



**CALIFORNIA STATE SCIENCE FAIR  
2008 PROJECT SUMMARY**

<b>Name(s)</b> <b>Mikael H. Matossian</b>	<b>Project Number</b> <b>S1412</b>
<b>Project Title</b> <b>Gamma Irradiation Studies of Spinach Leaves</b>	
<b>Abstract</b>	
<b>Objectives/Goals</b> My project studied the effects of gamma irradiation on reducing bacteria levels of E.Coli-contaminated spinach leaves, extending the shelf life of non-contaminated spinach leaves, and determining any adverse effects on smell, appearance, and texture. The results could have application to commercial treatment of spinach leaves.	
<b>Methods/Materials</b> Organic spinach leaves from Whole Foods Market were divided into 3 groups: E.Coli contaminated group 1, non-E.Coli contaminated group 2, and sensory assessment group 3. Non-pathogenic E.Coli (0157:H7) was used to inoculate the group 1 spinach leaves. Gamma irradiation of all spinach leaf groups were conducted at Sterigenics in Tustin, California. Experiment 1: Elimination of E.Coli Bacteria E.Coli contaminated spinach leaves were irradiated with gamma rays at 4 doses (0, 0.5, 1.4, and 2 kGy). E.Coli bacteria counts were measured over 11 days to determine the effectiveness of gamma irradiation in killing off E.Coli bacteria colonies. Experiment 2: Spinach Shelf Life, Smell, Appearance, and Texture Non-contaminated spinach leaves were irradiated at the same 4 doses. Over 11 days, the appearance, smell, and texture of the leaves were recorded to determine undesirable sensory changes to the spinach leaves. Spinach shelf-life improvements were estimated by measuring the aerobic (naturally occurring) bacteria levels on the leaves as a function of gamma dose.	
<b>Results</b> 1. A 2 kGy gamma dose caused a 500x reduction in E.Coli levels. A 0.5 kGy gamma dose caused a 5x reduction. 2. A 2 kGy gamma dose caused a 10x reduction in Aerobic (naturally occurring) bacteria levels, thus extending shelf life, while a 0.5 kGy dose caused a 4x reduction. 3. A 2 kGy gamma dose caused the color of spinach leaves to change from dark green to pale green, a dry texture, and a less fresh smell. A 0.5 kGy dose had little change on color, texture, and smell.	
<b>Conclusions/Discussion</b> Gamma irradiation is effective in eliminating E.Coli bacteria from infected spinach leaves, and extending the shelf-life of non-contaminated spinach leaves. However, it can adversely affect spinach leaf smell, texture, and appearance, if the dose level is high. I found that 0.5kGy is the near-optimum level for eliminating bacteria and extending shelf-life, while retaining good sensory attributes of spinach leaves.	
<b>Summary Statement</b> Gamma irradiation of spinach leaves can effectively eliminate bacteria, extend shelf-life, but may have an adverse effect on the smell, appearance, and texture.	
<b>Help Received</b> Professors Antonio Machado and John Schillinger of California State University at Northridge (CSUN) provided E.Coli bacteria for inoculation; Professor Anuradha Prakash at Chapman University critiqued the test methodology; Jeremy Bolnick of Sterigenics conducted the gamma irradiation tests.	