

PRELIMINARY RESULTS USING POLYACRYLAMIDE WITH SPRINKLER IRRIGATION

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Small amounts of polyacrylamide (PAM) added to irrigation water have successfully reduced furrow erosion up to 99%. Recently some irrigators have experimented with applying PAM through sprinkler irrigation systems.

In previous studies, large quantities of dry (20 lb/a) or liquid (2000 gal/a) material were applied directly to the soil surface, followed by a 2 to 3 inch irrigation with a rainfall simulator or an irrigation system (Ben-Hur, 1994; Levin et al., 1991; Stern et al., 1992). PAM reduced runoff and soil erosion, and in some cases, increased yield. However at a cost of \$3 to \$5 per pound, these PAM applications would cost \$50 to \$100 per acre.

Several irrigators in the Columbia Basin of Washington reported positive results when PAM was applying through center pivots. They injected 1 to 2 pints per acre of Soilfix LDP¹, a 50% active ingredient PAM, in their irrigation systems at an approximate cost of \$5/a. The PAM was applied with 0.3 to 0.4 inches of water, resulting in approximately a 10 ppm (part per million) PAM concentration in the irrigation water. A treated potato field showed uniform growth even though field slope varied from 0 to 8%. Reservoirs created by a Dammer-Diker¹ were still intact after 12 inches of water had been applied during 6 weeks.

We conducted a small field test on one corner system center pivot near Kimberly, Idaho. Approximately 2 gallons per hour of Soilfix IR, a 30% active ingredient PAM, was applied when system flow was 1000 gallons per minute. At these flow rates, 10 ppm PAM was applied at 2 lb/a at an approximate cost of \$8/a. We noted that irrigation depth could be increased from 0.75 inches to 1.0 inch without causing runoff.

We initiated a laboratory study in Fall 1996 at the Northwest Irrigation and Soils Research Laboratory near Kimberly, Idaho, to identify optimum PAM concentrations and rates for reducing runoff and soil erosion under moving irrigation systems. Our goal is to develop guidelines for PAM application through center pivot and linear-move irrigation systems.

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We constructed six soil boxes, 4 ft wide by 5 ft long by 0.5 ft deep, for our study. These boxes allow us to test different soils, slopes and PAM application rates under controlled conditions. For the first test, the boxes were filled with a silt loam soil and set at a 2.5% slope. A single oscillating nozzle applied 0.75 inches of water, or water/PAM solution, to each soil box at 3.0 inches per hour for 15 minutes. PAM concentration in the irrigation water was 0, 5 or 10 ppm, resulting in 0, 1 or 2 lb/a application rates. Our PAM source was a 1920 ppm active ingredient stock solution of Superfloc 836A¹.

Average runoff was 0.18 in. and soil loss was 140 lb/a for untreated soil boxes (0 ppm PAM concentration). Adding 5 ppm PAM (0.75 lb/a) to the irrigation water reduced runoff and soil loss from the soil boxes by approximately 50% compared to the untreated boxes. Increasing PAM concentration to 10 ppm decreased runoff and soil loss by approximately 75% to 0.04 in. and 35 lb/a, respectively.

All boxes were irrigated with plain water two weeks after the first irrigation. Runoff and soil loss from the untreated boxes were similar to the first irrigation (0.17 in. and 110 lb/a). By contrast, the 5 and 10 ppm treated soil boxes had approximately half the runoff and soil loss as the untreated boxes during the second irrigation (5 ppm B 0.10 in. and 45 lb/a; 10 ppm B 0.08 in. and 30 lb/a).

These preliminary results are encouraging. Under laboratory conditions, applying 1 to 2 lb/a of PAM reduced runoff and erosion on this silt loam soil for two consecutive irrigations. Reducing runoff potentially increases application uniformity, which is especially important when chemicals or fertilizers are applied through an irrigation system. PAM application should also allow higher irrigation rates or depths without causing runoff, resulting in faster field coverage, which is particularly beneficial for linear-move irrigation systems. However, these techniques need more rigorous field testing to quantify benefits during crop production.

REFERENCES

- Ben-Hur, M. 1994. Runoff, erosion, and polymer application in moving-sprinkler irrigation. *Soil Science* 158(4):283-290.
- Levin, J., M. Ben-Hur, M. Gal, and G.J. Levy. 1991. Rain energy and soil amendments effects on infiltration and erosion of three different soil types. *Aust. J. Soil Res.* 29:455-465.
- Stern, R., A.J. Van Der Merwe, M.C. Laker, and I. Shainberg. 1992. Effect of soil surface treatments on runoff and wheat yields under irrigation. *Agron. J.* 84:114-119.