Experiment #1, Brittany, France: WHEAT EARLY SOWING FOR LIMITING SOIL EROSION AND NITROGEN LOSS

The problem

Soil erosion

Several factors can explain why many soils in Brittany, France, are prone to soil erosion:

- Topography and intense rainy periods
- Reduction of the hedgerow systems for agricultural mechanisation
- Tillage operations close to rainy periods, especially for wheat sowing (mid-November).

Nitrogen losses

Linked to soil erosion, Brittany is exposed to nitrogen losses. A key reason for this is the difficulties associated with establishing a well-developed cover crop/crop before the rainy period (autumn/winter).

The proposed solution

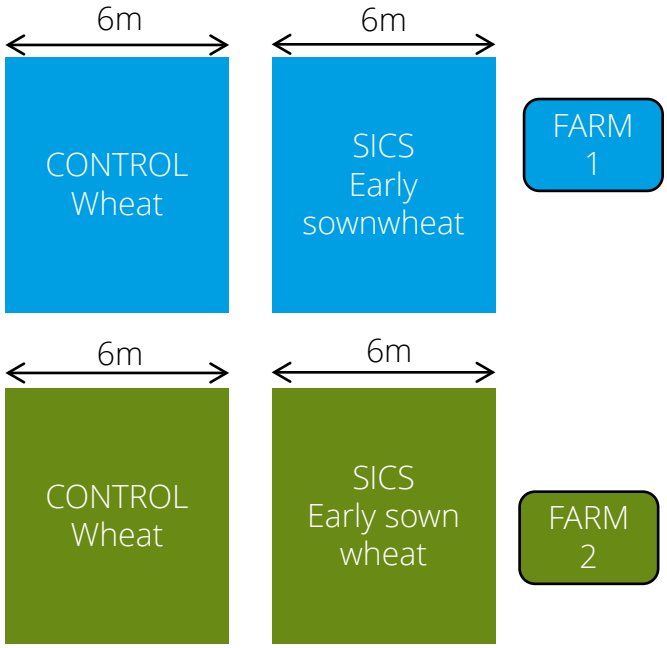
One response to these soil health problems would be to sow wheat earlier (in August).

This experiment trialled sowing wheat early, based on the Bonfils method whereby sowing rate is divided by two per month in advance, with wheat sown with companion plants. This approach replaced conventional sowing methods which contribute to soil erosion, where wheat is sown in mid-November with autumnal tillage.

Experimental design

Control: 150kg/ha wheat sown in mid-November.

Experiment: 50kg/ha wheat, 8kg/ha Alexandrian clover, 5kg/ha white clover, 5kg/ha buckwheat, and 2kg/ha nyger sown in August



Measurements taken
Soil organic carbon
Phosphorus and mineral nitrogen availability
Water stable aggregates
Bulk density
Levels of several nutrients (e.g., Ca, Fe, Mg)
Microbial biomass

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Results

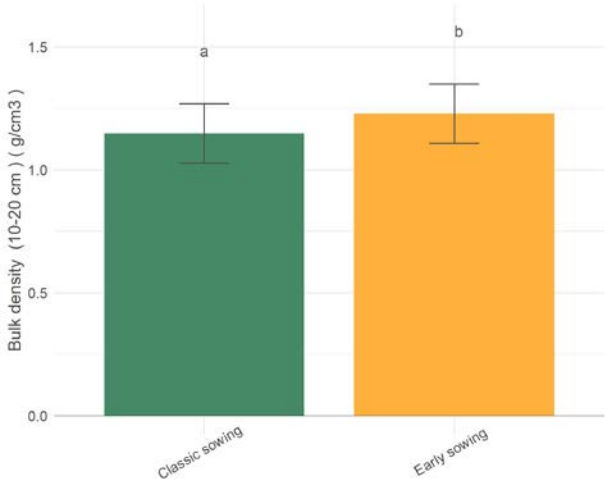

Figure 1. Bulk density in the top 10-20cm versus the timing of wheat sowing. The soil bulk density was slightly higher in the early sown plots.

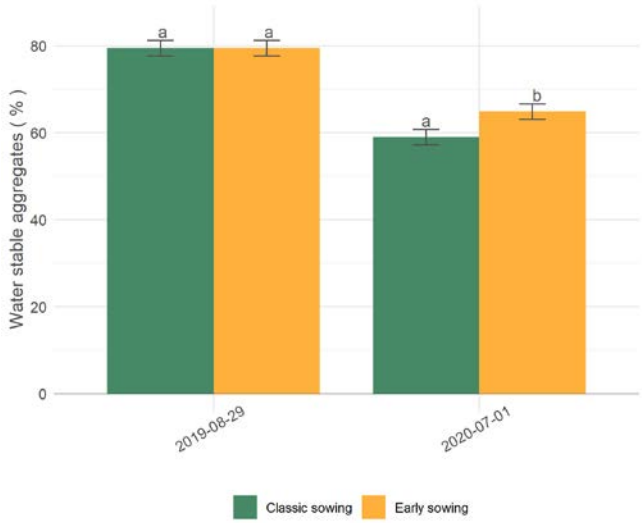

Figure 3. Water stable aggregates (%) versus timing of wheat sowing. The percentage of water stable aggregates was slightly higher in the early sown plots.

