Evaluation of Polyacrylamide (PAM) for Reducing Sediment and Nutrient Concentration in Tail Water from Central Coast Vegetable Fields

PROJECT LEADERS

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OBJECTIVES

1. Evaluate effects of PAM on infiltration rates of a range of soil types found in the Salinas and Pajaro Valleys under varying water qualities.

2. Quantify the effect of PAM on sediment and nutrient concentration in irrigation runoff from commercial vegetable fields.

EXECUTIVE SUMMARY

The Central Coast Regional Water Quality Control Board (RWQCB) identified agricultural run-off as a source of nutrients and sediments in the Salinas and Pajaro River watersheds. Treatment of soils with polyacrylamide (PAM), a large polymer molecule (10-15 Mg/mole), may reduce sediments and phosphorus transported in tail water run-off by flocculating suspended sediments, maintaining infiltration and stabilizing soil aggregates. Despite documented benefits of PAM for erosion control in other areas of the country, it is not widely used on the Central Coast region of California.

This project evaluated the effects of PAM on sediment and nutrient concentration in irrigation tail water from vegetable fields across a range of soil types found in the Salinas and Pajaro Valleys. The methodology utilized column and field studies to quantify the effect of PAM on infiltration, run off, and sediment and nutrient (ortho and total P, NO_3, Total N) loss from sprinkler and furrow irrigation systems. Because PAM has not been shown to be beneficial on all soil types and under all water qualities, the column studies screened a larger group of soils and water compositions than could be accomplished with field studies. Field studies evaluated the effect of PAM on infiltration rate using a recirculating infiltrometer. Trials were also conducted in cool season vegetable fields to

measure the effect of PAM on runoff, sediment and nutrient loss, and yield and quality. Information developed in this project was extended through field and seminar meetings, and newsletters. The target audiences for the project were vegetable growers and farm managers, NRCS and RCD personnel, irrigation industry reps and consultants.

The results of the field trials demonstrated that PAM can significantly reduce sediments and nutrients in tail water. Across all 6 sites evaluated, treatment with PAM reduced suspended sediments by 85% compared to the untreated control. Additionally, soluble P, total P, and total N were reduced in the PAM treated run-off. PAM had no effect on nitrate or salt levels in the run-off and the polymer did not increase infiltration. Results from the recirculating infiltrometer studies showed that in furrow systems, PAM, applied only in the initial water at 10 ppm, had no significant effect on infiltration at 4 of 6 sites evaluated. At 2 sites, infiltration was reduced with the addition of PAM. Results from trials conducted in cool season vegetable fields also demonstrated that PAM, applied through overhead sprinklers at a 5 ppm concentration, was able to significantly reduce the turbidity and the suspended sediments in the tail-water. Similar to the results obtained with the recirculation infiltrometer trials, PAM reduced soluble and total P and total N in the run-off, but had no significant effect on NO_3-N. Total sediment loss under sprinklers was reduced by as much as 95% using PAM. PAM applied 2 to 3 times before thinning the crop, had no significant effect on the marketable yield of lettuce; although at one location head weight was significantly increased and seedling emergence was significantly higher under the PAM treatment.

The results of the columns studies confirmed that PAM applied continuously in the irrigation water decreased the final infiltration rate of all soils evaluated. Relative viscosity measurements, conducted using columns packed with a standard sand media, demonstrated that the viscosity of the applied water increased as the concentration of PAM increased. The effect of PAM on viscosity may offset the ability of the polymer to increase infiltration though improved aggregate stability. Pre-treating the surface of the soil with water containing PAM, rather than applying water with PAM continuously, maximized the final infiltration rate relative to the untreated control. The effect of PAM on infiltration was also dependent on the total salinity (EC) and the sodium adsorption ratio (SAR) of the applied water. Increasing the EC of PAM treated water increased infiltration, and increasing the SAR of PAM treated water decreased infiltration.