



Application of WinSRFR4 program to zigzag corrugated furrow irrigation in Bolivia

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Program WinSRFR4, developed by the Agricultural Research Service-U.S. Department of Agriculture, is used to perform surface irrigation evaluations, to establish appropriate irrigation parameters to get better irrigation efficiencies, to execute irrigation simulations and so to set several alternatives to the design of an irrigation.

This paper aims to adapt WinSRFR4 program to zigzag corrugated furrow irrigation performed in the Andean regions of Bolivia. These irrigations are quite peculiar as they are carried out in areas with steep slope and with very low flow rates to avoid the risk of erosion. Besides of this, the flow rates are quite variable during the irrigation application. The greater length of the furrows is drawn on contours performing small jumps between consecutive contours. Available data are taken for seven irrigations for different periods of lettuce crop growth.

First, a model that fits irrigations executed has been searched. For this, we have conducted a series of tests with the program WinSRFR4, being necessary to carry some simplifications given the peculiarity of this type of irrigation. The procedure consisted in determining the advance curves during irrigation. Later, the parameters of the Kostiakov - Lewis equation have been calculated by the method of Walker and Elliot. Although the furrow longitudinal profile was available, a mean slope was used at the time of establishing the model. WinSRFR provides a model of analyzed irrigation with a coefficient of determination ranged from $R^2 = 0.3520$ to $R^2 = 0.9095$. Finally, the errors obtained in the mass balances are between 2% and 14%.

The model showed that application efficiencies ranged between 9% and 35%, rather poor, while runoff coefficients varied between 47% and 91%. Not too much importance is given to the fact that runoff occurs because runoff water is used in plots located at a lower level

Irrigation simulations have been carried out using WinSRFR by changing the operation variables: flow rate and cutoff time. Relatively high application efficiencies are obtained when applied flow rates are low. Furthermore, runoff depth is greater with higher flow rates while the irrigation cutoff time is the one with the greatest influence on the percolation depth.

As a conclusion, it can be remarked that with the reduction and homogenization of the applied flow rates and with the establishment of irrigation times of long duration, it can obtain acceptable application efficiencies. The use of WinSRFR program is essential since an acceptable model fit to real irrigation data is obtained.