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## AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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## **GROWER SUMMARY**

### **Headline**

Soil health assessment approaches have been reviewed in year 1 of this 'GREATsoils' project. Regional workshops were held, where growers' evaluated and rated the different soil assessment methods used in the UK. The findings are given in this Grower Summary. An extensive literature review detailing a wider range of soil assessment methods is provided separately as Appendix 1 of this 2016 Annual report.

### **Introduction**

It is widely acknowledged by scientists and an increasing number of farmers and growers that there is a problem with the state of UK soils. Most suffer from degradation (e.g. compaction, declining soil organic matter content, nutrient leaching, erosion), partly as a result of current farming practices. There is growing awareness and interest amongst farmers and growers in soil health and soil biology, and how their state affects soil fertility and function and therefore our capacity to produce food. However, and unfortunately, there are still a significant number of growers who consider the soil to be a substrate for plant production, the carrier for inputs, rather than itself being the resource and facilitator of plant growth. An extensive literature review detailing a wider range of soil assessment methods is provided separately as Appendix 1 of this 2016 Annual report.

Concerns that the current health of soils is much poorer than 30 or 40 years ago are supported by soil analysis data collected over the same period. Although concerned farmers and growers understand the importance of soil health for the productivity, sustainability and profitability of their business, many face significant challenges when interpreting results from soil laboratory analyses. Choosing suitable alternative tools or methods for assessing soils' health beyond the standard pH, phosphate, potassium and magnesium analysis is difficult for many. To be of value to growers and farmers, methods for soil assessment should not only measure soil health, but they should also provide information that can be used to inform decision making in relation to soil management.

Soil is a complex medium. The functioning of soil depends upon a complex interaction between large and small organisms, chemical reactions in solution and on surfaces of clay particles, within a structure determined by natural processes and modified by soil management. Because of this, a broad range of appropriate indicators of soil health is necessary, to evaluate the effects and sustainability of agricultural practices. The most commonly agreed and used soil indicators can be grouped in the three categories of (1) biological, (2) chemical and (3) physical parameters.

## A list of the most commonly used indicators for soil health

### A list of the most commonly used indicators for soil health:

Biological indicators	Chemical indicators	Physical indicators
Soil organic matter (SOM)	Nitrogen (N): mineralised N (N-min), ammonium (NH <sub>4</sub> <sup>+</sup> ), nitrate (NO <sub>3</sub> <sup>-</sup> )	Soil structure (e.g. aggregate stability)
Number and diversity of macro- and microorganisms	Macro-nutrients: phosphorus (P), potassium (K), magnesium (Mg)	Compaction
Number and diversity of Mycorrhiza (AMF), and root colonisation	Micro-nutrients: e.g. iron (Fe), copper (Cu), boron (B), manganese (Mn), etc.	Erosion
Number and diversity of earthworm populations	pH	Water-logging
Respiration rates	Electrical conductivity (EC)	
Enzymatic activity	Cation exchange capacity	
Microbial profiling	Salinity	

This project is a Soils Knowledge Exchange (KE) project, which aims to equip farmers and growers with the knowledge and skills to confidently assess the health of their soils to help them evaluate the health of their soils and engage in practical measures to improve it. Work so far has included a literature review, to capture all soil assessment methodologies available to growers, and grower-centered workshops to gather UK soil health assessment practices. The GREATsoils research team is also building a network of growers and advisors to share knowledge and experience of soil health online, through events, field trials and field laboratories (groups of growers who engage with scientists to discuss and trial out small scale grower projects on high priority topics, for the benefit of the group); as well as digitally through a website, webinars and via social media.

## Summary

### Work Package 1 - Review.

This work package was undertaken to gain an overview of the vast variety of soil assessment approaches that are currently available to UK growers and to produce a comprehensive synopsis of existing soil health assessment methods and tools. This included recent scientific papers and publications, but also commercially available methods/tests and guides from commercial companies and; innovative tools (also digital modelling/estimation tools) that are being developed in Europe. One of the main aims of this review was to provide a basis for discussion in the subsequent consultation events with regional growers groups, where the different soil assessment methods identified and categorised in the literature review were evaluated and rated by the growers, to establish their usefulness and relevance in practice.

## **Work Package 2 - Developing an integrated approach to soil health assessment and improvement.**

WP2 was undertaken to develop an integrated approach to soil health assessment and improvement in close collaboration with growers and stakeholders. The existing approaches for soil health measurement and management were critically reviewed by growers in four regional working groups (Scotland, East Midlands, West Midlands and Southeast England, see figure 1). The growers conducted an evaluation of the economics, practicalities and usefulness of these methods for individual, site-specific environments; taking key factors like geographical region, soil type, climate, crop rotation or management system into account. The outcome of these evaluations by the growers, combined with the results of the comprehensive literature review of WP1, informed the next step of this work package: field testing of selected soil assessment tools or method combinations.

