Escherichia coli (E. coli) Control in Irrigation Water

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Introduction

Water quality is a major issue in food safety with the concern related to E. coli, Salmonella, etc. There are numerous examples of surface water contamination that may have been the source of a foodborne illness outbreaks e.g. spinach in California and tomatoes from Virginia. All food safety programs and audits require some form of water testing to ensure pathogen levels are not above acceptable levels thus not contributing to pathogen loads on produce. However, there is no national standard for what is an acceptable level of a pathogen in irrigation water or how often water should be tested for pathogens. Generally, auditors acceptable open water swimming standards as being adequate for irrigation. The California Leafy Green Marketing Agreement uses these standards.

Sampling Standards

Under the California agreement water sampling is divided between foliar and non-foliar applications. When the irrigation is overhead (foliar application), no one sample can be higher than 235 colony forming units (CFU)/100 ml of water and the average of all samples is less than 126 CFU/100 ml. With non-foliar applications, no one sample can be over 576 CFU/100 ml of water and the average of less than 126 CFU/100 m. They sample at least monthly and use a rolling five sample average to calculate if the water is acceptable. These are the same the standards used in this 2009 sampling study.

Controlling E. coli

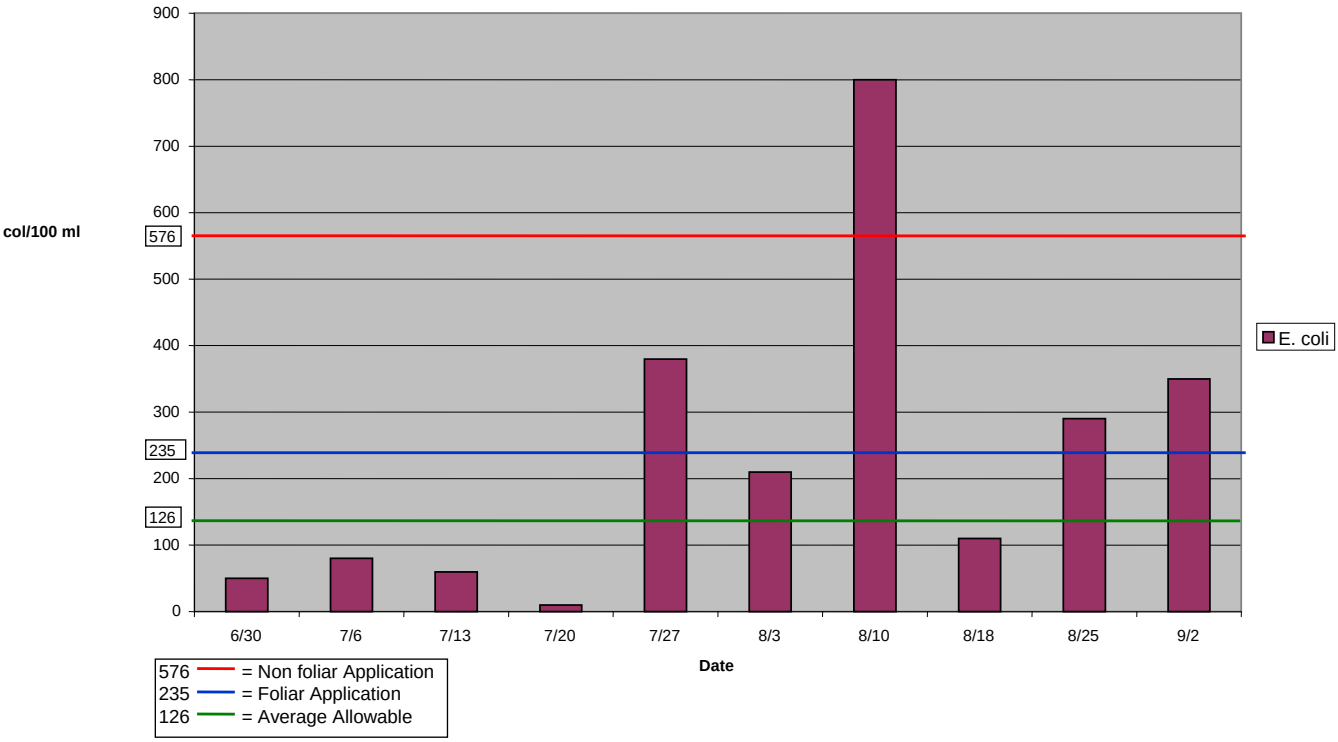
How do you control E. coli if it is found above acceptable levels? In wells the process is relatively simple. Calculations have been worked out for the use of Calcium Hypochlorite (70%) in the well to control the pathogen. However, with surface water the process is more complicated since the water is not enclosed in a pipe.

