PoS1-46

Service Crops Functional Markers Explain Soil Water and Nitrogen Stocks at Budburst in Mediterranean Vineyards

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Abstract: In Mediterranean region, summer droughts are getting more intense with climate change, and water management is essential to avoid grapevine water and nitrogen (N) stress in order to maintain berry production (Celette and Gary 2013). Numerous studies have shown the potential of service crops for providing services in vineyards, eventually in relation to water and N supply (Garcia et al. 2018). Functional characterization is increasingly employed for cultivated ecosystems (Martin and Isaac 2015; Wood et al. 2015), with the hypothesis that functional markers could help us to predict the ecosystem services provided by cash crops and service crops (Damour et al. 2015). However, there is a lack of studies that assess the relations between functional markers and ecosystem services in field conditions. The aim of this study was to test the relations between functional markers of service crops in vineyards, and water and N stocks in soils.

The experiment was carried out from 2016 to 2017 on a vineyard located in the South of France. Treatments consisted in 13 different service crop species and spontaneous vegetation in the inter-rows. Species were chosen to diversify botanical families, life cycles and growing behaviour. Service crops were sown on plots of 30m length in inter-rows. We studied plant communities of sown species and neighbouring weeds in three quadrats per treatment. At budburst, cover rate and aboveground biomass were recorded in all quadrats, and species were sort out to calculate their relative abundance. After biomass collection, soil cores were collected to measure soil water and N contents. Aboveground functional markers were measured on sown species and most frequent weeds (39 species in total) according to standardized protocols (Pérez-Harguindeguy et al. 2013). We recorded plant height, leaf area, leaf dry matter content, plant dry matter content, specific leaf area (SLA), carbon, N content and C/N ratio. Community weighted means (Garnier et al. 2004) were calculated for each marker to take into account species diversity in each quadrat. Cover rate and aboveground biomass were also included in the data analysis we performed to explain soil water and N stocks.

Our results show that soil water and N stocks were related to the aboveground functional markers of the service crops and associated weeds. Different sets of markers were involved in water or N stocks relations, respectively. Among them, plant N content and C/N ratio best explained N stocks variations (28% and 19%, respectively), while most of water stock variability was explained by cover rate and total biomass (28% and 29%, respectively). These results suggest that functional characterization of service crops at plant scale is relevant to understand and predict some ecosystem services provided by service crops; however, simple indicators measured at plant community scale (e.g. cover rate and aboveground biomass) sufficiently accounts for differences in water provision at budburst.

Keywords: Service crops, Ecosystem services, Trait-based approach, Vineyard, Water stock, Nitrogen stock

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Harnessing Innovations in 'Plant Team' Cropping Through Science-Practitioner Information Exchange

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Abstract: Ecological principles offer a theoretical basis for understanding the potential benefits of growing crop species mixtures. Species-rich systems often show higher productivity than monocultures, with reduced pest and disease severity, improved resource capture, and greater resilience to environmental stress. By understanding the processes promoting productivity, ecological approaches can be used to identify the plant traits and mechanisms that promote productivity in crop species mixtures or 'plant teams'. While experimental validation of scientific theory is crucial to make progress, scientists recognise there is an untapped reservoir of knowledge amongst communities of innovative practitioners who are motivated to grow crop species mixtures and have unique expertise in optimising their performance. Combining the two creates a potentially powerful means to define the ideal plant partners and practices for the best-performing plant teams.

The EU-funded Horizon2020 DIVERSify project (www.plant-teams.eu) adopts a multi-disciplinary approach, learning from tacit knowledge of innovative practitioners, to develop the concepts, methods and tools for crop improvement in plant teams. In the first year of the project (2017), field trials were established at research and stakeholder sites in a range of pedo-climatic zones across Europe. Regionally-relevant commercial cereal and legume cultivars were selected to test performance in plant teams (compared to monocultures). In parallel, consultation with stakeholders was undertaken through 15 National Stakeholder Meetings held across 11 countries to identify and discuss tacit knowledge, bottom up innovations and successful best practices, and to learn from what was not successful, for intercropping and crop mixture systems.

Here, we report preliminary results using this two-pronged approach. We present data from two field trials conducted at the James Hutton Institute, UK, where we identified overyielding in some cultivar combinations of wheat-faba bean (grown for silage) and barley-pea (grown for grain). Compared to monocultures, nitrogen concentrations of barley grain and pea seed were enhanced in mixtures, and the best-performing wheat-faba bean combinations maintained high silage protein concentrations. Further analysis will be used to identify which mechanisms and plant traits contributed to differences in yield and quality, but based on these findings, we chose cultivars for testing plant team performance at field scale. In addition, stakeholders identified 130 different plant teams practiced in partner countries; this co-produced knowledge has been used to select additional plant team partners for experimental trials in 2018, and to test a range of mixing ratios based on stakeholder experience. Information from these two approaches will be used to advise on cultivar selection and practices for cropping plant teams in each region and identify complementary legume and cereal crop traits as breeding targets.

Keywords: cereal, crop species mixtures, intercrop, legume, tacit knowledge, stakeholder

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