What came through at the regional workshops was that most growers used spade tests/diagnosis, and considered this an essential starting point in soils' assessment. The method is cheap, easy and quick and can be started with little skill (though of course growers get better at interpreting the results of their efforts with initial guidance and subsequent experience)

The benefits of other methods depended on the scale of the operation. Some larger-scale growers for example stated that they regularly use a mini-digger to dig larger and deeper soil pits to get a full picture of different soil horizons and the effects of their management. For smaller growers this approach might be impractical.



**Figure 1: Grower Consultation at Produce World**

UK growers also use a range of senses to assess their soils; including smelling the freshly dug soil, assessing its colour, feeling its texture between the fingers or even tasting small amounts of soil.

Biological testing in the laboratory is an area of increasing interest. Most growers have little experience of monitoring soil biology but are aware of the importance of earthworms and the key role of soil organic matter for sustainable soil fertility and productivity. However growers are still uncertain how much benefit they can gain from the results of these tests in terms of practical soil management and profitability.

It was also clear from that growers find assessing and understanding soil organic matter and its various components (e.g. the labile/active fraction) the most challenging aspect of soil assessment. Regardless of the size of organisation or their business, this longer-term vision for more sustainable management of soil organic matter was an important aim for the growers.

The regional grower groups identified six farms where field tests will be conducted over the next two growing seasons (2016 and 2017). The groups have defined their priorities for soil assessment methods. During the evaluation of these methods, field days and grower events will be held on the six sites, in order to gain input and feedback from a wider range of growers and advisors in order to develop joint recommendations.

Further work during Years 2 and 3 of the project will enable us to develop, in conjunction with growers, recommendations/guidelines for more effective soil assessment and more sustainable soil management in UK horticulture.

### **Work Package 3 - Development of KE strategy and materials.**

WP3 was undertaken to develop an agreed KE strategy and materials in order to disseminate information on best practice in measuring and managing soil health in soil-grown horticulture. The research team are using a range of proven KE tools as well looking at more novel approaches in order to convey information to the relevant AHDB levy payers. They have been attending events, writing articles and blogs, and building a twitter presence in order to build a network of growers and as expected, those that have signed up initially are already thinking about their soils. Most are doing some sort of soil health assessment and are keen to do more and share their experience.

- During year one of the project the team:
- Published articles in partner organisations publications
- Attended 13 events at which we promoted the project and soils health work
- Created Twitter handle @GREATsoils which so far has 168 followers
- Signed up more than 100 growers to an email network of growers.

There has been a tremendous response from the larger-scale growers, who often have particular difficulties because of the scale of their operations and the issue of short-term rental

on farms where they have no control over the rest of the rotation. However growers from all size of farm have signed up and we are encouraged by the enthusiasm to tackle this problem. The team is aware that reaching growers that have not yet come forward may prove more difficult and our focus in years 2 and 3 will be to widen the network and bring more levy payers into the network.

During the next two years of the GREATsoils Project we will use the field trials and field labs to build our knowledge of the range of soil health assessment methods and approaches. This will result in a series of recommended approaches for growers taking into account the range of different locations, soils and production systems. There will be case studies and briefing papers, webinars, short films to help share the knowledge from the network, as well as workshops and farm-focused events.

#### **Work Package 4 - UK wide KE programme**

WP4 is being undertaken to deliver a UK wide KE programme on best practice in measuring and managing soil health in soil-grown horticulture. In year 1 this will use existing materials and proven methods. In years 2 and 3 we will follow the strategy developed under WP 3, making use of new materials and a novel toolkit. We will use the following:

- Soils Roadshow: attending a range of grower events to engage growers with the aim of inspiring them to engage with the project and start improving their soil health
- Interactive one-day workshops: understanding the benefit of our toolkit will depend on growers seeing the benefits on farms. As such it is vital to get as many farmers and growers as possible to attend interactive farm-based soil events.
- “Youtube” films: covering key points of soil biology and management for promotion through our social network reach.
- Online presentations or webinars: we will develop a range of detailed presentations covering a range of soil health topics as identified in WP1 and WP2. We will also pilot live webinars based around this material and if successful deliver a range of these over the course of the project.
- Field Labs: these are topic-focused practical farm trials looking at either implementing new research or trialling new ideas generated by growers themselves. Each field lab comprises two to three events over which farmers identify a shared challenge and test and evaluate one or more potential solutions. The strength of the field lab approach is that they respond to growers needs.
- Media campaign: key articles released quarterly across a range of publications and matched to calendar ‘topics’ for each main publication. Plus a range of “GREAT Soils” content such as technical information and interactive material, webinars, articles and

blogs from growers and scientists, research and events. Key deliverable: evidence of articles / blogs and media coverage

- “Train the trainer” events: develop advisors to support growers post-project. This task will contribute towards the exit strategy from the project and will ensure that the learnings from the project will be taken forward by a team of trained advisors.

Through these activities we expect growers to increase testing of their soil and begin to make improvements in soil health. We recognise that this is a long-term project and that it may be difficult to evidence improvement on the ground. The success of this project will therefore be measured in terms of engaged growers, and changed farming practice rather than in changes in soil properties such as increased soil organic matter or numbers of soil organisms.

