

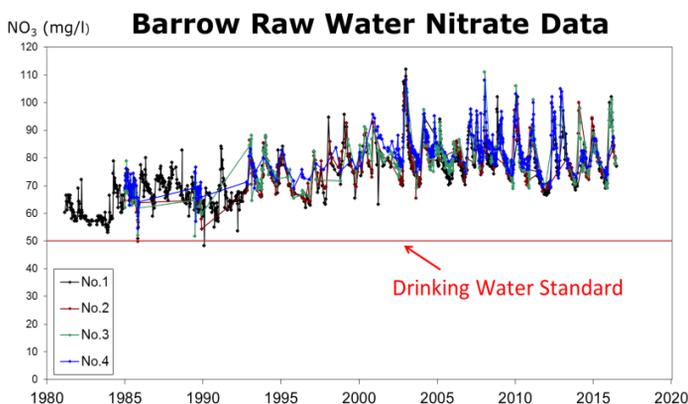
# Nitrogen retention in a Lincolnshire cover crop trial



## Background

Anglia Water has a string of boreholes across North Lincolnshire which abstract water from chalk aquifers. Drinking water standards state that nitrate levels cannot breach 50mg/l at the tap, but an example is given below from Barrow, where the levels of nitrate are consistently above the 50mg/l standard at the borehole.

Anglia Water therefore treats the water from Barrow and must also blend it with water from another source, to decrease the nitrate levels before allowing the water into supply.



Nitrate is an issue in all of the chalk boreholes in North Lincolnshire, and agriculture has been identified as a major source of that nitrate. Both customers and farmers could therefore save money if N retention in the field was maximised and water treatment reduced.

Cover crops are an effective measure to reduce nitrate losses to groundwater. After discussions with farmers to find out what would help uptake of cover crops, Anglian Water and the Environment Agency commissioned RSK ADAS UK to undertake a demonstration trial in autumn 2017. This looked at the effect of various cover crop species on nitrate losses. Frontier offered to measure the nutrient content of the crops.

## Demonstration Site

Five trial plots were established on a light soil after Forage Rye, at 30m plot widths. Three cover crops were compared with a stubble and a disced cultivated plot. The cover crop seeds were provided by Kings and drilled on the 23<sup>rd</sup> August 2017 with an Ojyard drill. The cover was sprayed off with Glyphosate on the 6<sup>th</sup> Feb 2018. The cost of drilling was **£50/ha**, the cost of seed was up to **£45/ha**. All the cover crops established well, and levels of pest and disease damage were low.



## Findings - Cover Crop Nutrient Uptake

Gram for gram, and on a per ha basis the plant N, P and K content was highest in the **cultivated (weeds)** plot, and spring soil N supply (SNS) was also good there.

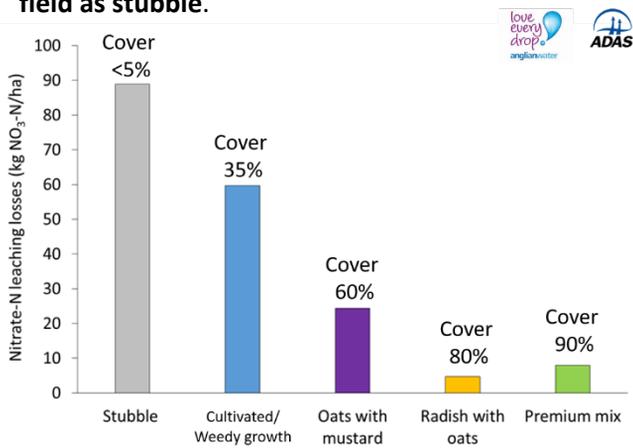
The **Radish mix** was next in terms of both nutrients per gram and NPK uptake/ha. This tallies with other studies showing good N uptake in Radish. The **Oat mixture** had the lowest recorded nutrients per gram, but the highest biomass. Spring SNS for both the Radish/Oat and Oat/Mustard mixes was good.

The **Premium mix** had the lowest biomass in this trial, the lowest NPK per ha and following on from that a lower spring SNS. Would measurements of additional factors such as erosion, soil biology, and other soil nutrients have shown wider benefits though?

## Findings - Nitrate Leaching

Looking at the bar chart below, we can see that **Nitrate leaching losses over the winter from the stubble plot were high, at nearly 90 kg/ha**. Just cultivating the soil reduced losses in this trial by **30%**, due to the improved soil cover provided by germinating weeds.

However, the three cover crop treatments lost less than 25 kg/ha of nitrate N (NO<sub>3</sub>-N) over the winter, a **reduction of 70% to 95% compared to leaving the field as stubble**.



The Radish/Oat mix had the lowest recorded amount of leaching, and despite being sown a little late, **all three cover crops produced better ground cover and much reduced leaching compared to the weeds**. The weeds biomass was actually very similar to the Radish mix, but it was clearly more patchy.

## Further information:



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More information about Anglian Water's work in catchment to improve the quality of our drinking water can be found at <http://www.anglianwater.co.uk/environment/our-commitment/our-plans/catchment-management.aspx>  
Twitter: @AWCoastCountry

## Findings - Soil Structure

Soil structure and plant rooting were good in the cover crops but only good in the top 20cm in the cultivated (weeds) plot; below this was a cultivation pan. Fewer worms and worm channels were also noted in the weeds plot. The stubble strip was wetter than the other plots; there was also less rooting, and aggregates were more angular.

## Take home messages

- ❑ Both the Oat/Mustard and Radish/Oat mixes worked well in terms of reducing leaching and retaining N and other nutrients for the next crop, compared to the stubble
- ❑ Sowing a cover crop resulted in N retention in the field worth at least **£39/ha** compared to the average of the cultivated and stubble plots (using the AHDB Feb 2019 mean price for Ammonium Nitrate of £270/tonne). Biomass potash content was also significant (42 – 55 kg/ha for the Oat mix, Radish mix, and the weeds)
- ❑ The cheaper 'weeds' option also produced a significant reduction in leaching on this site and an equally good spring SNS for the following crop. Care must be taken to get good green cover though, or the disturbance from drilling can just mineralise more N to be leached
- ❑ Distinct soil health improvements were seen under the cover crops, with better rooting and soil structure.
- ❑ The Nitrate Sensitive Area Schemes monitored in Lincolnshire from 1997 to 2003 also showed clear reductions in leaching with the use of cover crops after spring barley. The local Birds Eye Unilever work from 1997 onward also showed leaching benefits from catch crops sown between pea harvest and winter wheat drilling. ADAS data shows that for one year in five the cover crop may not be of benefit though
- ❑ The good soil structure and rooting under our cover crops mirror findings from elsewhere (e.g. Project Lamport) where plant roots have been seen to extend and stabilise the loosening effect of cultivations



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