



# Reduced tillage and green manures

**Julia Cooper and Oliver Crowley discuss the use of reduced tillage and green manures in organic arable and horticultural rotations**

**R**educing tillage is known to benefit soil quality and decrease energy use, but technical difficulties, most notably in weed control, mean that abandoning the plough can be challenging for organic farmers. The TILMAN-ORG project grew out of a recognition that developments in no-till and minimum tillage practices in organic farming systems have lagged behind those in non-organic farming in recent years.

To benefit from reduced tillage, systems need to be adapted to the special conditions in organic agriculture. Green manure use is more commonly practiced in organic systems, but there is still a need to improve these systems. The overall goal of the project is to design improved organic cropping systems that include reduced tillage and

green manure. These systems need to meet the criteria of enhanced productivity and nutrient use efficiency, more efficient weed management, increased biodiversity and lower carbon footprints (in particular increased carbon sequestration and lower GHG emissions from soils). This goal will be achieved through farmer survey, experimental and prototyping activities in the various partner countries.

## **Farmer survey**

The UK farmer survey work was co-ordinated by the Nafferton Ecological Farming Group (NEFG, Newcastle University). During late winter 2011 and early spring 2012 organic farmers in the UK were surveyed about

**ABOVE:** Organic farmers have been reluctant to switch from the plough to minimum or no-till systems, despite the known benefits to the soil



their reasons for adopting no-till, reduced tillage or green manuring practices and about the problems they had encountered with these practices. The farmers surveyed recognised the benefits of reduced tillage and the use of green manures, with improved soil structure and biological quality being the most common reasons selected for using these practices. Other reasons given for reducing tillage included: increasing soil organic matter, minimizing environmental impact, and improving biodiversity. Some farmers also cited the appeal of a technical or innovative challenge as another reason for trying reduced tillage. Farmers and growers were using green manures for a variety of reasons including: reducing nitrate leaching, limiting weeds, pests and diseases, increasing on-farm nitrogen production, improving biodiversity and improving yields.

### Challenging technique

Respondents reported many challenges associated with these techniques. Not surprisingly, weed pressure was identified as the number one problem with reduced- and no-tillage systems (Figure 1). Inadequate or expensive machinery was another problem, as well as a lack of specific technical skills. Challenges with green manures differed from those identified for reduced tillage systems.

For green manures, unfavourable establishment conditions was the number one problem, followed by the cost of seeds, problems with weeds, and a lack of specific technical skills.

**“I use min-till and do seem to have more weed problems. Having the right equipment is important, but a big capital cost.”**

**ABOVE:** Crop establishment in trials at Duchy Home Farm was more successful and faster under reduced tillage (left side of field) compared to mouldboard ploughing (right side of field)

The UK farmer survey is part of a larger survey being conducted in all project countries. Partners in France (at ISARA) are now compiling the results of the surveys. This will provide a useful indication of the current challenges and perceptions associated with these techniques in different parts of Europe. It will be particularly useful to determine if these techniques are more successful in specific regions of Europe, or in certain cropping systems. All of this information will be fed into the design of optimised cropping systems later in the project.