## **Financial Benefits**

Though there is anecdotal evidence from growers of the financial benefits of improving soil health (for instance Philipp Hubbert reported using 15 litres per hour less fuel when bed-forming after a crop of green manure, compared to not) it is still too early in the project to make an assessment of financial benefits. These will form part of the technical output in years 2 and 3

## **Action Points**

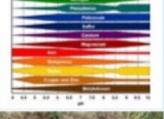
Though too early in the project to make detailed recommendations it is clear that the following will benefit all growers

- If not already doing so growers should start testing their soil for health. Those that are already doing some testing can always improve or expand their testing. The summary below will help growers make a decision about which methods to use. The project will make further recommendations as the on-farm testing continues.
- Building organic matter. This is well-recognised as one of the best indicators of soil health, but changes take place slowly and implementing is tricky within intensive vegetable/salad production systems.
- Join or set up a group of local, like-minded growers to work together. This will help benchmark findings as growers develop their soil health testing methods, but also provides a framework and discipline for testing and reporting to fellow growers

The support initially will come through the project partners and network of growers and advisors that is starting to build. We envisage that as this network grows there will be some advisors that are highly engaged and will actively support their clients and networks to do more testing for soil health which will lead to changes in practice and improved performance.

**Soil assessment methods as evaluated and rated by UK growers – Autumn 2015**

**Soil assessment tests evaluated and rated by growers**

1 = low; 5 = high rated by growers	Skill required	Time input	Cost input	Suitable for	Not suitable for	Comments from growers	
Spade diagnosis (depth 30cm)	1	1	1	Easy, quick, good indication of soil health, fast general impression of the soil status	Subsoil assessment, quantitative nutrient levels	Most common method used, very easy and informative; 'spade is always with me'	
Plant health monitoring (current and previous crop, weeds)	1	1	1	Early signs of nutrient deficiencies or compaction	Specific or quantitative information	Seasonal, need some experience and additional tests for details	
Total soil organic matter (SOM) (usually in %)	1	1	1	Total SOM (labile, stable and inert fractions of SOM)	Monitoring labile SOM (providing/releasing energy and nutrients)	No need to do annually, need specific sampling technique	
Visual soil assessment tools (eg AHDB Healthy Grassland Soil methods)	1	2	1	Good overview of a wide range of soil health indicators (roots, worms, soil structure, colour)	Quantitative assessment of nutrients	Assessment speed comes with experience, easy to learn, need the tool only at first	
Standard lab test (macronutrients and pH)	1	2	2	Soil nutrient content P, K, Mg and pH	eg soil life, structure, compacted layers, root development	Regularly done, directly informs fertiliser strategy	
Visual evaluation of soil structure (eg SRUC VESS tool)	2	2	1	Soil structure and compaction detection	Quantitative assessment of nutrients	Some specific knowledge required	
Earthworm counts	2	3	1	Good indicator for soil structure and health, soil life and activity, soil biodiversity	Quantitative assessment of nutrients, subsoil assessment	Seasonal fluctuations, some skill required for species identification	
Micronutrient test	2	2	3	Trace elements/micronutrient levels in the soil	eg soil life, structure, evaluation of compacted layers	Done only if deficiencies suspected in plants	
Soil pit/profile (depth range 30-150cm)	3	3	1	Subsoil assessment, horizons and exact location/depth of compacted layers	No quick results, is a rather destructive method, location of sampling important	Very useful results if done properly, good for structure assessment	
Soil health test	3	2	3	Measures pH, available P, K, Mg, texture, total SOM and respiration rate	In-depth evaluation and meaningful results/conclusions	Skill required for interpretation of overall results, eg respiration rates	
SOM balance modelling tool	5	5	2	Input/output estimation of SOM levels on field or farm level	Beginners in SOM assessment, basic day-to-day assessment	Not commonly used in UK yet, but might be a promising planning tool	
Soil life suites (eg food web tests, enzymatic activity, basal respiration etc.)	5	2	5	Bacteria and fungi, number, species and diversity (no standards yet)	eg soil structure, compaction evaluation	Skill required for adequate sampling and high skills for interpretation	

## SCIENCE SECTION

### Introduction

#### 1. Review and grower consultations

##### *The full review can be found in Appendix 1*

There are a wide range of soil assessment methods and tools from around the world and within the scope of this project it is not possible examine all of them in detail. Instead the researchers focussed on relevant methods for the UK, grouped similar approaches and tools together, as well as highlighting some of the innovative tools (also digital modelling/estimation tools) that are being developed in Europe.

A summary of the range of assessment methods used by UK growers, with ratings from growers is given in the Grower Summary. Growers scored each method according to skill, knowledge, time and labour requirements, as well as potential costs for the tools/lab test etc. The findings can help all growers work out methods that are most suitable and relevant for their own specific systems. Further work during years two and three of the project will enable the researchers to jointly develop recommendations/guidelines for more effective soil assessment and more sustainable soil management in UK horticulture.

What came through clearly from the growers who took part in the consultations (figures 2–5) was that most used spade tests/diagnosis, and they considered this an essential starting point in their soil assessment. This method is cheap, easy and quick and can be started with little skill (though of course growers will get better at interpreting the results of their efforts with initial guidance and subsequent experience).

