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Adaptation of an Automatic Irrigation-control Tray System for Outdoor Nurseries

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Inefficiency in water and nutrient management in outdoor nurseries causes environmental concerns. In this sense, the irrigation-control system should automatically modulate irrigation in accordance with water consumption by the substrate–plant system. The irrigation-control tray method (ICT), which is applied extensively in greenhouse plants raised in grow bags for horticulture production, has been successfully adapted to the specific conditions of plants grown outdoors in containers. The prototype was employed to irrigate plants during the entire experiment (18 months). The performance of the ICT method was comparable to the tensiometric method that it is a sufficiently proven method. The plant biomass was not significantly different between the two methods and also the irrigation events were comparable.

1. Introduction

It is becoming more necessary for ornamental plant nurseries to be equipped with irrigation-management systems to improve water-use efficiency and reduce the amount of nutrients that leach into the soil (Schuch & Burger, 1997; González, 1998; Bilderback, 2001). The cost of water and fertiliser usually represents a relatively low percentage of total production costs, which is why nurseries often do little to reduce consumption of these inputs. However, environmental policies now tend to limit excessive use of water and fertiliser (Biernbaum, 1992; European Parliament, 2000).

Bearing in mind that outdoor ornamental plant nurseries grow a wide variety of species and use different formats, strategies to promote water conservation require to consider many different factors, such as the needs of different species, the distribution of growing containers, and the design and maintenance of irrigation systems (Bilderback, 2002; Garber et al., 2002).

To increase irrigation efficiency in a group of homogeneous plants in a nursery (i.e. plants of the same species and of similar size), it is necessary to determine the dosage of water to be applied and the criteria for activating the irrigation system.

1.1. Irrigation-activation systems

Irrigation dosage is based on substrate characteristics, container volume and leachate-fraction percentage (Salas & Urrestarazu, 2001; Moreno, 2003).

In outdoor ornamental plant nurseries, irrigation is usually activated empirically, which means irrigation dosage and frequency are not based on objective criteria (Michelot, 2000). It is very common for irrigation to be programmed at regular time intervals without taking into account objective parameters such as substrate moisture (Lieth & Burger, 1989; Biernbaum, 1992). The aim is for irrigation to be activated automatically when plants need it, while bearing in mind water-retention capacity of the substrate and plant water consumption. Many methods have been described and sensors have been developed that provide reliable information so irrigation can be managed objectively (Biernbaum & Versluys, 1998; Salas & Urrestarazu, 2001). However, often the sensors are expensive and not mechanically robust enough for use in outdoor nurseries (Biernbaum, 1992). A few methods for outdoor nurseries stop the irrigation programme only when enough rain has fallen (Bilderback, 2001). This area is worth developing for nurseries located in regions with high rainfall levels.

