A SIMPLE INTEGRATED SYSTEM TO SUPPORT FERTILIZATION DECISION MAKING AT FARM LEVEL

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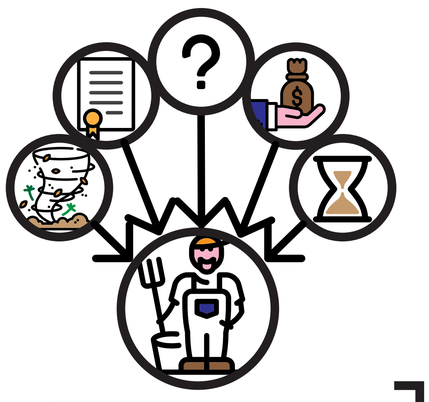
INTRODUCTION

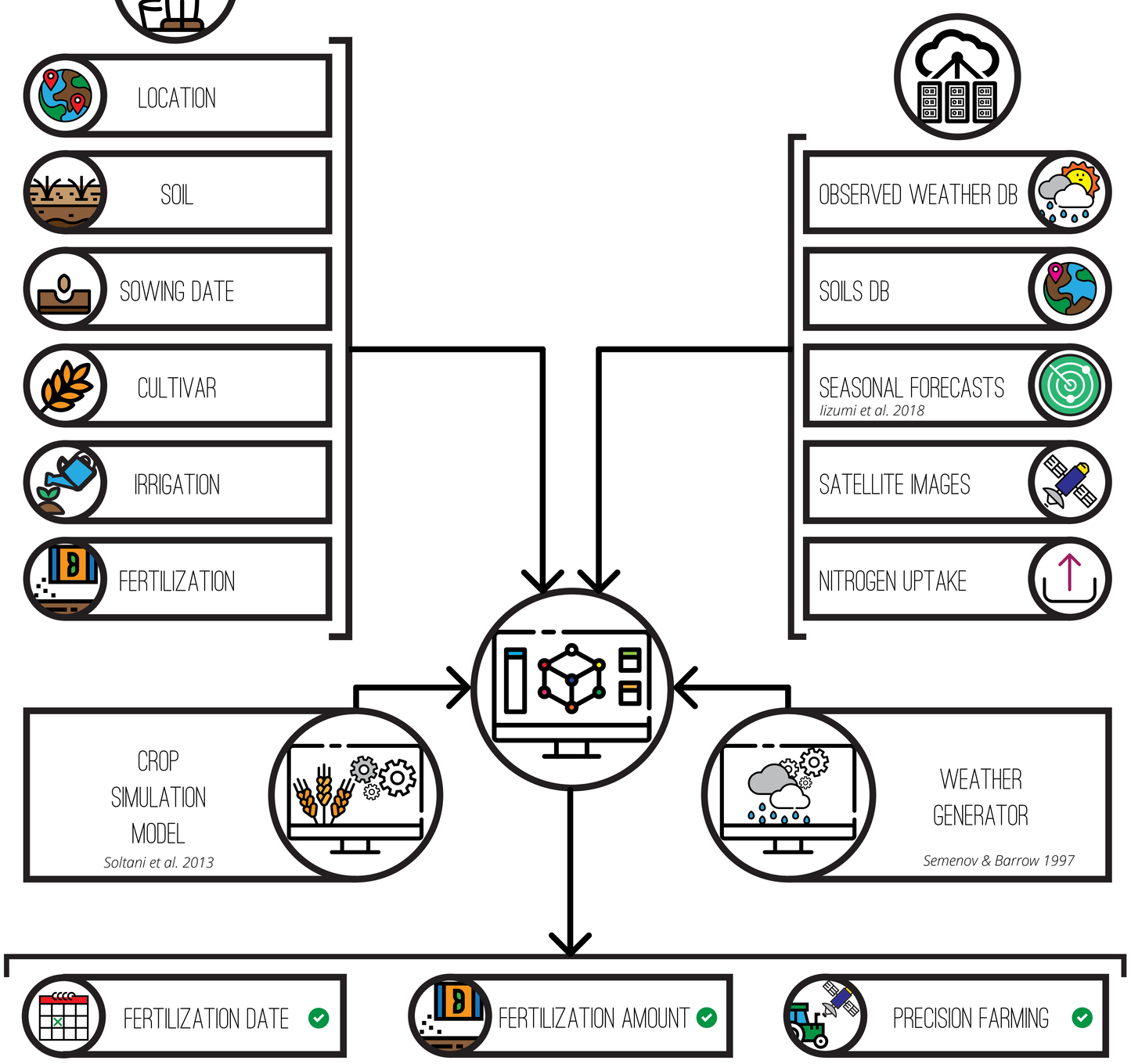
Climate change is strongly affecting agriculture, and therefore durum wheat cultivations, with repercussions on growth, phaenology and yields. As a consequences, often farmers tend to increase the amount of nitrogen supplied in order to secure the production, with higher leaching, costs and environmental pollution. However, market-, industry- and policy-driven higher requirements in terms of grain quality and environmental protection are stressing even more farmers when decisions related to fertilizations have to be taken.