The benefits of other methods may depend on the scale of the operation. Some larger growers for example stated that they regularly use a mini-digger to dig larger and deeper soil pits to obtain a full picture of different soil horizons and the effects of their management. For smaller growers this approach might be impractical.

The growers also stated that some soil assessment methods, such as VSA tools (Visual Soil Assessment tools) are in fact only used once or twice. They take the guide out to the field and follow the instructions step-by-step to rate different aspects of soil health. Growers then carry out the assessment from memory and adapt the methodology to their own site and system.

Growers also use a range of senses to assess their soils; for instance smelling the freshly dug soil, assessing its colour, feeling its texture between the fingers or even tasting small amounts of soil.

Biological testing in the laboratory is an area of increasing interest. Many growers have little experience of monitoring soil biology, but are aware of the importance of earthworms and the key role of soil organic matter for sustainable soil fertility and productivity. However, growers

are still uncertain how much benefit they can gain from the results of these tests in terms of practical soil management. It was clear from the consultations that growers find assessing and understanding soil organic matter and its various components (e.g. the labile/active fraction) the most challenging aspect of soil assessment. Regardless of the size or organisation of their business, this longer-term vision for more sustainable management of soil organic matter was an important aim for the growers.



**Figure 2: Grower consultation at Valefresco**



**Figure 3: Grower consultation at Kettle Produce**



Figure 4: Grower consultation at East Malling Research



Figure 5: Grower consultation at Produce World

### Field testing in 2016 and 2017

In the first year of this knowledge exchange focussed project we have not carried out any primary research. The review of current methods and tools builds on previous work of the Organic Research Centre and is laid out in the Appendix 1.

In the second and third project year, the regional grower groups will be carrying out field testing of some of these methods. During the consultation events the groups prioritised and rated the different soil assessment methods and tools most relevant or promising for their specific needs or systems. The groups were interested in trying out different methods to analyse and monitor soil organic matter, particularly the active (labile/light) fraction, as it is most relevant for soil fertility and plant nutrition. We identified 6 farms to host and conduct these field tests. A number of different methods were chosen:

- **NRM Soil Health Test** (analysing pH, available P, K, Mg; soil texture, total SOM and respiration rate). This test will be used on all 6 sites. The growers were specifically interested in the respiration rate outcomes, how to interpret them and what management recommendations could result from them.
- **Earthworm counts (EWC)** as a second potentially easy and effective method/indicator to assess active organic matter.

- **VSA tool** will be used on all the sites, again as reference method and to gain in-depth feedback on such approaches from the growers.

The table below shows an overview of the current (March 2016) state of the field testing plans on the six regional sites.

**Table 2:** Current state of plans for field testing soil assessment methods (March 2016).

Trial	1	2	3	4	5	6
<b>Region</b>	Scotland	West-Midlands	East-Midlands	East-Midlands	South/South-East	South/South-East
<b>System</b>	(conventional)	Lettuce/Oriental veg, large scale (conventional)	Salad/Lettuce crops, large scale (conventional)	Salad/Lettuce crops, large scale (organic)	Top fruit (conventional)	Diverse field and protected veg, smaller scale, stock-free (organic)
<b>Host</b>	David Aglen, Balbirnie Estates (growing for Kettle Produce)	Steve Nickells, Hampton Lucy, Valefresco	Phillip Hubbert, Jepco	Joe Rolfe, Taylorgrown Ltd. (growing for Produce World)	Paul and James Smith, Loddington Farm (top fruit)	Iain Tolhurst, Tolhurst Organics
<b>Method to evaluate</b>	The group is in discussions, but has not identified any specific methods yet	Effect of cover crops on soil health and fertility, assess and monitor benefits in a <u>large scale conventional veg</u> production system in the West-Midlands: focussed on <b>soil health suite, SOM,</b>	Various approaches to assess and monitor SOM in a <u>large scale conventional veg</u> production system in the East-Midlands: focussed on <b>respiration rates, soil health suite, earthworm counts</b> and their <b>result interpretation.</b>	Various approaches to assess and monitor SOM in a <u>large scale organic veg</u> production system in the East-Midlands: focussed on <b>respiration rates, soil health suite, VSA tool</b> and their <b>result interpretation!</b>	Various approaches to assess and monitor SOM in an <u>orchard production system</u> in the South: particularly the <b>labile SOM fraction, respiration rates and earthworm assessments</b> and their <b>result interpretation</b>	Organic matter assessment and monitoring, in a stock-free organic system <u>without animal inputs:</u> <b>labile SOM, respiration rates, earthworm counts</b> and their <b>result interpretation.</b>
<b>Details of the trial</b>		Identify reasons for differences in crop productivity within one of field (can soil health measurements assist in coming up with appropriate management interventions?)	split one field: (1) intensive salad rotation and (2) strip green manure for 5-6 weeks. Test NRM health suite, VSA and EWC, <u>plus</u> leaf quality just before harvest of following crop and its shelf life test done on the holding.	split one field: (1) carrot on beds, add (2) flower strips on bed to encourage predators and add OM to soil. Test NRM health, VSA and EWC, <u>plus</u> pest evaluation on leaf during/end of growing period.	split one field: pears, (1) half treated as normal (herbicide) (2) other half including flowering green manure stripes for beneficials and SOM. Test NRM health, VSA and EWC before and after main growing season.	split one field: early potatoes harvested June. Compare (1) early and (2) late sowing of green manure on SOM and EW. Test NRM health, VSA and EWC over two years in old and new fields in rotation.