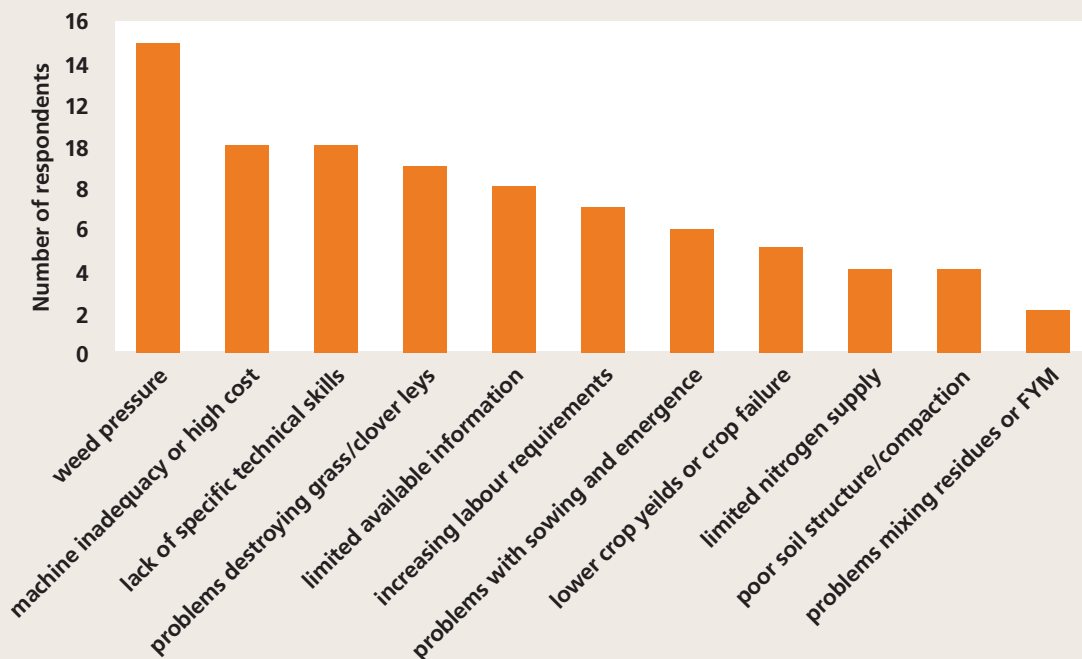
### Field trials

While NEFG has been involved with the farmer survey part of the TILMAN-ORG project, the Organic Research Centre is running field trials examining the use of reduced tillage at Duchy Home Farm, where farm manager David Wilson has been experimenting with reduced tillage since 2010. As part of the trials, three 3.5ha fields have been split in half: one side being cultivated with mouldboard ploughing (to 15cm soil depth; hereon referred to as “plough”), while the other side is cultivated with the Ecodyn ([www.eco-dyn.com](http://www.eco-dyn.com)), which uses duckfeet shares to loosen the soil



## Figure 1: Problems encountered

Problems associated with reduced or no-tillage practices in organic farming systems based on farmer surveys and interviews in England



at 7.6cm depth (hereon “RT”). So far the trials have been conducted over three cropping years (spring oats, spring barley, and winter rye) and have revealed some consistent results. In all three years, crop establishment was significantly more successful in the RT system. More plants emerged after drilling and they developed and covered the ground at a faster rate than those sown under the plough. The advantage of RT was particularly apparent during dry spring sowing conditions, where the lack of inversion helped conserve soil moisture and retention of soil organic matter in the upper soil layers may have conferred a greater water holding capacity. However the RT machine’s performance weakened under wet conditions, as the duckfeet shares became clogged with soil. Consequently, the adoption of RT can present a certain degree of technical challenge, often requiring modifications to make the machinery suitable for specific soil conditions.

As expected, weed cover early on in the growing season was always greater in the RT system (average 13% greater over the three years), which was offset by improved seed establishment leading to a thicker crop in the RT system, which curtailed the weed community and by the time of grain filling there was no difference in total weed cover or biomass in any of the three growing years. However, shifts in the community composition of weeds, particularly to a dominance of grasses, are likely to pose more of a problem, and in 2012 the density of grass weeds was significantly greater in RT.

### FIND OUT MORE

The TILMAN-ORG Project started in September 2011 and involves partners in 11 European countries, including Newcastle University and the Organic Research Centre in the UK. To learn about TILMAN-ORG, visit the project’s main site at:

[www.tilman-org.net](http://www.tilman-org.net)

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In the first two years, grain yields were very similar between the plough and RT systems (yield data for the winter rye crop are forthcoming). Fuel use was reduced by a third and tillage operations could be completed in a quarter of the time needed for the plough, meaning energy efficiency and profit margins were greater. This advantage was further enhanced by a 25% increase in earthworm abundance, although there were also slight increases in soil bulk density in the third year of RT, indicating compaction. Additional soil parameters are also being examined, and a further two years of cropping will be investigated as part of the project.

### Annual meeting

The TILMAN-ORG annual project meeting for all European partners will be held this January in Birmingham, immediately before the annual Organic Producers Conference. Many of the project partners will stay on and participate in the Producers Conference and a special TILMAN-ORG session is planned where attendees can learn more about the project results to date, in particular the farmer surveys from across Europe. In the meantime, if you have any experiences with reduced tillage and/or green manure use on your organic farm that you would like to share with the project, please get in touch.

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