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Achieving near-complete hydraulic emission uniformity in Trapezoidal Drip Irrigation Units fed from the Major Base

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In recent years, considerable efforts have been dedicated to developing simple solutions for designing one-lateral and rectangular drip irrigation systems (Baiamonte, 2018). However, the trapezoidal shape that often aligns more naturally with the division of agricultural fields, has been poorly attempted; furthermore, it serves as a fundamental model from which rectangular and triangular configurations can be derived as specific cases. Building on previous research, new analytical solutions for trapezoidal units have been proposed (Baiamonte and Palermo, 2025), demonstrating that the rectangular shape (RCT) is a special case of these solutions. Moreover, a comprehensive performance analysis of trapezoidal units was conducted using the pressure head tolerance concept. Two types of trapezoidal units were evaluated based on their feed points: major base-fed (MJR) and minor base-fed (MNR). Interestingly, the MJR-fed trapezoidal unit exhibited higher hydraulic emission uniformity than both the RCT and MNR configurations. This improved performance is attributed to lower manifold inside diameters, reduced inlet pressure heads, and a smaller coefficient of variation in the pressure head distribution. As a result, MJR is recommended over both RCT and MNR. An application demonstrating the near-complete hydraulic emission uniformity achievable with MJR trapezoidal drip irrigation units is presented and analyzed, further supporting the effectiveness of the proposed design approach.

References

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