## Materials and methods

After a thorough review of the recent literature and soil assessment methods and tools available to growers, the first step of work package two was to identify the needs, priorities and feedback from growers. After an online survey (using Survey Monkey), asking growers for a feedback on which soil assessment methods they use and which ones they find most useful and suitable for their needs, we organised a series of grower consultations across the UK. We invited levy payers and other growers and advisors to participate and share their experience. The consultations took place during October and December: in Hampton Lucy, hosted by Valefresco; in Fife, Scotland, hosted by Kettle Produce; in East Malling, Kent, hosted by EMR; and in Peterborough, hosted by Produce World. The locations were chosen to represent some of the most important growing regions of the UK, and to allow for different growing systems and priorities of participants.

The consultations introduced the project and gave a short overview of the soil assessment methods and their categories identified in the literature review. The main focus of the events

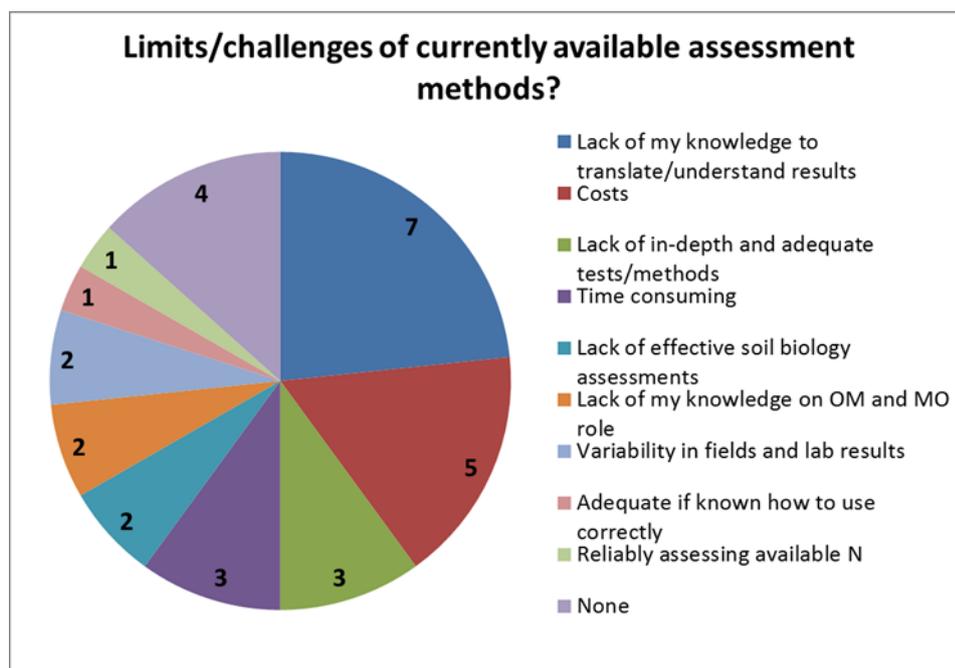
was to obtain feedback from growers and practitioners on the different methods and approaches. Also to identify which tools are most relevant and most useful in practice, for decision making on soil management. The consultations also aimed to identify one or two trial hosts in each working group (region), who would conduct field tests with jointly selected and prioritised soil assessment tools or combinations of tools over the next two growing seasons (2016, 2017). First trial plans are shown in Table 2

## Results

The online survey identified which soil assessment methods growers are currently using and which they find most relevant and useful, and was open from August to September 2015. The survey produced 33 analysable answers. One of the main outcomes was that most growers do test their soils regularly, using standard lab tests to analyse main macro nutrients and pH (P, K, Mg and pH), but often don't have much experience with other laboratory tests or on-farm soil assessment tools (apart from spade analysis, which the majority of growers use regularly). Although many growers use standard lab tests, only very few of them find the results of the test useful. The survey also showed that most growers have difficulties with the interpretation of more detailed soil analysis and test results, and attributed their own lack of knowledge as the main reason for not making more use of these methods.

The graph below shows the different categories, and the total number of survey participants who answered in these categories with regards to limitations of current soil assessment methods. Lack of knowledge, as well as the costs of soil assessment methods, is cited as the main challenges.

**Figure 6:** Survey results to the question: what are the main limits and challenges of currently available soil assessment methods?



The outcomes of the four consultations are summarised in the 2-page summary given at the end of the Grower Summary. This combines the results of the literature review with the results of the grower consultations. Each working group rated the different tools and methods for the assessment of soil health and added any useful tools and methods that were not yet listed in the review (such as crop health assessment for example). These ratings and some of their most important feedback was then listed.

