

Detection of Genetically Modified Organisms (GMOs) in Organic and Non-Organic Food

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Abstract:

Genetically modified organisms (GMOs) are defined as organisms in which the genetic material has been altered in a way that does not occur naturally⁽¹⁾. Currently, there is no law requiring food labels to state whether they contain GMOs. Thus, genetically modified foods are treated with pesticides and herbicides that may have potentially harmful ingredients and chemicals that the common consumer would not have any knowledge of. The purpose of this study was to determine whether USDA certified organic food items contain GMOs.

Introduction:

The uses of GMO's are endless, as they can be applied to different areas of science such as pharmacy, medical research, and experimental medicine. With every GMO, there is a common process that takes place to achieve the status of being genetically modified. Generally, a foreign gene called a transgene, is implanted into the genome of its host called a transgenic. This is usually a gene that is from a different organism than the host. The most common ways of integration are using modified viruses and plasmids or injection of the transgene using pronuclear microinjection⁽¹⁾. In order for something to be labeled organic by USDA standards, it must only contain ingredients that are certified as organic, but may also include up to 5% non-organic ingredients⁽²⁾. With this said, there is no guarantee that there won't be GMOs in organic food items. The current study will investigate whether products that are labeled organic contain any GMOs by testing for two common GMO genes. They are the 35S promoter of the cauliflower mosaic virus (CaMV 35S) and the terminator of the nopaline synthase (NOS) gene of *Agrobacterium tumefaciens* which are both commonly found in GMOs⁽⁴⁾.

Specific Aims:

- To test various organic and non organic foods for the presence of GMOs
- To compare and determine what foods contain GMOs

Methods:

- Bio-Rad GMO investigator kit and protocol was used
- 2g of food was ground with motor and pestle
- 50 µl of sample added to 500 µl of InstaGene Matrix
- 20 µl of sample was mixed with 20 µl of GMO primers and placed in Polymerase Chain Reaction (PCR)
 - Initial denaturation: 94°C for 2 min with one cycle
 - PCR amplification: 94°C for 1 min
59°C for 1 min
72°C for 2 min
A total of 40 cycles
 - Final extension: 72°C for 10 min with one cycle
- PCR products visualized via gel electrophoresis with a 2% agarose gel
- Visualization of the PCR products were made possible by the use of a methylene blue stain

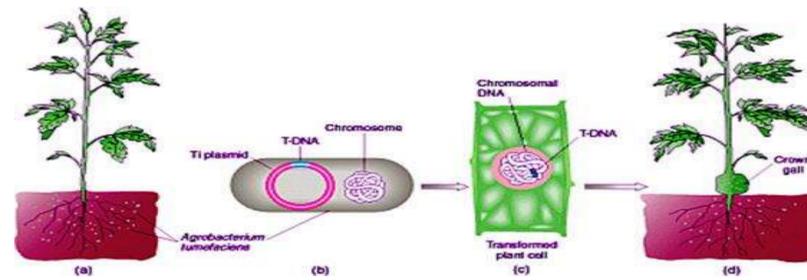


Fig 1: This figure shows the process of GMO implantation, specifically with *Agrobacterium tumefaciens*⁽³⁾.



Fig. 2: This figure compares a non-organic tomato to an organic tomato.

Results:

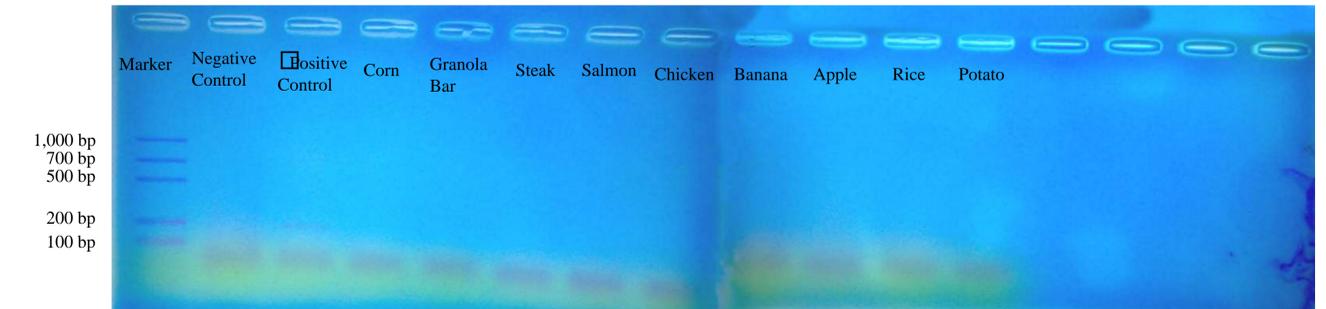


Fig. 3: This figure shows the organic PCR products after gel electrophoresis.



Fig. 4: This figure shows the non-organic PCR products after gel electrophoresis.

Conclusions:

- The fact that the positive control was visible on the gel means that the PCR step was successful.
- Since there are no bands in any of the test samples, it can be said that there either was not enough DNA extracted or the quality of DNA was not good from the test foods.
- It is a possibility that the food tested were not treated with the GMOs that the primers specifically amplify.
- Further research needs to be done to correctly isolate and amplify the test food DNA that are targeted by the specific primers.

Acknowledgements:

I would personally like to thank the Waynesburg University Biology Department for providing the funds and materials necessary in order to perform this research. To my mentor, Professor Wright, for giving me advice throughout my research. To Dr. Sethman for supporting and giving guidance for my research. Also to the staff of the Center of Research and Development for providing the services to print this poster. Without all of you, this research would not have been possible, thank you.

References:
 (1): Verma, C., Nanda, S., Singh, R.K., Singh R.B., & Mishra, S. (2011). A Review on Impacts of Genetically Modified Food on Human Health. *The Open Nutraceuticals Journal*, 4, 3-11.
 (2): <http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5078591&acct=noggeninfo>
 (3): http://mol-biol4masters.masters.grkraj.org/html/Genetic_Engineering4D-Transformation-Plant_Cells.htm
 (4): Bio-Rad. Biotechnology Explorer GMO Investigator™ Kit. Hercules, CA.