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| **Project title** | Maximising the benefits from cover crops through species selection and crop management (Maxi-Cover Crop) | | | |
| **Project number** | 21140009 | | | |
| **Start date** | 01/08/2016 | | **End date** | 01/11/2019 |
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| **Project aim and objectives** | | | | |
| This project aims to maximise the potential economic, agronomic and ecological benefits from cover crops through a better understanding of species effects and crop management technologies. Specifically to:  1) Quantify the effects of different cover crops on soil properties, crop rooting and yield; 2) Validate the effects of different cover crop mixtures and new cultivation/destruction technologies on Monitor Farms; 3) Update cover crops guidance; 4) Transfer knowledge of the project findings to growers, industry and academia. | | | | |
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| **Key messages emerging from the project** | | | | |
| Early establishment of cover crops is essential to ensure good cover and maximum benefits.  Increased rooting in the cover crop may result in increased rooting in the following spring crop in situations where the spring crop established well. This will need to be confirmed by on-going work  Cover cropping can result in increased moisture retention in the topsoil, which may impede establishment of the following spring crop | | | | |
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| **Summary of results from the reporting year** | | | | |
| At the large plot trial in Cambridgeshire (established in autumn 2016), there was some evidence that increased rooting in the cover crop resulted in increased rooting in the following spring barley crop, with Phacelia and mixes containing Phacelia giving rise to the greatest root length density. However, this did not lead to differences in spring barley yields (August 2017). Winter barley was subsequently established in autumn 2017, and the potential legacy effect of the different cover crop treatments on soil properties measured in spring 2018. Topsoil organic matter (SOM) contents ranged from 1.5% following a Buckwheat cover crop (destroyed *c*.12 months previously) to 1.9% following Phacelia, with the control (stubble/volunteers) at 1.7% (*P*=0.05). Differences in SOM were related to the amount of above and below ground biomass produced by the cover crops (r2= 50 & 55%, respectively).  A further two large plot trials were established in Nottinghamshire and Yorkshire in August 2017, *c*.1 month earlier than at the Cambridgeshire site the previous season. Early drilling improved establishment and led to a good cover of all species, such that by February 2018, the cover crops had produced *c*. 2–3 t/ha dry matter and taken up over 70 kg/ha nitrogen (compared to *c*. 1 t/ha biomass and < 10kg/ha N uptake at the Cambridgeshire site the previous year). The control plots at both sites also had a considerable cover of cereal and oilseed rape volunteers (1-2 t/ha dry matter). However, there was no significant difference in soil penetration resistance, bulk density or moisture content following the different cover crops or compared to the control in spring 2018.  Validation trials on four Monitor farms have been established (Kent & Yorkshire in autumn 2016 and two Cambridgeshire farms in autumn 2017), comparing two of the mixes from the large plot trials with an uncovered control. At the Kent site, spring barley yields were 0.1-0.4 t/ha higher in August 2017 following cover cropping over winter 2016-17, although this was not statistically significant. At the Yorkshire site, spring bean yields were reduced by 0.4 t/ha (*P*<0.05) following a cover crop of oats and clover and by 0.2 t/ha (not statistically significant) following a cover crop of oilseed radish, phacelia and buckwheat. This was most likely due to greater moisture retention in the topsoil (0-30cm depth; *P*=0.08) following the cover crops which resulted in poor establishment of the spring bean crop. Indeed, spring bean root length in May 2017 was significantly lower (*P*<0.001) where cover crops had been grown. Four tramline trials have also been established comparing cover crop establishment techniques (direct drilling, cultivator drill or strip tillage). In 2017, there was no effect of the different establishment techniques on yields of the following spring bean or barley crops. | | | | |
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| **Key issues to be addressed in the next year** | | | | |
| 1. Follow the effect of the cover crop treatments at the large plot and tramline trials established in autumn 2017 on the yield of the current spring crop (harvest 2018) and following winter crop. 2. Assess soil physical (structure), biological (earthworms) and chemical (organic matter) properties at these sites in spring 2019 3. Evaluate the legacy effects of the cover crop treatments at the Cambridgeshire large plot trial and 2016 tramline trials on soil properties and the yield of the winter crop 4. Complete a cost-benefit analysis for all of the trial sites. | | | | |
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| **Lead partner** | | Anne Bhogal/Charlotte White, ADAS | | |
| **Scientific partners** | | Nathan Morris, NIAB | | |
| **Industry partners** | | Hutchinsons, RAGT Seeds Ltd, AMAZONE Ltd, Cousins of Emneth Ltd. | | |

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| **Has your project featured in any of the following in the last year?** | |
| ***Events***  Crop Tec Show (November 2017)  NIAB Members results day (Jan 2017)  Warrington Monitor Farm meeting (March 2018)  RAGT & Hutchinsons open days (May & June 2018)  ADAS/AHDB Rosemaund open day (June 2018) | ***Press articles***  Arable Farming Research in Action, July 2018: ‘*Autumn drives cover crop value’* |