In response to this, there is an increasing number of complex decision support systems aimed at helping farmers in their activities. However, these systems are often not particularly user friendly, requiring a large amount of information from farmers, and thus significantly time consuming. This could prevent farmers to successfully rely on these system in order to have more efficient, environmental friendly, cost-effective fertilizations.



We developed a simple yet reliable integrated system aimed at supporting farmers in fertilization decision making, with a high level of automatization, extremely low information requirements, and farm level specific results.

The system is based on the integration of crop growth simulation models, satellite images, seasonal forecasts, weather generator and soil and weather databases.



HOW IT WORKS

Farmer is asked to provide a few information about the cultivation: location, basic soil information, cultivar and sowing date, and farm activities (such as fertilization and/or irrigation, date and amount of) if any. With these information, the system is able to gather all the data needed.

First, the system is generating hundreds of mixed observed/generated weather data combining observed data and forecasts, based on time series for the relevant meteorological cell. This is done regularly, as soon as new forecasts are available.

Then, the system runs thousands of simulations, for the specific soil and cultivar, with the generated weather data, for different combinations of fertilization level and date of application, in order to assess the optimal fertilization options, taking into account the climate variability.

Regularly the system is calculating NDVI for the simulated cultivation from satellite images, in order to have a reliable estimate of the growth stage of the crop, and to better self-calibrate the simulations.

The system is eventually proposing a few optimal fertilization options to the farmer, with times and amount of application.

The system can be also used in precision farming, by supplying more information (field shape, soil data): farmer will obtain data suitable for the most common tractors with precision fertilization systems.

BIBLIOGRAPHY

Toshichika Iizumi, Yonghee Shin, Wonsik Kim, Moosup Kim, Jaewon Choi, Global crop yield forecasting using seasonal climate information from a multi-model ensemble, Climate Services, Volume 11, 2018, Pages 13-23, ISSN 2405-8807, https://doi.org/10.1016/j.cliser.2018.06.003.

Soltani, A., Maddah, V., Sinclair, T.R. SSM-wheat: A simulation model for wheat development, growth and yield (2013) International Journal of Plant Production, 7 (4), pp. 711-740.

Semenov, M.A., Barrow, E.M. Use of a stochastic weather generator in the development of climate change scenarios
(1997) Climatic Change, 35 (4), pp. 397-414. DOI: 10.1023/A:1005342632279

Ferrise, R., Toscano, P., Pasqui, M., Moriondo, M., Primicerio, J., Semenov, M.A., Bindi, M. Monthly-to-seasonal predictions of durum wheat yield over the Mediterranean Basin (2015) Climate Research, 65, pp. 7-21. DOI: 10.3354/cr01325

Lawless, C., Semenov, M.A. Assessing lead-time for predicting wheat growth using a crop simulation model
(2005) Agricultural and Forest Meteorology, 135 (1-4), pp. 302-313. DOI: 10.1016/j.agrformet.2006.01.002

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