**Application**

Understanding of how different agricultural interventions influence SOC is crucial for sustainable agriculture and ecosystem preservation.

**Introduction**

Ecosystem health combines several indicators, among which SOC plays a pivotal role. Previous research has extensively investigated the impacts of farming interventions and land management practices on SOC content. Existing literature indicates that SOC content is influenced by factors such as land management practices, including ploughing and reseeding. However, gaps persist in comprehensively assessing the effects of different animal grazing species and ploughing frequency on SOC temporal dynamics. This study addressed this gap in knowledge by analysing SOC content in relation to ploughing and animal species grazing over a 10-year period.

**Material and methods**

This study was carried out in the North Wyke Farm Platform (NWFP), a large-scale experiment located at Rothamsted Research in southwest England. The NWFP, established in 2010, spans 63 ha, comprising fifteen hydrologically isolated catchments distributed across three farmlets. The experiment monitors a variety of bio-physical variables relevant for assessing sustainability of farming interventions. Between 2011 and 2013, all fields were managed as permanent pastures. From 2013 to 2015, two farmlets underwent ploughing and reseeding with grass only or grass and clover, i.e., improved pasture. In 2019, one of the improved pasture farmlets transitioned to arable management. Every spring, 30 yearling cattle and 75 ewes (and their lambs) are turned to pasture to graze under a continuous stocking method until the end of the grazing season. Some fields are exclusively grazed by cattle until October-November and other fields are exclusively grazed by sheep until December. After cattle are housed, sheep may graze in the cattle grazed fields for short periods. Silage is made from some cattle and sheep grazed fields in May and July-August each year. Soil surveys at 0-10 cm depth were conducted in 2012, 2016, and the yearly from 2018 to 2021, providing SOC content. Farm field event including pasture type (permanent pasture vs improved -reseeded- pasture) and the animal species grazing the fields (cattle or sheep) were recorded over time. We analysed SOC content as a function of both management factors and time. We used linear mixed models where the dependent variable was the SOC content, the fixed factors were pasture type, grazing animal species and time in years, and used the fields id as a random factor (all analysis were carried out in R version 4.2.3 and used the lmer package).

**Results**

SOC content was affected by the three main factors “species grazing” (p = 0.042), “pasture type” (p < 0.001) and “year” (p < 0.001) and by the interaction effect pasture type × year (p = 0.047). Fields grazed by cattle had greater SOC than those grazed by sheep (5.20% vs 4.67%). As expected, the permanent pasture had greater SOC content than the improved pasture (5.64% vs 4.09%), given the decrease in SOC with ploughing (Figure 1). In 2012, all the fields were under similar management in term of pasture type and, had similar SOC content (4.59%). The transition to improved pastures demanded ploughing between 2013 and 2015, reducing SOC concentration to 3.89% when assessed in 2016. SOC recovery to pre-ploughing values took a maximum of eight years (Figure 1). However, the interaction effect was evidenced by the constant increase in SOC in the improved pasture since 2016 and an alternation of increases and decreases for the permanent pasture around 6% since 2016 after a remarkable increase between 2012 to 2016 from 4.58% to 6.02% (Figure 1). This suggests that the permanent pasture stabilised its SOC content around 6%, whilst the improved pasture still has potential for recovering SOC, and that cattle grazing boosted this recovery.

**Figure 1**. Mean soil organic carbon concentration (SOC, %) across the NWFP between 2012 and 2021 in the fields grazed by cattle or sheep on a permanent (PP) or improved (IP) pasture (Segura et al., 2023).

**Conclusions**

Under cattle grazing SOC content was higher than under sheep grazing. It demanded a maximum of eight years to recover SOC content to pre-ploughing levels after reseeding. Permanent pastures generally maintained higher SOC than improved ones, but an intriguing pattern emerged; permanent pastures oscillated around 6% after a notable increase in the first four years, suggested and stabilisation of SOC.

**References**

Segura, C., Neal, A. L., Castro-Sardina, L. and Irisarri, G. 2023. Rothamsted Research. <https://doi.org/10.23637/rothamsted.98y60>

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