In the second step, each regional working group identified one or two host farms, who will test different soil assessment methods over the coming 2 years. Most groups prioritised a focus on soil organic matter, particularly the assessment and improvement of the labile (active or light) fraction of soil organic matter. In the diversity of systems (orchards, leafy salads or small scale organic vegetable systems) this parameter was highlighted as one of the most useful to take forward in the field tests. The table below shows the draft plan of the groups so far. More details on the conduction of these participatory on-farm trials are being developed over the coming 2-3 months and will be reported on in the next annual report.

Table 3 shows the indicators found from the review of current literature, tools and methods that are most often used to evaluate soil health, grouped under Biological, Chemical and Physical indicators, although these are interlinked.

**Table 3** – A list of the most commonly used indicators for soil health

**A list of the most commonly used indicators for soil health:**

Biological indicators	Chemical indicators	Physical indicators
Soil organic matter (SOM)	Nitrogen (N): mineralised N (N-min), ammonium (NH <sub>4</sub> <sup>+</sup> ), nitrate (NO <sub>3</sub> <sup>-</sup> )	Soil structure (e.g. aggregate stability)
Number and diversity of macro- and microorganisms	Macro-nutrients: phosphorus (P), potassium (K), magnesium (Mg)	Compaction
Number and diversity of Mycorrhiza (AMF), and root colonisation	Micro-nutrients: e.g. iron (Fe), copper (Cu), boron (B), manganese (Mn), etc.	Erosion
Number and diversity of earthworm populations	pH	Water-logging
Respiration rates	Electrical conductivity (EC)	
Enzymatic activity	Cation exchange capacity	
Microbial profiling	Salinity	

## Discussion

There are a large number of ways of assessing soil health. These range from the cheap and easy spade test for basic assessment up to expensive and complicated computer modelling systems and biological laboratory testing. Most growers who took part in the consultation recognised the importance of testing soil health and regularly implemented one or more of the methods listed. However we are aware that these growers are a self-selecting group that came forward to be part of the project. They will act as soil pioneers and some are now becoming hosts to the field testing of different approaches in year two and three.

## **Conclusions**

We are building a network of growers and advisors that are already starting to share experience and expertise. As the project continues this will increase in size and scope. The following project years will closely involve levy payers and other growers and advisors to identify which soil assessment approaches or combinations of existing tools will be most useful for specific horticultural systems. The project tasks will collect experiences and feedback from a wide range of growers across the UK, which will also inform guidelines for a more cost- and labour-efficient soil assessment and sustainable soil management in UK horticulture.

## **Knowledge and Technology Transfer**

Media output

- Twitter - 153 followers
- AHDB launch article in Grower July 2015
- Organic Farming Magazine Issue 119 Autumn / Winter 2015
- ORC Bulletin 119 Autumn / Winter 2015
- Organic Grower Magazine 33 Winter 2015
- Soil Health Blog - SA website

See Appendix 3 for more details

### **Events**

13 events attended to promote the project and sign up growers to the network, of which eight were “key events” as identified in our project plan. See Appendix 4 for full details

### **Building membership of GREAT soils network**

108 members after first year of project

Though not an indicator in original proposal we believe tracking the members of the network provides a good indication of grower engagement and potential for evaluating impact at the end of the project.

See Appendix 5 for knowledge exchange strategy

See Appendix 6 for media plan

## **Glossary**

Not applicable

## **Appendices**

Appendix 1 – Full report of review of soil health methods – separate document

Appendix 2 – Media output in year 1

Appendix 3 – GREAT soils team attendance at events

Appendix 4 – KE Strategy

Appendix 5 – Media Plan

## Appendix 2 – Media output

### Twitter

- 168 followers
- Top tweet – the review from WP 1 total reach 6044

Jan 2016 • 31 days

#### TWEET HIGHLIGHTS

**Top Tweet** earned 6,044 impressions

Which tests to assess your **#soilhealth** ?  
[tinyurl.com/Soil-assess](http://tinyurl.com/Soil-assess) See our new guide  
 @OrgResCent @Ben\_Raskin  
[pic.twitter.com/eQGpBbTzCV](http://pic.twitter.com/eQGpBbTzCV)

Soil Test	1	2	3	4	5
<b>Earthworms</b> Number per 100g soil	2	3	1		
<b>Plant health</b> Diseasing (0-5)	1	1	1		
<b>Standard Lab</b> Soil tests (0-5)	1	2	2		
<b>Measurement</b> Soil	2	2	1		
<b>Total soil organic</b> Carbon (SOC%)	1	1	1		

**Top mention** earned 31 engagements



**Ben Raskin**  
 @Ben\_Raskin - Jan 28

[covercrops.eu](http://covercrops.eu) tool box looks fantastic.  
 #ORC16 @GREATsoils @SoilAssociation  
 @OGAgrowers

👍 10 ❤️ 6

[View Tweet](#)

