# Evaluation of Polyacrylamide (PAM)-Sprayed Buffer Strips for Controlling Soil Erosion

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Manure management on dairy farms has come under local and national scrutiny due to concerns that manure applied to farm fields may be a potential nonpoint source of nitrate and phosphate contamination of ground and surface waters. In 2003, with support from the Environmental Technology Program we commenced a project to evaluate the effectiveness of using Polyacrylamide (PAM) in reducing phosphorus, manure N, and sediment in runoff. PAM has been used in furrow-irrigated agriculture for soil erosion control and to increase infiltration. Our hypotheses was that by applying PAM to a strip of vulnerable land we would reduce soil loss in runoff from farm fields, and would therefore, remove phosphorus and other nutrients in water flowing over and through soil. This will then reduce the potential for nonpoint source pollution.

Three study sites have been established with field plots. These are at the UMass Agronomy Research Farm and one each on two cooperating dairy farms. At each of the sites three PAM treatments of 5, 10 and 15 feet width were established on sloping fields, and compared to bare soil and grass strips. The rate of PAM applied was 20 lb/ac at the farm sites and one of the UMass sites. The rate at the another UMass site was 10 lb/ac. This site was adjacent to the first UMass site and the reduced rate was used as a comparison.

Data collection commenced in June immediately after treatments were imposed. Although June came with a lot of rain, all of it has been quite gentle and it infiltrated the soil. Therefore there was not a significant amount of runoff at any of the experimental sites. Thunderstorms in July resulted in runoff at one of the farm sites but not at the UMass site or other farm location. Despite this, we have been able to collect data related to soil splash patterns from the different treatments. This was done using a 1 to 5 rating system, where 1 was equivalent to little or no soil splash, and 5 was considerable soil splash. By doing this, we are able to provide a qualitative evaluation of the soil stabilizing character of PAM. Results of this evaluation are given in Figures 1 to 3 and are the mean values of three replications and separate ratings by three researchers. Ratings for PAM strips where combined, since only the edge next to the collection trough was meaningful, not the full or varying widths of strips.

The ratings from the three experimental sites show that a grass strip was superior to bare soil and PAM (Figures 1 and 3) and that PAM reduced splashing at only one of the experimental sites compared to bare soil (Figure 2). At this site PAM was similar to the grass stip which was seeded at the beginning of the experiment. These results shows that establishment time of the grass filter strip is important if it is to provide protection from soil erosion. Based on splash data PAM did not offer much protection from splashing with these soils. However, splashing alone does not indicate downward movement of large quantities of soil.

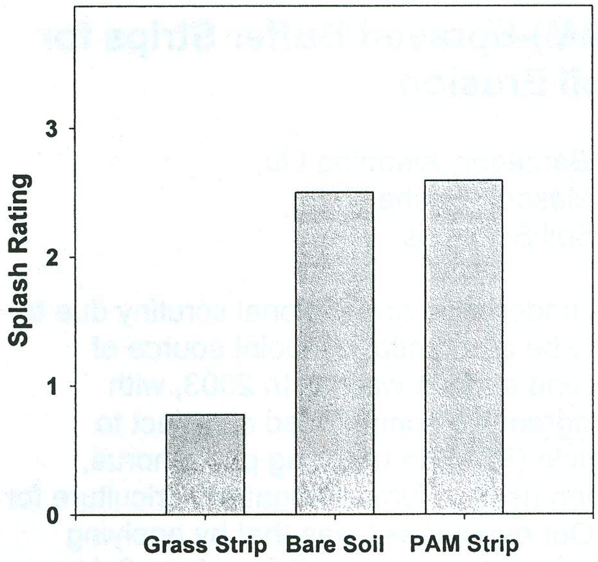


Fig. 1. Soil splash at UMass Site 1 (20 lb/ac PAM) with grass straw mulch.

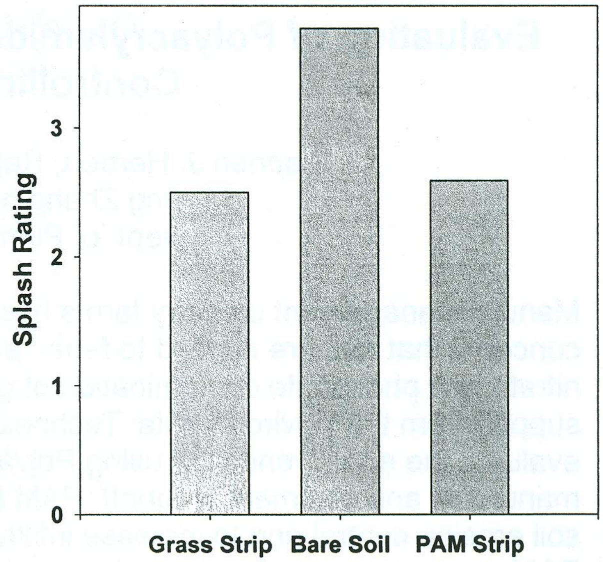


Fig. 2. Soil splash at UMass Site 2 (10 lb/ac PAM) with newly seed grass strip.

