

Effect of polyacrylamide on soil physical and hydraulic properties

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The effect of polyacrylamide (PAM), as a soil conditioner, on selected soil physical and hydraulic properties (infiltration rate ($f(t)$), hydraulic conductivity (HC), soil moisture content, aggregate stability (AS), and soil aggregation) was studied. Two types of anionic PAM were used: Low molecular weight (LPAM) (1×10^5 g/mol) with medium charge density (33-43) and high molecular weight (HPAM) ($1-6 \times 10^6$ g/mol) with medium charge density (33-43). Sandy loam soil was packed into plastic columns; PAM solutions at different concentrations (100, 250, 500, and 1000 mg L⁻¹) were used every two weeks in four wetting and drying cycles. The highest infiltration rate value was 0.16 mm s⁻¹ at 1000 mg/L low molecular weight PAM while the highest value of infiltration rate in high PAM molecular weight was 0.11 mm s⁻¹ compared to the control (0.01 mm s⁻¹). Soil HC was about 3.00 cm h⁻¹ for LPAM at 1000 mg L⁻¹ PAM, while the highest value for HPAM was about 2 cm h⁻¹ for the same concentration, compared to the control. The amount of water that can be held by soil increased with the addition of PAM compared to the control. Differences in water content were more pronounced in LPAM compared to HPAM. The addition of LPAM increased aggregate stability proportional to PAM concentration. Moreover, 1000 mg L⁻¹ produced the highest aggregate stability (19%) compared to HPAM and control (7% and 5%), respectively. As PAM concentration increased, the geometric mean diameter (GMD) increased for both PAM molecular weights compared to control (0.4 mm). At 1000 mg L⁻¹ the GMD values were 0.88 mm and 0.79 mm for LPAM and HPAM, respectively. The addition of PAM improved soil physical and hydraulic properties, with an advantage to LPAM owing that to its ability to penetrate soil aggregates and therefore stabilizing them.