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Weighing lysimeter studies as basis for irrigation management

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Efficient irrigation management aims for an optimum water supply for the plant in order to maximize yield on the one hand, and minimize losses of water and energy on the other hand. One approach in this regard is to keep the soil water content within an ideal range for plant water uptake. Therefore, it is essential to know the current soil water content during the vegetation period. In general, the soil water content is increased by rainfall R and irrigation I, and it is decreased by evapotranspiration ET and deep percolation P. Provided that the necessary data are available, the change of the soil water content dS can be computed using the water balance equation dS=R+I-ET-P. Beside this method, the soil water content can be measured using soil water sensors. For example, FDR-sensors can measure the water content in a soil profile with a high temporal resolution.

Both methods are the basis for irrigation scheduling in the Marchfeld, an intensively used agricultural area in the eastern part of Austria. The lysimeter- and agro-meteorological station in Groß-Enzersdorf lies in the Marchfeld. The lysimeters are operated by the University of Natural Resources and Applied Life Sciences, Vienna. Two weighing lysimeters are used to adapt and improve irrigation management practices. One lysimeter is grown with grass in order to determine the reference-evapotranspiration, the second one is planted with different annual crops that are typical for the Marchfeld. The amount of percolation water and the change of weight are measured and stored automatically. FDR-sensors are installed in the lysimeter for measuring the soil water content in different soil layers.

ET is determined from the lysimeter data and calculated from equations, e.g. Penman-Montieth. The essential weather data originate from the nearby meteorological station of the Austrian national weather service. As a result, daily measured soil water content is compared with calculated soil water and FDR-sensor readings during the vegetation period. FDR-sensors from different companies are installed in the lysimeter for comparison in order to get a link from laboratory tests to field applications. Part of practical irrigation research is a telemetry network connecting such soil water sensors as well as weather stations distributed over the Marchfeld. Stand-alone devices with on-line data connection are also used for irrigation management.