

Marginal cost curves for water footprint reduction in irrigated agriculture: a policy and decision making guide for efficient water use in crop production

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Reducing water footprints (WF) in irrigated crop production is an essential element in water management, particularly in water-scarce areas. To achieve this, policy and decision making need to be supported with information on marginal cost curves that rank measures to reduce the WF according to their cost-effectiveness and enable the estimation of the cost associated with a certain WF reduction target, e.g. towards a certain reasonable WF benchmark. This paper aims to develop marginal cost curves (MCC) for WF reduction. The AquaCrop model is used to explore the effect of different measures on evapotranspiration and crop yield and thus WF that is used as input in the MCC. Measures relate to three dimensions of management practices: irrigation techniques (furrow, sprinkler, drip and subsurface drip); irrigation strategies (full and deficit irrigation); and mulching practices (no mulching, organic and synthetic mulching). A WF benchmark per crop is calculated as resulting from the best-available production technology. The marginal cost curve is plotted using the ratios of the marginal cost to WF reduction of the measures as ordinate, ranking with marginal costs rise with the increase of the reduction effort. For each measure, the marginal cost to reduce WF is estimated by comparing the associated WF and net present value (NPV) to the reference case (furrow irrigation, full irrigation, no mulching). The NPV for each measure is based on its capital costs, operation and maintenances costs (O&M) and revenues. A range of cases is considered, including: different crops, soil types and different environments.

Key words: marginal cost curve, water footprint benchmark, soil water balance, crop growth, AquaCrop