



**CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY**

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Project Title Molecular Detection of Peronospora effusa during the Latent Period	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Downy mildews are a serious disease of many crops in coastal California. In spinach, downy mildew is caused by <i>Peronospora effusa</i>. In California, where nearly 75% of the US fresh spinach is grown, downy mildew disease causes millions of dollars in losses annually. Currently, the disease is controlled by fungicide applications, and some of these fungicides are applied whether or not infection has occurred on spinach because of the explosive nature of these epidemics. Thus, I hypothesized that if downy mildew infection could be detected during the latent period, fungicide applications could be targeted only when the pathogen is present. This in turn may prevent epidemics from developing.</p> <p>Methods/Materials For specific detection of <i>P. effusa</i> or <i>Peronospora</i>, polymerase chain reaction (PCR) with <i>P. effusa</i>-specific primers were used to detect the pathogen DNA from potential infections on 50 samples weekly for six weeks. Spinach plants were randomly sampled every 3 m from a 36 m plot, consisting of four beds. For the first four weeks, primers to detect generic <i>Peronospora</i> species and for the last two weeks, primers specific for <i>P. effusa</i> were used in the PCR. Following the PCR, gel electrophoresis was performed to determine which of the fifty samples that week carried the pathogen.</p> <p>Results #Spinach leaf samples collected four weeks after crop emergence were asymptomatic. However, <i>Peronospora</i> spp.-specific PCR detected the presence of the pathogen in three of the 50 samples collected and processed, demonstrating that the pathogen could be detected during the latent period. #Six of the 50 samples collected five weeks post-emergence were symptomatic and carried the pathogen. Three more samples had chlorotic spots without sporulation also contained <i>P. effusa</i>. #By six weeks post-emergence, 28 of the 50 samples were symptomatic and strongly positive for <i>P. effusa</i>. Six more samples that provided weak bands were asymptomatic. This was indicative of the utility of the PCR in pathogen detection during latent and infectious periods. #By week nine, all samples exhibited downy mildew symptoms and carried the pathogen by PCR.</p> <p>Conclusions/Discussion In conclusion, using PCR, downy mildew pathogen DNA was detected on symptomless spinach plants, and application of fungicides on these plants is expected to prevent further downy mildew development. The approach requires additional validation in larger commercial fields.</p>	
Summary Statement If downy mildew infection can be detected before symptoms appear (during the latent period), fungicide applications could be targeted only when the pathogen is present, which may prevent epidemics from developing.	
Help Received Dr. Steve Klosterman and Mrs. Amy Anchieta (USDA Agricultural Research Service, Salinas CA) accommodated me in their laboratory and guided me through all phases of my study.	