Ecophysiological response of maize (*Zea mays* L.) to water stress: remote sensing and upscaling techniques for a more efficient management of water resources in agriculture

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Introduction

Some of the most relevant effects of global change are the alteration of hydrological events and the increase in heatwave frequencies, which affect many human activities, including agricultural ones.
In 2021 cereals were the leading group of crops worldwide (32% of primary crops production), and maize (*Zea mays* L.) showed the highest production (1.2 billion tons) and the fastest production rate over the last decades (+104% since 2000).
Moreover, maize edibility depends on the quantity of mycotoxins in the grain, which are produced by fungal pathogens such as some *Fusarium* and *Aspergillus* spp., whose presence and toxigenicity depend on environmental conditions, mostly on precipitations and temperature.

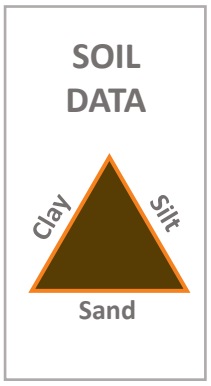
Aim of the PhD

The aim of this project is to better understand the correlations between the environment, the physiological response of maize plants, the fungal community, and the occurrence of mycotoxins. To do so, a multidisciplinary approach will be used, combining physiological and remote sensing multispectral data, to study this crop at different phenological stages.

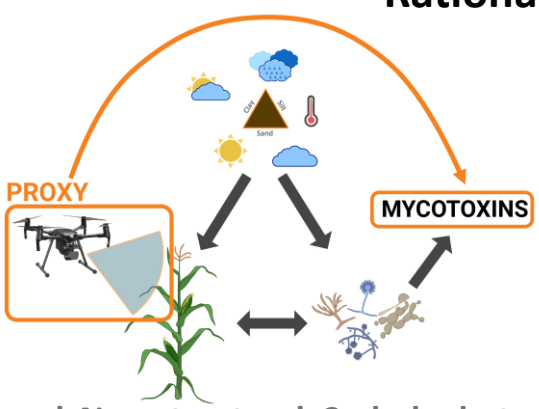
Study Area

In collaboration with ERSA (Regional Agency for Rural Development), about 20 maize fields along a pedoclimatic gradient in NE Italy have been chosen to be studied in a 2-years program.

Data Collection

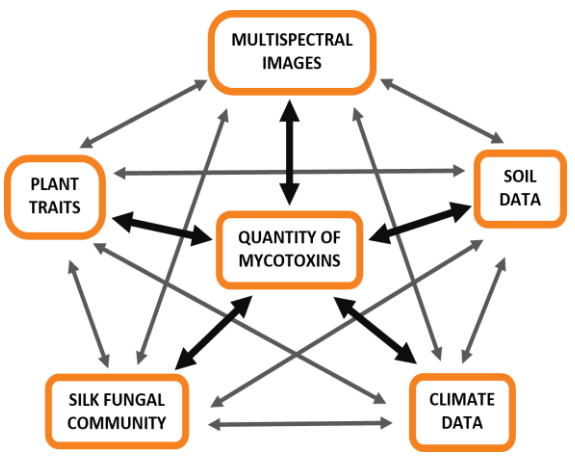


Rationale



It is already well known that soil and climate conditions influence both the microbial communities and some plant physiological traits. Among the latter, flavonoids, chlorophylls, and Non-structural Carbohydrates (NCSs) are some of the most important proxy of plant response to biotic and abiotic stress. Moreover, fungal communities, and the consequential presence of mycotoxins, are influenced by both climate conditions and plant state.
The idea is to use drone- and satellite-derived multispectral images as a proxy of plant state, and in turn as a remote, non-invasive, high-resolution, easy-to-have proxy of mycotoxin risk in maize fields.

Conclusions



This project will allow the development of an interpreting model concerning all the components that interact on maize. Based on this model, it will be possible to verify which components are more affected by environmental changes, and which are the weakest points in the agro-ecosystems.
This information will allow strategies to be implemented to limit fungal diseases risk, with important ecological and socioeconomical consequences all over the world.
This approach could then be applied also to other ecosystems.