

SOIL HEALTH AND FERTILITY

4. cover crop/green manure crop trial

Key points

- Cover crops are short term crops, sown after a main crop has been harvested, allowed to grow over the winter and then grazed or incorporated into the soil before another crop is sown.
- The main aim of a cover crop is to provide the subsequent crop with nutrients, especially nitrogen (N) and phosphorus (P), in a relatively available form.
- Cover crops can also improve soil structure, add organic matter to the soil, “catch” nutrients which may otherwise leach out of the root zone, and legume cover crops fix nitrogen.
- Cover crops can control weeds, protect the soil and provide stock feed in the spring.
- A trial was run at the BHU, Lincoln University, to assess the value of common crop mixes as late-sown green manure/cover crops over winter.
- Oats and peas, oat and tares, and forage brassica produced excellent growth and suppression of weeds during winter, and were financially viable options as cover crops.
- There can be a yield boost to the following crop from grazing the cover crop rather than incorporating it into the soil.

What are cover crops?

Cover crops are short term crops, sown after a main crop has been harvested, allowed to grow over the winter and then grazed or incorporated into the soil before another crop is sown.

Cover crops can improve soil structure, add organic matter to the soil, “catch” nutrients which may otherwise leach out of the root zone, and legume cover crops fix nitrogen. They control weeds, protect the soil and can provide stock feed in the spring.

Main purpose of cover crops

The main aim, however, of a cover crop is to provide the subsequent crop with nutrients, especially nitrogen (N) and phosphorus (P), in a relatively available form. Some cover crop species (e.g., lupins) are good at utilising RPR (reactive phosphate rock) and making P more available to the following crop. There should be a good release of N and P at the establishment phase of the following crop.

Cover crop trial

A trial was run to assess the value of common crop mixes as green manure/cover crops over winter as part of the MAF Sustainable Farming Fund project on risk management in organic farming. The trial was a comparison of late sown crop species over two harvest dates to evaluate soil fertility and subsequent crop performance. Wheat was sown after the cover crops as a soil fertility indicator crop. Sowing date was 2 May 2005.

The purpose of the cover crop trial was to see which species or varieties are good options for cover crops after a late harvested crop. The trial had a cereal focus because legumes aren't usually considered suitable for late sowing. They don't establish quickly enough in autumn to fix useful amounts of nitrogen before growth stops in the winter, and legume seed is usually a lot more expensive than other options.

The main trial used four replicates of oats, barley, triticale, oats + tares, and a fallow. Another experiment compared oats + peas, oats + vetch, tick beans at two different sowing rates, a forage brassica (Hunter), and lupins.

The trial investigated nitrogen and organic matter returned to or conserved in the soil following the crop harvests in early September and mid October. A spring wheat crop (cv. Torlesse) was then sown on 3rd October (1st sowing) and 31st October (2nd sowing).

Results

In September, the forage brassica had the highest dry weight. The lowest dry weight was from lupin plots due to low germination. All other crops produced similar dry weights (Figure 1).

At the October harvest, fast growth in spring resulted in higher biomass in all crops. Lupins had the lowest dry weight of 2.1 t/ha followed by brassica with just over 3 t/ha. There was no significant difference between cereals in the amount of dry matter in the second harvest. The mixture of oats + peas produced significantly higher dry matter than oats + tares.

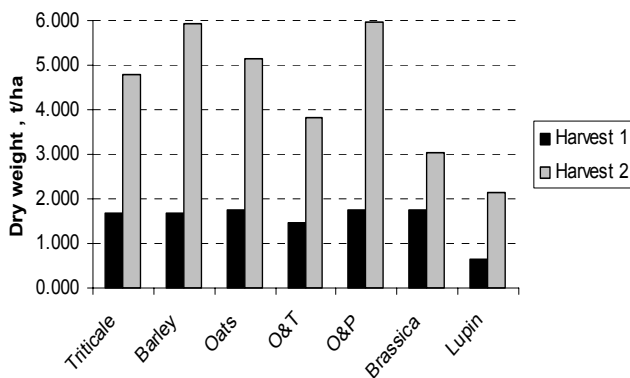


Figure 1: Dry matter production of cover crops at the first harvest (1/9/05) and at the 2nd harvest (17/10/05)

C:N ratio

The carbon to nitrogen ratio is one of the most important measures of how available the nitrogen will be to the following crop. The highest C:N ratio after the first harvest was 14.4 for the brassica. Around 14-16 is ideal. Also good were the combinations of cereals and legumes (the oats + peas and oats + tares) which both gave a C:N ratio in the ideal bracket.

Lupins also had a good C:N ratio (14) but did not contribute a high level of nitrogen per hectare, because of their low dry matter (bulk). Legumes sown at this late sowing date would not fix much nitrogen during winter so would only be acquiring it from the soil.

Growth of following crop

Visual assessment showed the best vigour in the wheat sown after the cover crops (spring wheat cv. Torlesse) was in the plots following oats + peas, while wheat following cereals, especially oats, had poor vigour. Averaged over the two sowing dates, wheat biomass was greater in plots after oats + peas, forage brassica and lupins and less after cereal crops. Plots after cereals, especially triticale, had low biomass figures, while wheat after oats + peas gave the highest dry weight.

Conclusion

Oats + peas, oats + tares, and forage brassica produced excellent growth and suppression of weeds during winter and were financially viable options as cover crops.

Grazing or incorporation?

Is it better to use stock to eat the cover crop or mechanically incorporate it into the soil? Allowing stock to eat the crop has the advantage of feeding stock at a time of year (late winter – spring) when feed can be short. Some trials show a yield benefit in the following crop from grazing, but not all.

The disadvantage of grazing is that there can be a loss of energy (carbon) for feeding the soil biomass although there is little loss of minerals and nitrogen – most is returned to the paddock as dung or urine. It would therefore be particularly advantageous to graze if the cover crop had a high C:N ratio.

Thus nutrient loss is not much of an issue but nutrient transfer can be – the grazing should be well controlled by break fencing to get as even a return of nutrients across the paddock as possible.

In this trial mechanical incorporation was used. Firstly the crop was mulched, then grubbed, tine weeded, then rotary hoed and rolled. Trials in the United States have shown it is possible to kill vetch and tares in a one-pass operation using an implement like a heavy roller with metal bars welded on to it. This leaves a surface mulch that can be direct drilled. For more information on this see http://www.newfarm.org/depts/NFfield_trials/1103/notilroller.shtml

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More information on the trial can be found in the Foundation for Arable Research (FAR) Update 61: Comparing cover crops in organic farming.

For more information on cover crops see Organic Update 13: Soil health and fertility – New Zealand cover crop literature review.