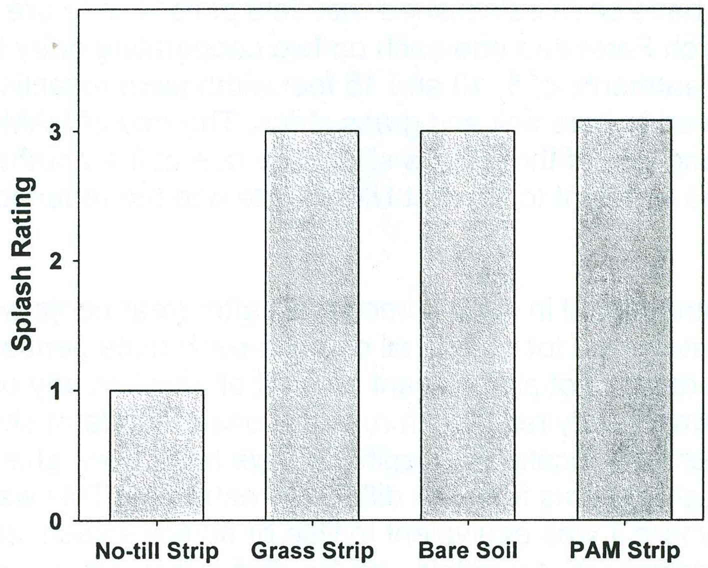


Figure 3. Soil splash at Cooperating Farmer Site 1 (20 lb/ac PAM) with newly seed grass strip and adjacent none tilled strip.

At the second farm site, planting was delayed until late June due to weather, and the experiment was setup in early July. A heavy downpour at this site resulted in considerable soil movement and Figure 4 shows the relationship to width of the PAM strips. The erosion ratio was calculated by dividing the amount of soil in each collection pot by the amount in the control. The PAM treatments did not completely stop the flow of water and soil but there was a clear relationship of less soil loss from erosion with increasing width of the PAM strip. The 15 ft wide strip of PAM reduced soil loss to 50% of the control. The field slope was about 22% at this location, and tilled slope length was greater than 100 ft. This is perhaps greater slope than would be expected for PAM to be totally effective.

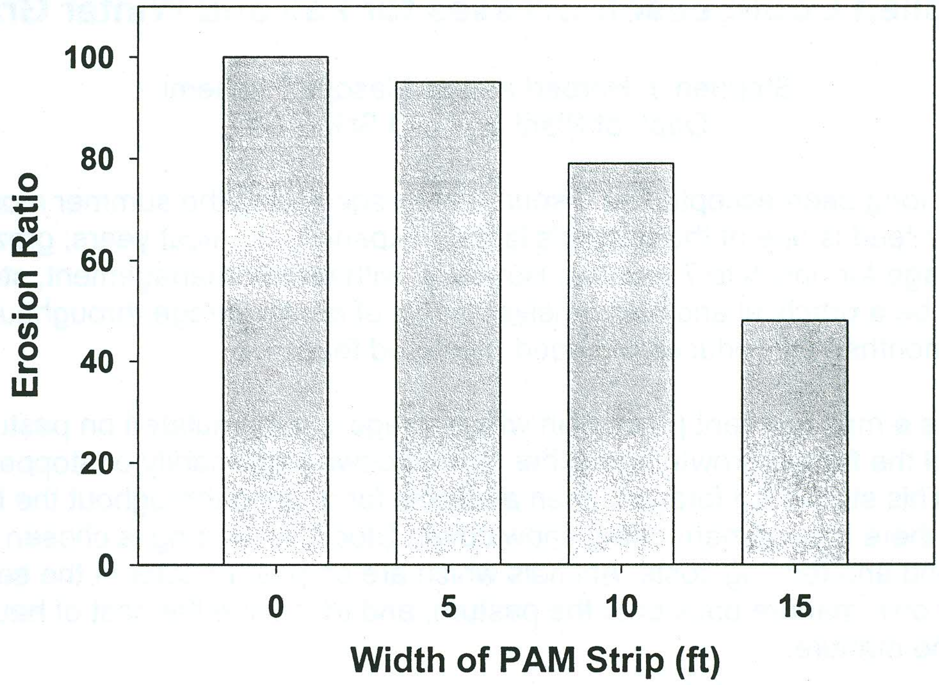


Figure 4. Erosion ratio for soil from field plots with varying width of PAM strips.

At the UMass site we simulated a cloud burst downpour from a thunderstorm, using a big gun irrigation system and a more steady rainfall. Results from the cloud burst showed that bare soil was subject to much water erosion, and the PAM treatments were similar, overwhelmed by such a torrential downpour. With a more steady simulated rainfall there was visual evidence of more washing of soil in non-PAM treated areas compared to greater soil stability in PAM treated areas. The slope of this field site was 16%.

This evaluation of the effectiveness of PAM is premature, based on the amount of information available from the established sites. There is some evidence from our studies that PAM does provide some soil stabilization but it is insufficient for steep fields. The extent of any benefit from PAM has to be further confirmed for less sloping fields. Our studies and data collection are ongoing and we hope to have more data to use for the evaluation of PAM.