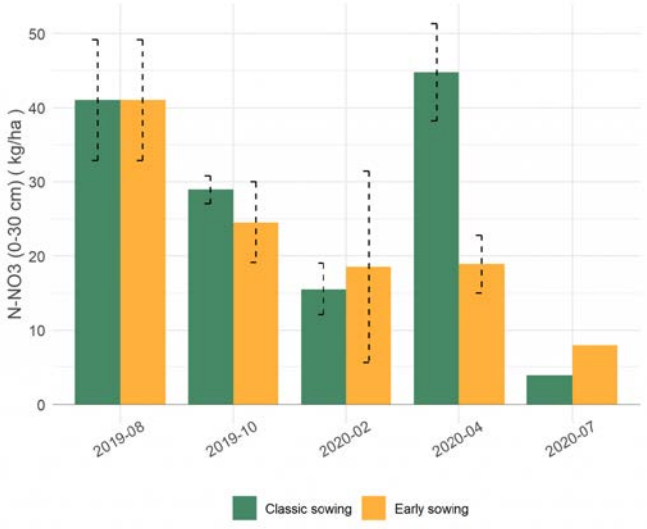

Figure 2. Plant available nitrogen in the top 0-30cm versus the timing of wheat sowing. Plant available nitrogen was higher in the early sown plots.

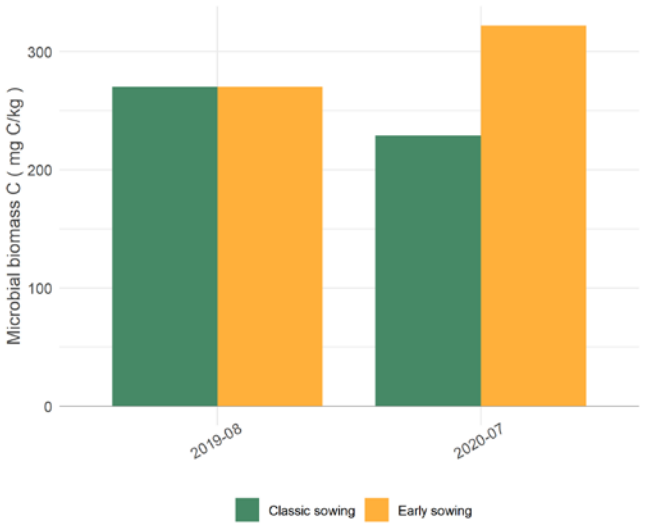

Figure 4. Microbial biomass levels versus the timing of wheat sowing. Microbial biomass was higher in the early sown plots than in the classic sown plots by 2020.

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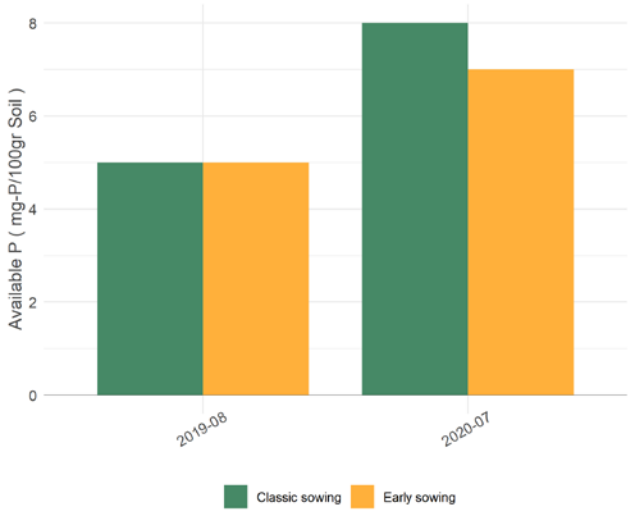

Figure 5. Availability of phosphorus (P) versus the timing of wheat sowing. The availability was the same regardless of treatment in 2019 but was higher in the classic sown plots in 2020.

Stakeholder feedback

- It was agreed that the results of the experiment indicate that the different timings of tillage due to early sowing enhanced the mineralisation process.
- It was argued that longer-term experiments are needed as the success of this method is highly linked to the weather conditions.
- The experiment results aligned with existing understanding of 80% of stakeholders, however, it was argued that the measurements could have been simplified, given the very innovative status of this practice.
- It was agreed that SoilCare has encouraged discussion and allowed stakeholders to build a better understanding of soil processes.

Economic results

- Early sowing wheat had a negative effect on economics due to the increased risk of crop failure.
- The early wheat crop in the SICS trial was not harvested in 2020 and therefore the benefit is recorded as zero.
- The SICS required less maintenance and lower production costs due to the reduced stubble cultivations.
- If it is to be economically viable, this SICS needs to be improved by incorporating companion plants, altering sowing rates.
- The economic viability of early sown wheat is mainly dependent on climatic conditions (i.e., good sowing conditions, in August or September and good mechanical weeding conditions in Autumn).

Agricultural management technique	Normal sowing date (control)	Early sowing date (SICS)
Investments costs	0	0
Maintenance costs	34.6	23.7
Production costs	317.5	211.5
Benefits	1350	0
Summary=benefits-costs	998	-235.2
Percentage change	-123.5	

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Key findings

- Microbial biomass was higher in early sown plots than classic sown plots, indicating that this treatment may improve soil health.
- The percentage of water stable aggregates was slightly higher in the early sown plots.
- There were no significant differences between sowing dates and P availability, bulk density or soil organic carbon levels.
- Early sown wheat was not economically viable, thus this SICS may need further developing with companion cropping and altering the sowing rates.
- This approach may only be feasible under ideal climatic conditions.

Conclusions

Early sowing of wheat may help to reduce soil erosion due to the increase in water stable aggregates. Soil organic carbon levels had begun to increase more in the early sown plots than in the classic sown plots by 2020. This indicates that a longer term trial may continue to result in higher SOC levels under early sowing.

Weed infestation and nitrogen deficiency symptom in early sowing of wheat

Fact sheet authors

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