Half the surface tilled – a cropping system without heavy tillage, using row hoeing and under-sown subsidiary crops

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In this project we develop and evaluate a management strategy for reducing heavy tillage in cropping systems under organic farming. Reducing heavy tillage has shown to have several benefits to soil and environment, but often problems with weeds increase since deep ploughing is one of the most efficient ways to reduce the amount of weeds. In the proposed systems design we use under sown subsidiary crops (SC) and row-hoeing as measures to control weeds when ploughing is excluded during the cropping sequence spring cereal – winter cereal, in this case oat and winter wheat. SCs are sown in the oat crop and terminated by row-hoeing in spring, in winter wheat, the year after. Apart from weed control, the SCs also provide services such as nitrogen fixation and additional biomass production, which could potentially improve soil fertility.

In the project we will evaluate several services provided by the SCs. For a schematic overview of the experiments, see the uploaded poster from 2017. In this summary, we only show the results of oat yield and SC and weed biomass production during the growing season 2017.

Annual leguminous species undersown in oats

Direct drilled winter wheat between the rows of a leguminous mixture.

The experiments are carried out in two regions, Östergötland and Skåne. In each region two experiments are set up, one that started in 2017 and one that started in 2018. The experiments

are two factorial, the first factor is SC placement, and the second factor is SC species mixture. Placement is either in the cereal row, between two cereal rows or adjacent to the cereal row, allowing for one or two row-hoeing events during the growing season for the spring cereal. The species mixtures are *Trifolium squarrosum* and *T. resupinatum* (annuals), *T. incarnatum* and *Vicia villosa* (annuals), and *T. pratense*, *T. repens* and *Medicago lupulina* (perennials). In Östergötland the experiments are on-station experiments and in Skåne the experiments are on-farm experiments with commercial machinery. Hence, the experiments vary a bit in their layout and technical equipment.

After the first year, we can conclude that the weather during the main growing season affects the system's performance. At the on-farm experiment in Skåne the yields were reduced by approximately 10 percent in plots with SC, probably due to a wet summer which favors the growth of legumes. The yield reduction was higher with annual SC than with perennial SC. A decrease in yield was also seen with more intense row hoeing, due damage caused by the tillage implements. However, the row hoeing did not cause any damages in the on-station experiment in Östergötland, maybe due to the wider row spacing there, or because the GPS-traction system made the hoe follow the rows better than in Skåne where no traction system was used.

In Östergötland SCs did not have a significant effect on yields in any direction, except when i hairy vetch (*Vicia villosa*) was used, which led to a significant yield reduction. The weather in Östergötland was not as wet as in Skåne, and SC biomass was smaller. Weed biomass was small in the inter-row spaces, and there was no significant difference in weed biomass due to row hoeing intensity in any of the experiments.

This indicates that for the control of annual weeds and newly germinated perennials one row hoeing event was enough to achieve satisfying weed control. Due to wet weather and high clay content, it was not possible to direct sow winter wheat at the on-station experiment in Östergötland. Instead, there will be spring wheat at this site in 2018.

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