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Comparison between the efficiency of different irrigation methods applied in the Piedmont area of Italy

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The irrigation districts of Turin and Cuneo (Italy) are characterized by aging surface irrigation systems. Maize is the most widely used crop. The increasing frequency of dry winters, springs and summers has enhanced the scarcity of water for such irrigation systems. New pressurized irrigation systems have been installed in some farms. The aim of this work is to compare the efficiency of surface versus sprinkler irrigation systems in some representative maize fields. For this purpose automatic Time Domain Reflectometry (TDR) probes have been installed at different depths within the maize rows and inter-rows during the two growing seasons of 2006 and 2007. Six farms with similar homogeneous soils were chosen for our study. Actually, the irrigation efficiencies of the border and furrow irrigation systems are in the order of 63 to 77 %, while those of the sprinkler irrigation systems exceed 90 %. This difference is mainly due to the fact that water volumes applied with surface irrigation systems are quite non-uniformly distributed with considerable differences between the infiltrated volumes at the top and the end of the irrigation runs. For sprinkler irrigation systems, the water application is much more uniform allowing less water volumes to be applied; however, these irrigation systems suffer from water losses due to evapotranspiration. The results of our study showed that an increase of irrigation efficiency of the surface irrigation systems may only be targeted for soils which are not too coarse (e.g., sandy soils) and for irrigation runs shorter than 600m. For various farms with furrow irrigation systems, deep percolation was observed for depths over 70 cm; these losses attained in some cases 7% (2006) to 11% (2007). An increase in irrigation efficiency of these systems can possibly be obtained by decreasing the intake time at the head of the ir-

rigation run; however, such practice implies an increase in the number of irrigation events associated with an increase in work load of the farmers. The crop production of 2006 and 2007 showed that, independent of the deep percolation losses, higher crop yields were attained for higher inflow rates when dealing with surface irrigation systems. Consequently, for the case of surface irrigation systems, the economical optimum not necessarily coincides with the optimum defined from the point of view of irrigation efficiency. For the case of sprinkler irrigation, the gap between economical optimum and maximum water efficiency is much smaller. Hence, when dealing with quantitative feasibility studies for irrigation management, obviously both economical and hydrological aspects should be taken into account.