EVALUATION OF SUSTAINABLE SOIL MANAGEMENT AND COVER CROP PRACTICES

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Introduction
There is increasing ‘on farm’ interest in the use of cover crops to improve productivity and resilience of farming systems, and also for their capacity to provide wider environmental benefit. These goals are very much in keeping with Sustainable Intensification (SI) aspirations. While the term SI can be subjective, the Sustainable Intensification research Platform (SIP) suggests that key SI objectives in an agricultural context may be expressed as ‘managing farmland to increase farm output and competitiveness, whilst protecting the countryside and enhancing environment and social benefits’ (www.siplatform.org.uk). The SIP initiative is a highly collaborative platform, working with stakeholders to explore risks and opportunities associated with the practical delivery of SI across a range of perspectives and scales. At a farm level SIP study farms at Morley (Norfolk) and Loddington (Leicestershire) are examining further the impacts of cover crops on aspects of soils, environment and production at a range of scales.

Materials and Methods
Cover crop research at Morley (sandy loam soil) builds on the New Farming Systems (NFS) programme (initiated in 2007). This examines tillage system (plough, inversion to c. 20 cm depth; deep non-inversion, c. 20 cm depth; and shallow non-inversion, c. 10 cm) and brassica cover crop (radish, Raphinus sativus) interactions in large, fully replicated plots using farm scale equipment. Rotations alternate between winter wheat and spring sown combinable crops, and rotations are differentiated further by the presence/absence of an autumn cover before spring crops (for details see Stobart et al., 2014; Morris et al., 2014). Highly complementary research at Loddington (clay loam soil) is evaluating cover crops at a farm level, using large scale field strip studies, where a range of autumn sown cover crops are compared to farm standard approaches (over winter stubble or autumn cultivation), followed by a spring oat crop established by direct drilling.

Results and Discussion
The interaction of brassica cover crop use and primary tillage method on the yield of other crops in the rotation can be gauged through the NFS data presented in Figure 1. Positive yield responses from the use of a cover crop are represented as values above the zero line and negative responses as values below. Findings suggest an interaction between cover crop yield response and tillage practice; with brassica cover crop use in conjunction with shallow non-inversion tillage more likely to give a positive yield response in this study. Interestingly the only appreciable negative value in the shallow non-inversion tillage system was in 2014, where oilseed rape followed repeated use of a brassica cover crop; this is discussed further in Stobart & Morris (2014). Findings from the field scale evaluation at Loddington (clay loam soil) is evaluating cover crops at a farm level, using large scale field strip studies, where a range of autumn sown cover crops are compared to farm standard approaches (over winter stubble or autumn cultivation), followed by a spring oat crop established by direct drilling.

Table 1. VESS Score and follow crop yield (spring oats t/ha) in farm field strips following different cover crop and farm practice treatments at Loddington, 2015

<table>
<thead>
<tr>
<th>Treatment/ Cover Crop</th>
<th>Overwinter Stubble</th>
<th>Autumn Cultivation</th>
<th>Radish + Oats</th>
<th>Radish</th>
<th>Radish + Tillage Radish</th>
<th>Rye + Vetch</th>
</tr>
</thead>
<tbody>
<tr>
<td>VESS Score</td>
<td>3.03</td>
<td>2.61</td>
<td>2.49</td>
<td>2.54</td>
<td>2.35</td>
<td>2.35</td>
</tr>
<tr>
<td>Follow Crop Yield</td>
<td>6.26</td>
<td>6.57</td>
<td>6.77</td>
<td>7.26</td>
<td>6.66</td>
<td>6.36</td>
</tr>
</tbody>
</table>
Conclusions
Collectively these findings demonstrate both the potential for positive yield and financial responses associated with cover crop use in arable systems, but equally that system interactions (e.g. tillage approach and crop rotation) will impact on performance.

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References