**Top media Tweet** earned 166 impressions

#### JAN 2016 SUMMARY

Tweets: 19  
 Tweet impressions: 11.2K

Profile visits: 659  
 Mentions: 11

New followers: 87

### Articles

- AHDB launch article in Grower July 2015
- Organic Farming Magazine Issue 119 Autumn / Winter 2015
- ORC Bulletin 119 Autumn / Winter 2015
- Organic Grower Magazine 33 Winter 2015

### Blog

- Soil Health Blog - SA website  
<http://www.soilassociation.org/blogs/latestblog/article/1172/what-is-healthy-soil-and-how-do-i-know-if-ive-got-it>

Comments from SA web editor on the reach of Blog post

“501 views (455 unique views, so some people coming back to it a second time). And based on the average amount of time people spend on the page (somewhere between 3 and 8 minutes) the people who end up on the page are in fact staying and reading it. Also, of all the people who read the blog, the vast majority (78%) came directly to our website via blog post—meaning that they came across a link to it and clicked on it. “

### Facebook

We trialled a facebook page but decided it was not effective for this project

## Appendix 3 - Events

### Activity 3.1

Soils Roadshow – attendance at 18 key events

<p><b>13 events</b> attended in year one of the project of which <b>8</b> were “key” events as decided in our original plan (key events marked in bold), with a number of other events at which we took the opportunity to promote the project and sign up growers to the network</p> <ul style="list-style-type: none"> <li>• 3 x Soil Association farm walks</li> <li>• Grantham Centre, Sheffield University soil lecture - Promoted project BR</li> <li>• 16th September <b>Rijk Zwaan Horticultural event</b> - Promotion and signup sheet BR</li> <li>• <b>Soil Symposium</b> - 5 Nov 15 - stand, postcards and signup sheet, BR, AL, AV, LB</li> <li>• <b>Onion conference</b> - 4 Nov 15 - attended with postcards MW</li> <li>• <b>Reading University Soil Health Conference</b> - 18 Nov 15 - attended, and chaired conference session BR</li> <li>• Innovative Farmers "Cracking Compost" event at GS grower Iain Tolhurst. Promoted GS and handed out postcards 8 Dec BR</li> <li>• <b>Oxford Real Farming Conference</b>- 6/7 Jan 16 shared stand with Innovative Farmers, Review report, postcards and signup sheet BR, LB</li> <li>• <b>ORC producer conference</b> session with 2 Paul Smith and Simon Gardner speaking (growers from the consultations) + stand with reports. 28/29 Jan AV, BR</li> <li>• <b>Crop Protection in Northern Britain</b> – 23 Feb attending and speaking AL</li> <li>• <b>Carrot Growers Conference</b> 22 March –sign ups BR</li> </ul>	<p>Details of Soil Association farm walks</p> <ul style="list-style-type: none"> <li>• 15th July Goldhill - BR</li> <li>• 12th August Yatesbury BR</li> <li>• 24th September Barcombe BR</li> </ul>
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## **Appendix 4 – KE strategy for GREAT soils**

The GREAT soils project aims to inspire and support fruit and vegetable growers (primarily) to develop the ability and confidence to assess the health of their soils and take practical action to improve their soil management strategies with the long-term aim of enhancing soil health and crop productivity.

Knowledge Exchange (KE) is a vital part of the project. The aim is to effectively disseminate project findings to AHDB levy payers who grow fruit, vegetables and salads. Our proposals are draft at this stage and your views are very important. Please let us know whether you are happy with the way in which we plan to engage with growers and publicise information from the project. If not, please tell us how you think it could be improved.

### Outline plans for KE activities in the 3 year GREAT soils project

1. Soils Roadshow – We plan to attend 18 events, taking our materials, toolkit (of soil health assessment methods) and approach to events and colleges throughout the three years of the project. We will attend a mix of purpose-designed events and events organised by others (e.g. Cereals, the Carrot producers conference, the ORC Conference, Brassica producers conference, Soil Symposium, Royal Highland Show). Approximately four roadshows will take place in year one, with approximately seven taking place in each of the remaining two project years.
2. Website – We plan a simple outline on the shared new AHDB website (as opposed to the multiple websites which AHDB currently have). This outline will link to other relevant sites and pages (e.g. Seven ways to save our soils pages).
3. Twenty four interactive one-day grower workshops throughout the UK – These will be separate from the field tests. They will be practical, with limited numbers of attendees and will be targeted at growers in particular geographical areas (and therefore with a limited range of soil types and local climates). We may also target events towards growers of particular crops or crop groups, depending on demand. We will look at field soil assessment techniques, will discuss options for soil health assessment and potential management options which would be likely to result in improvements in crop health. This will involve using the tool kit and advisory approaches we have developed earlier in the GREAT soils project and we will use data generated in the project too where possible. These interactive workshops will take place in years two and three of the project, with approximately eight in year two and sixteen in year three. We may do more of these and less of another depending on feedback gained at events. The main theme will be the GREATsoils message. We are currently getting very little interest from soft fruit growers, therefore intend to ask key advisors (e.g. Scott Raffle) whether it is worth continuing to pursue them or whether it is better to concentrate on vegetable and salad growers, from which we are getting a lot of interest. The main issue with soft fruit growers is the declining area being used to grow soil-grown crops (most are now in substrate).

