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Estimation of irrigation water requirements for green walls: Irrigation schedule

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The increase in world population, and the increase of people migration from rural to urban areas, causes an increase in temperature and contamination as well. To overcome these and improve the environmental conditions in cities, a development of green and roof walls has been observed in the last decades.
Green walls need water to survive thus, this work addresses first, the estimation of water requirements for green wall and second, its irrigation programming.
This work is complementary to other which characterizes the drip irrigation system and its uniformity in water application in the green wall placed over the East façade of the itd-UPM bulding (Centro de Innovación en Tecnología para el Desarrollo Humano) which is located at Ciudad Universitaria de Madrid in Spain.
The garden is comprissed for seven vegetal species: Carex oshimensis, Cineraria marítima, Cyrtomium falcatum, Lampranthus spectabilis, Luzula nívea, Tulbaghia violácea, and Vinca minor. They were randomly located over the wall. At presente, the are 32 units of Vinca minoras), 20 of Lampranthus spectabilis, 29 of Tulbaghia violácea, 29 of Cyrtomium falcatum, 29 of Cineraria marítima, 15 of Luzula nívea and 14 of Carex oshimensis.
Since the number of vegetal species in green walls is high, it is unfeasible to estimate a crop coefficient (Kc) for each of them. Then, a garden coefficient (Kj) is usually determined which describes the water irrigation requirements considering the vegetal species needs, plantation density and microclimatic conditions.
The net irrigation water requirements is calculated by subtracting evapotranspiration to the effective precipitation. Finally, the real irrigation water requirements is calculated by increasing these need by the efficiency in water application and considering also, the leaching fraction for salt flushing.
The period of study was 106 days. he climatic data were recorded in an automatic weather station (Vantage Pro2 Davis) close to the green wall which loges information every hour.
Water requirements were determined following the FAO procedure. The Penman-Monteith equation was used to estimate the reference evapotranspiration (ETo), and the evapotranspiration (ET). The garden coefficient was calculated as $kj{=}ET/ETo$.
The water balance was used to estimate the irrigation efficiency.
The ETo increased during the summer. The minimum value was 0.74 mm/d and the maximum, 8.5 mm/d. The critical period corresponded to the first week of August with a demand of 5.6 mm/d. The lowest demand coincided with the end of December (0.24 mm/d.
The Kj varied as ETo and ET. Their values were within the interval [0.15-1.6]. Its average value was 0.6 in the summer and 0.36 in the winter.
The average water requirements for the green wall were estimated in 833 mm/year. Only 16 mm were supply by the precipitation.
The water application efficiency was 83% which is low for the trickle system and must be improved. This could be accomplished by increasing the frequency of irrigation events and shortening the irrigation time. If the water efficiency would increase in 7%, the saving of water would be 351 L/year.