NEWSLETTER

December 2020

SHui

Managing water scarcity in European and Chinese cropping systems

WP1 - DATABASE

Several teams within the SHui project have investigated ways to reduce soil erosion and its negative effects on agriculture, water body pollution and building damage. Compared to conventional tillage, alternative crop management (*e.g.* planting cover crops and modified tillage treatments) can mitigate erosion thereby maintaining soil quality, allowing increased crop yields and net profit. Thus applying mulch tillage (MT) and no tillage (NT) practices in Austria decreased surface runoff by 27% (MT) and 41% (NT) thereby decreasing nutrient and pesticide losses to the environment, and more than halved soil loss. While the different tillage treatments had similar effects on long-term yields, decreasing tillage increased soil fertility and saved farmers fuel and time. These investigations are compiled in SHui's open-data research platform.

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WP2 - MODELS

Researchers at IAS-CSIC are currently collaborating with local farmers, evaluating on-farm data and using the AquaCrop model along with spatial analysis algorithms and hydrological simulation tools, to predict water-limited yield gaps in rainfed cropping. Ongoing field experiments are combined with historical data analysis of several hundred hectares. By quantifying yield gaps caused by the spatial distribution of water, farmers can adopt variable rate seeding and site-specific management to maximise yields and limit costs. One of the farmers associated with the study said "*I am happy that we finally get the chance of digging into our own data, following a scheme of analysis that is systematic, and from which we expect to extract information that will allow us to take decisions in a more supported way, with numbers. We are interested in simulating different management options and the economic implications of them*."

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WP3 - SATELLITES

Farmers can now monitor soil moisture and crop growth from space. Satellite-based microwave sensors regularly measure these variables all over the globe, day and night, and through clouds. While these data are freely available to everyone over large spatial scales, satellite-based soil moisture sensing is limited to about 5 cm depth and is intermittent in time and space (the Earth rotates while the satellite circles around it). Since soil moisture estimations need to be to about 1 m depth (the crop rooting depth), SHui's researchers at KU Leuven are combining microwave remote sensing with soil-plant modelling to generate daily pan-Europe (1 km2 resolution) maps of root-zone soil moisture and crop biomass. These can be used predictively, to see where more or less irrigation is needed to maintain biomass production.

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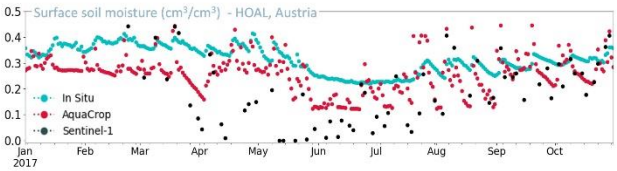

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WP4 – TOOLS FOR FARMERS

Within SHui, the Agricultural Research Organization in Israel, at its southern Gilat Research Center campus is experimenting with variable rate irrigation of cotton and interacting with the TerraVisionLab to analyse data to build decision support tools. We gather an almost infinite amount of data from soil sensors, plant-based measurements, drone flights with RGB, multispectral and thermal imaging, and satellites. We will organize and make sense of this data to build tools to help growers with water (and other) management decisions. For precision irrigation water management, we've identified potential decision support tools to:

1) delineate management zones to enhance water use efficiency
2) predict crop yields or plant water status
3) determine where and how to sample or place sensors in the field

Together these will boost farmer uptake of variable rate technologies to increase yields, conserve resources and maximize profits.

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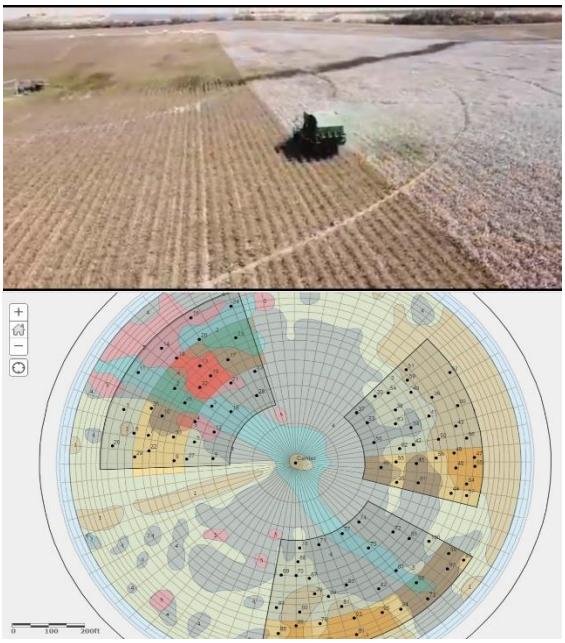

WP5 – SOCIO-ECONOMICS

The SHui socio-economic team have identified a research gap in implementing global policy recommendations for sustainable and environmentally friendly food production and water use for agricultural water management. While it's of great practical and scientific significance to analyze and evaluate irrigation water use, farmers were concerned with implementing Good Agricultural and Environmental Conditions (GAEC) with insights like:

- *"It's a vicious circle: If the European GAECs are becoming too high and expensive, food will be produced somewhere else in the world under bad conditions for the environment"* (F9, Austria 2019);
- *"Sustainability stops the profitability; it doesn't work together"* (V6, Spain 2019),
- *"We tried many different types of soil management to save water and to prevent erosion. But all experiments caused higher pesticide use"* (F6, Austria 2019).

Since farmers are often reluctant to invest resources in unfamiliar or complex strategies, SHui is undertaking extensive cost-benefit analyses of specific management options in both EU and China.

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