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Exploring the effects of vineyard soil management on spontaneous vegetation, soil health, vine growth and grape quality: preliminary results from Chianti Classico

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Introduction
Cover crops (CCs) can improve soil health and increase the provision of multiple ecosystem services from vineyards. However inter-row tillage is common practice in Mediterranean areas as vine growers are increasingly concerned about CCs competition for nutrients and water. As a result, intensive tillage has escalated soil degradation and to date vineyard is the land use with the highest soil loss rate in Mediterranean Europe. There is therefore a clear need to explore on-farm strategies able to strike a balance between improving soils and at the same time guaranteeing grape production and quality.

Methodology
We designed an experiment in two organic farms, namely San Giusto a Rentennano (SG) and Montevertine (MT), located in two typical terroirs of Chianti Classico (Tuscany, Italy) and characterized by different soils, altitude and climate. The aim is to assess the effect of different soil management practices on vine (Vitis vinifera L., cv. Sangiovese) water stress, leaf greenness, grape yield, berry composition and spontaneous vegetation. The experiment began in 2017 and will run for an additional year. We are testing five treatments: conventional tillage (CT), spontaneous vegetation (S), faba bean (Vicia faba var. minor Beck) incorporated in spring (F), mixture of barley (Hordeum vulgare L.) and clover (Trifolium squarrosum L.) both incorporated (CCI) and left as dead mulch (CCM). Concerning soil health, we are monitoring chemical (soil organic matter, N, P, K), physical (aggregate stability, resistance to penetration) and biological (QBS-ar) indicators. Midday stem water potential (Ψstem) and SPAD values are collected from pre-veraison to berry ripening as proxies for vine water stress and leaf greenness, respectively. Grape yield and yield composition (clusters weight, number of clusters, weight of 100 berries) are estimated at harvest. Destemmed berries are then analysed for qualitative parameters (pH, total soluble solids, titratable acidity, malic acid, anthochianins, total polyphenols, yeast assimilable nitrogen). Spontaneous vegetation is also studied through soil cover estimation and biomass weight by species in spring and fall.

Results
Preliminary results indicated that treatments significantly affected SPAD in both farms. However we found higher SPAD readings under CT in SG while S and CCM showed the higher SPAD values in MT. Lower water stress was found in CT as compared to CCs and S treatments in SG. No significant differences in Ψstem across treatments were found in MT due to the high precipitations during the sampling period (236mm in MT vs 73mm in SG). Grape yield did not differ significantly across treatments in both farms. The analysis of functional traits of the weed communities highlighted a strong association between tillage and both creeping perennial and fast-developing annual species.

Conclusion
These results indicate that the stress triggered by soil cover practices is not necessarily associated with yield reduction. Moreover tillage seems to act a driver of change in weed communities towards more competitive weed species. These results will be combined with future analyses on soil and grape quality in order to support viticulturists in selecting soil management strategies able to combine ecological and agronomic benefits.