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## Yield prediction of durum wheat: the added value of MED-GOLD climate services products

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Early within-season weather conditions forecast and yield prediction can provide useful information to improve farmers' management decisions and to create a unique opportunity for implementing new solutions to specifically address key aspects of agricultural systems.

Within the aims of the EU funded Horizon 2020 MED-GOLD project (<https://www.med-gold.eu/>), a durum wheat case study has been established to assess an innovative climate service tools for the management of climate risks and to increase yield and reduce potential risk.

In this study, the added value of seasonal forecast was assessed by looking at the historical yield data and by comparing the data provided by climate service tool with traditional crop forecasting systems.

For three hot spot areas (Ravenna, Ancona, and Foggia), the skills of the ECMWF-System5 seasonal time-scale forecasting provided through the Copernicus Data Store (CDS) were evaluated as a driver to the crop modeling system DELPHI, to test their added value to durum wheat yield prediction.

Initially, the DELPHI model was run with observed daily weather data from sowing to harvest to obtain the reference yield. Then, yield predictions were calculated at a monthly time step, starting from February 1st and April 1st, by feeding the model with synthetic weather scenarios based on historical observations (dry, average, wet scenario - current mode) and with weather seasonal forecast (new tool) until the end of the growing season. Results for yield prediction on the basis of the current DELPHI System (historical scenarios) and on the basis of seasonal forecast (25 ensembles) were compared against reference yield.

For Foggia and Ancona, in low yielding crop years and 4 months before harvest, the mean yield prediction based on the new DELPHI System tool show lower normalized root mean square error values (nRMSE) than yield predictions based on the current DELPHI system, while the latter

performs better 2 months before harvest. The opposite conditions arise for the Ravenna area: lower nRMSE for the current DELPHI system 4 months before harvest and lower nRMSE for the new DELPHI system 2 months before harvest. In high yielding crop years, the new DELPHI system performs better than the current one in all the study areas both 4 and 2 months before harvest, except in Foggia where the current DELPHI system shows lower nRMSE 2 months before harvest. In general, the availability of unbiased data slightly improved the yield forecast, with the best result achieved for the high yielding crop year in Ancona, where 2 months before harvest the nRMSE dropped from 20.3% (biased) to 9.3% (unbiased). Based on these first promising results this benchmarking framework will be extended over a wider study area and for the full reanalysis temporal coverage.