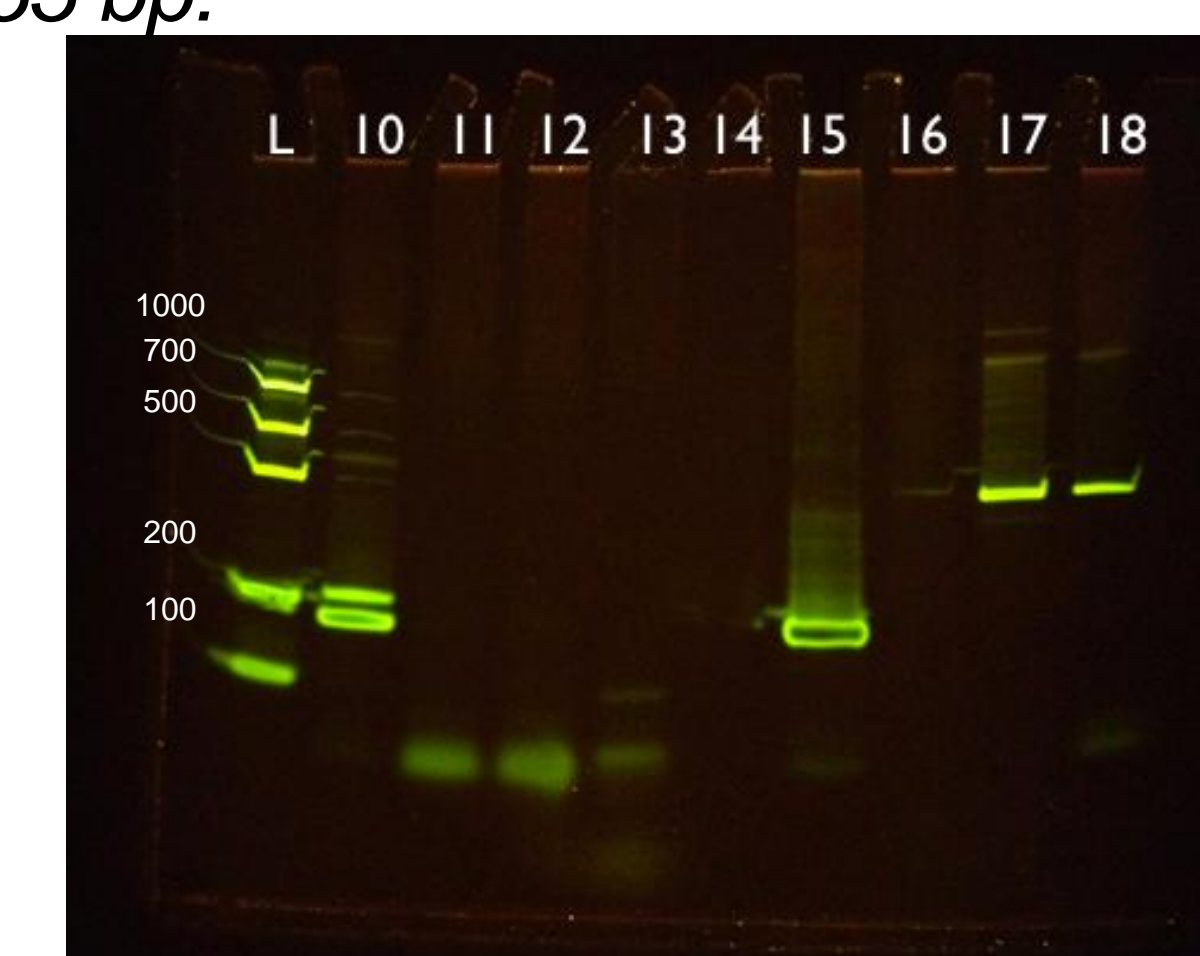


Figure 5: Presence of GMO's in Samples 10-18 at 200 bp.

Conclusions

We hypothesized that the organic products would contain no GMO's, the all-natural products would come up with mixed results, and the unclaimed or unlabeled products would all contain GMO's. In the organic group four products tested negative and one tested positive, the all-natural products had mixed results with two negatives and one positive samples, and the unlabeled group one tested negative and three tested positive (Table 2). Contrary to what we expected the organic blue chips labeled organic as well as non-GMO were found to contain GMO's. The two different types of celery were both negative for GMO's when we expected the regular celery to be genetically modified. To control for contamination of non-GMO food items, we ground our organic products before the non-organic. While we designed the study to have three samples per category, we would have to increase our sample size both for the food type itself as well as within the groups to answer our research question definitively.

Table 2: Results of Presence of GMO's in 12 samples

	Presence of GMO's	
Organic	4 negative	1 positive
All Natural	2 negative	1 positive
Unclaimed	1 negative	3 positive

Our results suggest that the labeling laws may not be accurate and additional guidelines could be necessary. As to the non-GMO organic blue corn tortilla chips, we wonder if the heavy use of Bt or other gene sequences in crops caused the genes to transfer into supposed non-GMO. It is very important for the consumer to know what is going into their body. With the possibility of potential health risks GMO's should be ingested wisely. Additional research could include an increased sample size, different products, as well as researching what other countries regulations on organic labeling.

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