

Maximizing water use efficiency in designing microirrigation unit (IrriLab Software)

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As the year 2050 approaches, the world population will reach 9 billion - so does the challenge of doubling crop yields. To meet this crop yields demand, the associated dramatic improving of water productivity (WP) must necessarily be accompanied by maximization of water use efficiency (WUE) (Ragab 2011, UNEP 2014). In this work, a recently developed software (IrriLab, <https://www.facebook.com/irrilab>) moving in this direction is presented. IrriLab is a very simple tool allows to design microirrigation unit optimizing WUE, pressure energy and irrigation unit costs.

Irrigation software available in commerce provide microirrigation system designs, by mainly looking at the maximum flow rate uniformity criteria. Thus, each emitter installed along the laterals operates with an operating pressure head occurring in between an established range of pressure head variability ($Dh \leq Dh_{adm}$). However, the latter condition does not always corresponds to the cheapest and to the maximizing WUE solution; in fact, it is not assured if the entire range of the admitted pressure head is profited and used by the emitters. IrriLab allows this occurrence because, for the entire Irrigation Unit Area, IUA, each design solution assures that at least two emitters rigorously operates, one with the minimum admitted pressure head, and the other one with the maximum admitted ($Dh = Dh_{adm}$), (Baiamonte et al., 2015; Baiamonte, 2016). The same extreme values of pressure head are those that in the common design criteria delimit the range of pressure head, but without assuring their achievement. Compared to the common design criteria, this condition i) for fixed laterals' length and inside diameter, allows reducing the inlet required pressure head whereas, ii) for fixed pressure head at the inlet, provides an increasing in laterals and manifold lengths and in the associated IUA.

Based on analytical solutions, IrriLab follows a very simple rectangular sketch, any way oriented in the space, and defined by two slope values, one for the laterals and one for the manifold. By considering the possible combinations of i) horizontal, downward or upward sloped laterals and manifold, ii) the manifold position in respect to the laterals and iii) the inlet position in respect to the manifold, which can be equal to 0%, 24% or 50%, in respect to their lengths (Baiamonte, 2016), IrriLab accounts for 25 optimal irrigation unit layouts, for each of them providing maximum WUE.