Surface water can be continually recontaminated from wildlife, domestic animals and runoff from surrounding fields. Also, rainfall and air temperature can have an effect on the amount of pathogen load and growth. A system must be in place that continually disinfects the irrigation water as it is being applied to the crop.

Water Sampling Research

A pond was sampled weekly from June to September for E. coli. The samples were taken directly from the pond and analyzed by a private company using the EPA 1603 which is the accepted method for testing. There were four samples over the acceptable level for foliar application and one over for non-foliar application. All samples collected from July 27 to the end of the study on September 2 were over the acceptable average of 126 CFU/100 ml of water. The data is presented in table 1.

Table 1. Pond Microbial Study 2009



At four sampling dates calcium hypochlorite was injected into the irrigation water at the pump at the rate of approximately 4 ppm and the E. coli level was checked at the pond, at the filter and at the end of the drip line. The pathogen was almost zero at the end of the irrigation line after injection and above acceptable levels in the pond. See table two.

The goal was to maintain 4 ppm at the point of injection (pump) and 2 ppm at the end of the irrigation line. When the trial started it took one week to register any chlorine at the filter and 14 days to register at the end of the drip line. The drip system had been operating and organic matter had built up in the line. Chlorine is tied up with organic matter so it took time for the system to be cleaned. The amount of chlorine did fluctuate through the season, but E. coli was controlled even when the levels were 0.5 ppm at the end of the drip line. See table 3

Table 2. Irrigation Water Treatment Study 2009
E. coli levels

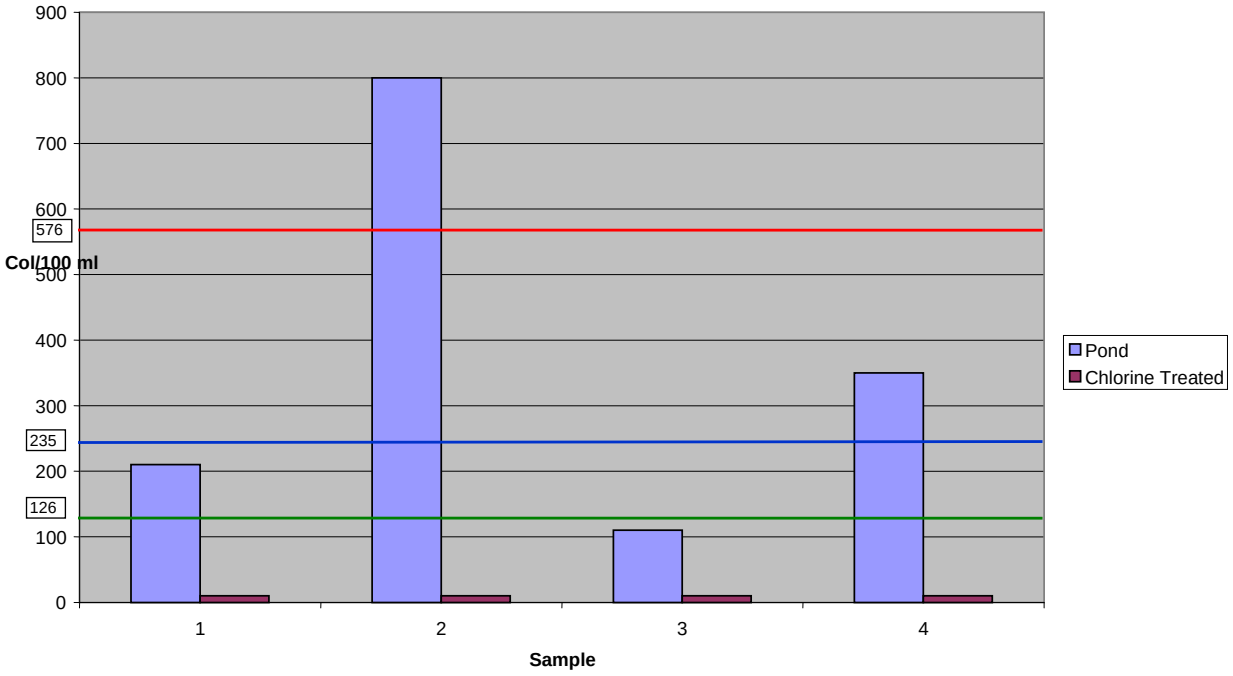


Table 3. Irrigation Water Treatment Study 2009
Chlorine Treatments