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Irrigation efficiency and optimization: the Optirrig model

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A possible way to save agricultural water is to improve global irrigation efficiency, defined as the ratio between the irrigation water volume used for crop transpiration and the total irrigation water volume. Higher irrigation efficiency leads to higher irrigation productivity ("more crop per drop") and profitability in relation to irrigation water costs: higher financial expectations for the same water and energy costs or identical financial expectations for lesser water and energy costs.

Improvements of irrigation efficiency may be sought either from better performing material (contextual relevance, technical quality or durability) or from optimized irrigation strategies with multiple levers of action (dates, doses, scheduling or trigger criteria, leaning on weather forecasts or not) and expected constraints (availability, quota, prefecture decrees).

It is even possible to handle these two issues at once by

- (i) evaluating the irrigation water losses attributable to material (e.g. accidental pipe rupture or unavoidable intrinsic losses when using rainguns, spatial heterogeneity of water delivery),
- (ii) evaluating the losses due to inadequate irrigation strategies (drainage or evaporation of irrigation water, excessive irrigation water storage in soils, losses due to wind drift)
- (iii) gathering all losses in a "cascade scheme" that organizes them in phenomenological and chronological manner, somehow assuming successive losses "from the canal to plant roots",
- (iv) exploring numerous irrigation scenarios that would allow reducing losses, improving efficiency and finally finding the minimal irrigation water amount required to reach the target agricultural yield (or fulfil a typical set of contradictory constraints, e.g. irrigation quota vs. objectives in crop yield profitability and possibly no drainage)

This was the scope of the recent development of the "Efficiency" module of the Optirrig model built for the generation, analysis and optimisation of crop irrigation scenarios.