At present, we plan the following events, some of which may be delivered as webinars.

- i. Roots in Moray coast (twice) AL
  - ii. Salads and field veg in Fife (twice inc Angus) AL
  - iii. Soft fruit in Angus (AL - draft)
  - iv. Mixed veg in East Lothian (AL - draft)
  - v. Cornwall
  - vi. Somerset/Dorset?
  - vii. Wiltshire/Hampshire (twice)
  - viii. Kent/Sussex (twice) MW
  - ix. Gloucestershire/Worcestershire/Warwickshire
  - x. Shropshire/Herefordshire/Staffs (twice) MW
  - xi. Lincolnshire/Cambridgeshire (twice)
  - xii. Notts and East Midlands (twice)
  - xiii. Norfolk/Suffolk
  - xiv. Lancashire
  - xv. Humberside
  - xvi. South Wales (twice)
4. Three “Youtube” films – Three short films will be produced which demonstrate in an engaging way, practical methods for improving soil health. These will be completed by the end of year two and will be available to all levy-payers.
5. Four online presentations or webinars – Four online presentations will be produced for growers on different aspects of soil health measurement or management. Potential topics include: “The importance of soil organic matter”, “Strategies to measure soil health”, “Techniques to measure and improve soil organic matter levels” and “Strategies to improve soil health”. These are likely to be delivered on one occasion only (and growers would be invited to log in at a fixed time), but it is likely that the presentations could be downloaded at a later date for those unable to attend during the initial oral presentations.
6. Five Field labs (target ten farmers over four dates) – “Field labs” “Innovative Farmers” (<https://www.innovativefarmers.org/>) is an independent project being run outside of the GREAT soils project. There is an opportunity to run “Innovative Farmers” projects in parallel with the GREAT soils project. The aim of the GREAT soils project in this context is to encourage the development of, and facilitate grower groups which aim to study practical

aspects of assessing or improving soil health over the course of a 1 to 2 year project on one farm.

7. Media campaign – Key findings from the project will be communicated to growers using press articles, blogs and possibly radio and TV stories. The aim will be for two UK growers to produce regular blogs of their work monitoring and managing soil health over the second 2 years of the GREAT soils project. Key practical messages derived from project work and drawing attention to other relevant projects will also be published in a range of hard copy and online publications including Organic Grower, the Grower, the AHDB publications, Farmer's Weekly, the ORC Bulletin and other appropriate vehicles. Around 12 articles will be published over the course of the project, with two being produced in year one and five in each of years three and four.
8. Development of advisors to support growers post project – We acknowledge that some growers will still require help after the end of the project to develop a soil health strategy and to choose methods to measure and manage soil health. This might be particularly true where growers are geographically remote from the areas in which project activities have primarily taken places. For that reason, we plan to run two training events towards the end of project year three, particularly for advisors, in order to equip them to help their clients to develop effective strategies for monitoring and managing soil health. This event will be based on information gained throughout the three years of the project.
9. Case studies – There will be two per year. The first two (due in spring 2016) will cover soil health issues arising from the recently completed DC-Agri project and another long-term compost project in the SE of England.
10. Guidance documents – Due in years 2 and 3. Initial plans include: cover crops over winter, short-term green manures, cultivation techniques, composts/manures, altered rotations, top fruit and "Share to grow", where growers share the costs of managing the land and shares the benefits of the extra care given to the soil.

**Appendix 5 – Media plan**

		<b>Topic</b>	<b>Details</b>
2016	Jan	Soil Health	How Soil Organic Matter and Soil health work together to form productive fertile soil
	Feb		
	Mar		
	Apr	What lives in my soil	More detailed examination of what creature live in the soil and how to look after them. To include biological additives
	May		
	Jun		
	Jul	Soil testing	What you learn by testing your soil? How to do it? Sampling/visual/testing. Factors affecting interpretation of results. pH What does it mean and how does it affect soil health and fertility, available nutrients (P,K,Mg)
	Aug		
	Sep		
	Oct	Soil Organic Matter	Where does SOM come from, how does it help soil and how can you increase it. TO include carbon sequestration
	Nov		
	Dec		
2017	Jan	Compost and manures	Using bulky organic fertilisers to build organic matter and fertility and your soil. To include a food processing residues, spent mushroom compost, fibre digestate, green waste compost, food compost
	Feb		
	Mar		
	Apr	Soil Structure	Why it's important and how to maintain and improve it. Benefits of reduced and min tillage, Compaction, aggregates, etc
	May		
	Jun		
	Jul	Nitrogen Pathways	Manures (from poultry to FYM),, off-farm bulky organics, green manures, liquid feeds
	Aug		
	Sep		
	Oct	Rotations and green manures	Weed control, reducing pest and disease burdens, nutrient balancing, etc Maximising soil health and fertility by using Green Manure crops
	Nov		
	Dec		
2018	Jan	Building soil resilience	Trees, drainage and long term green manures, and catch crops to control water on your farm.to include Managing water in your soil + protection from erosion. Agroforestry
	Feb		
	Mar		