The Effect of Soil Remediation Treatments on Microbial Populations Following an Extreme Flooding Event

RESEARCH COMPLETED

SUMMARY

Flooding may pose a risk of contamination of soils and crops by human pathogens. Crops for human consumption grown in previously flooded areas may be at risk for contamination by foodborne pathogens. In June and July of 2015 the Wabash River flooded a portion of the Southwest Purdue Agricultural Center (SWPAC) near Vincennes, IN. When floodwaters receded, an experiment, consisting of a randomized complete block design with 4 replications of 6 treatments, was established in a previously flooded field. Soil samples were periodically collected from experimental plots. Samples were then tested for levels of coliforms, aerobic microbes, and yeasts and molds. Data analysis performed at the conclusion of the experiment suggested that best practice in the case of extreme flooding is to leave soils undisturbed for a period of time following the recession of floodwaters.

OBJECTIVES

Project objectives were to estimate an adequate interval between a flooding event and the subsequent production of crops for human consumption, and to estimate the effect of various remediation treatments on soil microbe levels following a flooding event.

METHODS

Prior to project initiation, water samples were taken from flooded areas at SWPAC to confirm coliform levels. The flooded land was accessed on July 30, three days after floodwaters receded, and 24 plots (25 ft. x 50 ft.) were established. Plots were arranged in a randomized complete block design with 4 replications of 6 treatments.

Treatments were control, cover crop, collards + incorporation, black plastic mulch, clear plastic mulch, and periodic tillage. Soil samples were taken from each plot at 3, 14, 24, 36, 52, 67, 78, and 107 days post-recession. Samples were processed and analyzed for total coliform count, total aerobic plate count, and total mold/yeast count. At the conclusion of the experiment, data were used to model the dynamics of soil microbes over time and to conduct appropriate statistical analyses.

RESULTS TO DATE

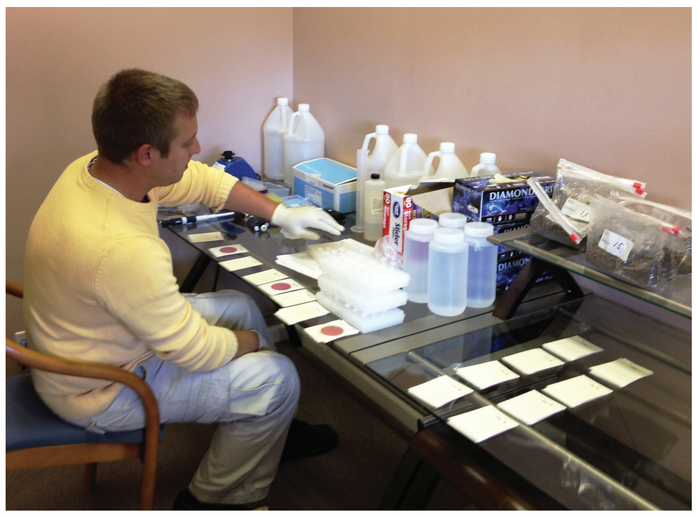
Trapezoidal integration was used to calculate areas under plots of coliform counts (Log CFU·g soil^{-1}) vs. time to estimate overall post-recession coliform levels. Fisher's LSD indicated that among treatment means, the control treatment was significantly different (α=.05).

Total aerobic counts generally increased over time. Following trapezoidal integration of aerobic microbes (CFU·g soil^{-1}) vs. time, Fisher's LSD detected significant differences in treatment means. An ANOVA of total aerobic plate counts at 107 days post-recession indicated highly significant differences among treatments, with Fisher's LSD indicating differences among treatment means. The control treatment had the lowest overall mean value.

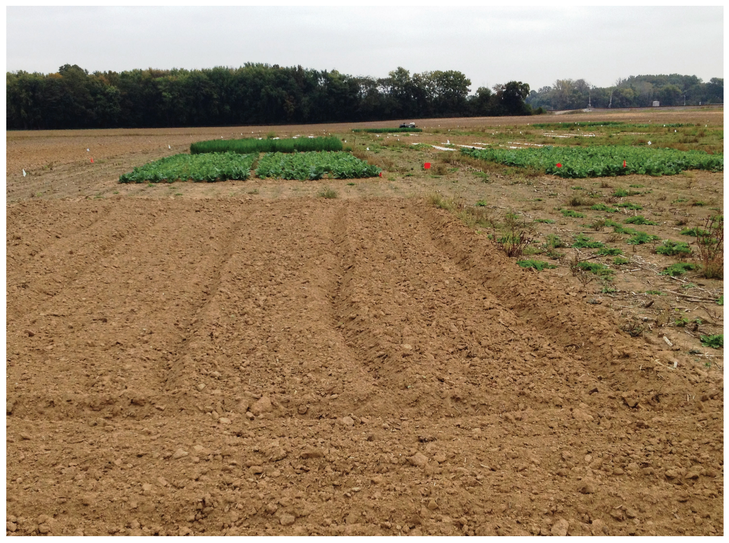
Results indicate that best practice following an extreme flooding event is to leave soils undisturbed in order to maximize the rate of decrease of flood-deposited microbes. Results further indicate that tillage, due to incorporation of both microbes and oxygen into the soil, will decrease the rate at which flood-deposited microbes are reduced.

BENEFITS TO THE INDUSTRY

The results of this project give producers insight into soil microbial dynamics following an extreme flooding event. Results also indicate best practice following such an event. This information will offer guidance to industry and producers as production decisions are made in previously flooded production environments.

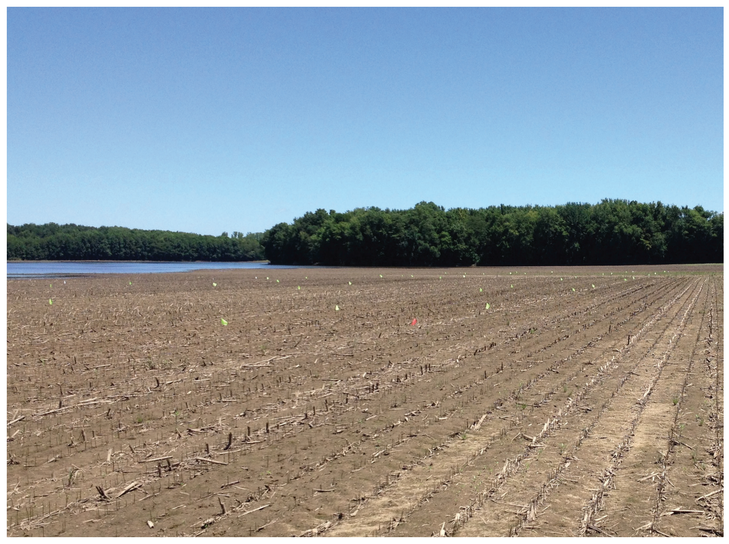


Soil testing set-up



Established experiment

Initial flooding



Receding flood - plot establishment

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