# Report for 2005MO47B: Improved Modeling for Runoff and Soil from Natural Events

Publications

- Dissertations:
  - Mattingly, Christina A. 2004. Influence Of Raindrop Energy On Polyacrylamide Effectiveness. MS Thesis. University of Missouri-Columbia, Columbia, MO.

Report Follows

**Missouri Water Resources Research Center**

**<u>Title:</u>** Soil Erosion and Runoff Reduction Using Three Methods of Polyacrylamide Application.

**<u>Name</u>**: C.J. Gantzer, S.H. Anderson, and A.L. Thompson

**<u>Nature, Scope and Objectives of Research:</u>**

This project is studying of the longevity of protection from application methods of Polyacrylamide Monomer **(**PAM) to protect soil from surface sealing and erosion. The research objective is to determine the amount of rainfall PAM-treated soil can withstand before erosion returns to untreated rates of detachment. The goal of this work is to develop improved guidelines for use of PAM to reduce soil erosion on bare soil until protective vegetative cover is established.

**<u>Progress:</u>**

A gravity-fed rainfall simulator at 6.4 cm $h^{-1}$ was used for initial testing (Regmi and Thompson, 2000). Polyacrylamide influenced cumulative surface runoff depth and cumulative sediment loss. It was determined that applying PAM at 40 kg $ha^{-1}$ was not significantly different than the application of 20 kg $ha^{-1}$ PAM during a period of an hour. Separate trends were distinguished between application of 0, 20, and 40 kg $ha^{-1}$ PAM. Measured interrill erosion rates were compared to predicted interrill erosion rates for 3 treatments of PAM at 3 rainfall rates (6.4, 9.6, and 12.8 cm $hr^{-1}$) for two fall heights (0.8 and 13.8 m). Linear regression equations were fitted to the three PAM treatments for during the 1 hr sampling time to account for the breakdown of PAM by droplet energy. A soil stabilizer factor, *P*, was calculated based on these regressions. The addition of a soil stabilizer factor to the modified interrill erosion prediction equation improved the percent of variation explained from 0.75 to 0.93.

The laboratory study used a rainfall simulator (Miller, 1987) that produced a constant intensity of 80 mm/hr with rainfall energy of 25 J $m^{-2}$ $m^{-1}$. Cumulative studies of 3 one-hour duration events hours (a total rainfall 240 mm) for each test bed were done on bare soil beds of 1 by 0.3 by 0.3m in size on a 5% slope. Mexico silt loam soil (fine, smectitic, mesic Aeric Vertic Epiaqualf) were collected from Bradford Research Center. Disturbed soils were collected and air-dried, and sieved to pass a 4 mm sieve and packed into soil beds to a bulk density of ~1.3 g $cm^{-3}$. Rainfall and runoff was monitored throughout the tests. Treatments include four levels of solution application of PAM (20, 40, 60, and 80, kg $ha^{-1)}$ in single and split applications. Ultra high resolution x-ray CT of soil surface seals formed from raindrop impact were used to create *3-D* volume rendered images to characterize the surface seal macropore volume, number, size-distribution, perimeter, circularity, topological dimension, and pore-connectivity, tortuosity, volume and width using the 3-D medial axis software package written by Lindquist. Results are in given in detail in the below student thesis that is available on request.

**<u>Publications</u>**: Mattingly, Christina A. 2004. Influence Of Raindrop Energy On Polyacrylamide Effectiveness. MS Thesis. University of Missouri-Columbia, Columbia, MO.