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APPLICATION OF POLYCRYLAMIDE DRY GRANULES FOR SURFACE IRRIGATION EROSION CONTROL

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Polyacrylamide Reduces Soil Erosion in Surface Irrigation

Polyacrylamide (PAM) is a man-made compound that when added to irrigation water in very small amounts can dramatically reduce soil erosion in row crops. PAM works either by protecting soil aggregates from being broken down by clean irrigation water or binding together dispersed soil particles carried in the turbid flow and settling them to the bottom and sides of the irrigation furrow.

When properly applied, the result of using PAM is a clean run-off with an 80 to 98% reduction in sediment leaving the irrigated field. Additional benefits of PAM-use are improved soil aggregate (clods) stability, better water infiltration and improved water distribution across the field. Better water infiltration can mean better irrigation efficiency, reduced loss of plant nutrients and pesticides by run-off and savings such as reduced clean-up costs of settling ponds.

Choosing a Commercial PAM Product

PAM is a generic term. Thousands of different PAM compounds, also known as PAM polymers, are made of acrylamide sub units called monomers. However, only a few of these PAM polymers are suitable and environmentally safe for use in irrigation erosion control. **Read the label**. By law, the label of PAM products used for erosion control should state that the active ingredient is **anionic** and have **less than 0.05% free acrylamide monomer** by weight regardless of its trade name or type of formulation.

PAM products are available from several manufacturers in four typical formulations: dry granules, blocks, emulsified concentrates and aqueous solutions. Each formulation has its advantages and drawbacks. However, the advantages of solid over the liquid PAM formulations are easier storage, handling, and lower cost of the product and application equipment.

Safety and Health

Although PAM-use in agriculture is relatively new, it has been used safely for many years in wastewater treatment and food-processing plants to remove suspended solids.

When using PAM, follow proper health and safety precautions according to the label and good industrial hygiene guidelines. If inhaled in large quantities, PAM dust can cause choking and difficult breathing. Persons handling and mixing PAM in granular form should use a dust mask of a type recommended by the manufacturer. Spills of PAM can be slippery. Follow label instructions for clean up and disposal procedures.

Tips for Effective PAM Application

- According to the NRCS conservation standard practice, the concentration of PAM in irrigation water applied on active ingredient basis should not exceed 10 ppm [mg/L].
- Do not over apply PAM. Excessive application of PAM can lower infiltration rate or suspend soil particles in water, rather than promoting settling.
- Apply PAM during the first irrigation and after any soil disturbance by traffic or cultivation.
- Avoid untreated water wetting the furrow ahead of the PAM-treated flow. Untreated water severely degrades soil structure before PAM-treatment, greatly reducing PAM's effect.
- Add PAM to irrigation water only during the advance phase of a surface irrigation.
- When water reaches 2/3 to 3/4 the length of the furrow, application of PAM into the head ditch or gated pipe should be stopped.
- Use lower PAM rates if good soil erosion control is achieved.

PAM and other Irrigation Management Practices

PAM and Irrigation Flow Management. Use of PAM may result in a significant increase of water infiltration into soil. PAM application may increase infiltration up to 60%, with 15% being an average. Thus, irrigation flow rates need to be increased to compensate for infiltration and to assure reasonable advance times.

PAM and Surge Irrigation. Higher soil infiltration rates may increase leaching below the root zone due to PAM application. In turn, surge irrigation can help to reduce excessive soil infiltration. Therefore, PAM applications can be combined with surge irrigation to both reduce vertical infiltration and soil erosion substantially.

PAM and Sediment Retention Ponds. Use of PAM reduces sediment load in irrigation tail water and clean up cost of sediment ponds.

PAM and Grading at End of Furrows. Too steep gradients at the end of furrows will cause excessive tailwater velocities and increase the potential of soil erosion. A non-erosive gradient needs to be installed to avoid deep cutting at the end of furrows.

Application Methods

1) Dispensing PAM in the head ditch or gated pipe flow. Applications of dry granules into the head ditch or gated pipe flow can be satisfactorily semi-automated through use of a variety of PAM granule dispensers. Timers could be used to shut off PAM application at the end of the advance phase provided the approximate advance time was measured prior to PAM application. Turbulent mixing of PAM is critical. Otherwise, jellying and deposition of PAM material downstream of the application point will occur.

2) Furrow placement or "powder patch" method. PAM is applied directly into irrigation furrows using a hand-held dispenser. PAM is spread along the furrow-bottom just below the water source prior to turning in the water. The hand-held dispenser can measure about 0.5 to 1 ounces of PAM per furrow and distribute it in a narrow band 1 to 2 inches wide and 3 to 4 feet long.

Estimating Application Rates

PAM requirements can be predicted by observing the field conditions and degree of erosion in past years.

PAM application rate estimates can be easily calculated with a hand calculator. Target PAM rates or concentration target values in the table are similar to those calculated using the following formulas:

Dispenser Method

Application Rate to Head Ditch or Gated Pipe Flow:

PAM ounces/h = Target PAM Concentration (ppm) X Flow (gpm) X Correction Factor (0.008) **[1]**

Calculate Field Application Rate:

Total PAM Applied (lbs) = PAM (oz/h) X Irrigation Advance Time (h) X Correction Factor (0.0625) **[2]**

PAM Rate (lbs/acre) = Total Applied (lbs) / # Irrigated Acres **[3]**

Example:

Suppose you are an irrigator who has 300 gpm of water flowing in the head ditch and wishes to treat the flow with 10 ppm.

Question: How many ounces per hour PAM should be dispensed into the head ditch to attain a target concentration of 10 ppm PAM?

Answer: Using formula [1] calculate

PAM application rate to head ditch (oz/h) = 10 ppm X 300 gpm X 0.008 = 24 oz/h

Now that you know the dispenser output into the head ditch, if the irrigation advance phase is 12 hours and the irrigated field is 20 acres.

Question: What is the field application rate of PAM in pounds per acre?

Answer: Using formula [2] calculate

Total applied (lbs) = 24 oz/h X 12 h X 0.0625 = 18 lbs

Using formula [3] calculate

PAM Rate (lbs/ac) = 18 lbs / 20 acres = 0.9 lbs/ac

Furrow Placement ("Powder Patch") Method

PAM oz/furrow = Target PAM Rate (lb/ac) X Furrow Length (ft) X Furrow spacing (ft) X Correction Factor (0.00036736) **[4]**

Example:

Suppose you are an irrigator who has a field with 600-ft long furrows 5-ft spacing.

Question: How many ounces per furrow are necessary to attain a target PAM application rate of 1 pound per acre?

Answer: Using formula [4] calculate

PAM Rate for each furrow (oz/furrow) = 1 lb/ac X 600 ft X 5 ft X 0.00036736 = 1.1 oz/furrow.