

Viewpoint

The current status of soil and water management in England

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Summary

Soil and water management face challenges with a much depleted professional body of specialists. The career structure for new entrants is poorly defined, and this discourages entry. A small cohort of professionals is needed mentored by those (now mostly retired) with a proven field record. The prime requirement is to use and develop the considerable store of fundamental research information available with future emphasis on applied research and development. Defra and other bodies need to be alerted to the problem and encouraged to move from its current largely environmental policy to one which embraces production within an environmental framework. The RASE, working with other parties, should attempt to raise £1 million/year for a 5 year period to support the development of a group of soil and water specialists to link applied research and development.

Introduction

The RASE has set up a “Practice with Science” Advisory Group to advise it on being “the leading independent voice for agriculture and the rural economy”, based on its commitment to “Practice with Science”. Chaired by Sir Don Curry, the Group has focussed on four early priority areas: soil, water & energy; plant breeding; the environmental benefits of livestock; and public good. Underlying all the theme areas is the importance of investment in research and the need for an effective bridge between knowledge and practice.

This paper is an abbreviated version of a report on soil and water management in England. It summarises the answers the authors make to specific questions the “Practice with Science” Advisory Group asked. The full report describes how the current situation developed and provides a thorough chain of reasoning from which its recommendations follow. The full report is on the Society website at: <http://www.rase.org.uk/>

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Is the UK's soil and water management research capability "fit for purpose" and does it have a vision for the future of the science and the needs of a changing UK farming industry?

The UK soil and water research base is not as it should be - it has diminished catastrophically from its peak in the 1980s. Many of the key applied soil science, soil physics and engineering researchers have now retired. There is little connection with agriculture and apparently no coordinated future vision for applied research.

In July 2008 presentations by immediate post doctoral and doctoral students on waste application, tillage, traction and compaction work at Cranfield University at Silsoe received positive feedback from soil and water research engineers at conferences in the USA, with comments that this work was virtually unique internationally. Hence the state of soil and water research internationally is even less robust than the current UK position. There is, therefore, no comfort in the concept that you can "buy into" other nations' research. This is especially true with soil and water topics which are very much local site and weather specific.

In the recent past there has been a move to computer modelling because it is relatively inexpensive. These models can be very valuable in assisting in the full understanding of physical processes and as tools to help design solutions to field problems. They need, however, to be validated with real data, and they cannot provide the total practical solution to applied research problems.

The good news is that a significant amount of good science and engineering has already been conducted and it is the application of this that is required to meet the changing needs of UK agriculture. Hence, the future thrust must be from individuals and research programmes at the applied end of research, and linked strongly to development and extension.

What future soil R&D will be required to ensure the agricultural industry can meet the challenges of increasing output whilst reducing dependence on agro-chemicals, pesticides etc and improving the environment?

The main topics for research are highlighted below. The actual requirements will be dependent upon the needs of the market conditions and the general direction of agriculture.

Fundamental Research

To develop an effective design procedure to identify risk and the measures required to reduce runoff and control soil erosion under UK conditions.

Applied Research

- Relationship between good field drainage and flood risk, including the use of the soil for water storage and detention for both lowland and upland situations. Linking this to the management of uplands for increased production of food and fuel, whilst maintaining water supply and bio-diversity;
- Control of nitrates and soluble phosphates in drainage water;
- Drainage and soil management economics;
- Practical adoption of internationally well tried soil conservation measures to reduce runoff and erosion that do not restrict mechanised field operations e.g. grass waterways;
- Improved methods for controlling runoff from tramline wheel marks;
- Appropriate cultivation systems for "novel" crops for a range of soil types;
- Selection of tyre/wheeling management systems, including controlled traffic, to reduce compaction and the need for deeper tillage and tillage energy;

- Application techniques and nutrient accumulation for farm wastes, composts and bio-solids to reduce demand for fertilisers;
- The spatially variable application of fertiliser to reduce residual nitrogen and the overall requirements for herbicides and pesticides.
- Techniques for improving water use efficiency and precision such as:
 - Precise, specifically targeted water application methods;
 - Appropriate low cost soil moisture sensors for water control; and
 - The benefits of spatially variable application of water to accommodate variation in soil water holding capacities.

Herbicide and pesticide research is currently being addressed by the Silsoe Spray Applications Group led by Professor Miller which is part of The Arable Group (TAG). Their current and future topic areas include:

- Developing the fundamental relationship between application method and the formulation of active ingredients;
- Improving the targeting of spray applications, particularly drift control; and applying this in practice;
- Matching agrochemical applications to spatially variable targets;
- Improving product handling and traceability.

Currently the tenure of the Group's base at Silsoe and the location of this world leading facility are under discussion. Support from the RASE for the continuance of this activity would be particularly valuable.

Does the UK have access to the necessary soil and water management resources (including expertise), given a background of cuts in R & D capacity and expenditure?

The answer to this question is best split into physical resources and expertise.

a) Physical Resources

Whilst there is some concern with these, the recent moves of the Soil Physics Group from Silsoe Research Institute to Rothamsted Research; and Silsoe College and Soil Survey and Land Research Centre to Cranfield University, have resulted in new build and refurbished state of the art soils laboratories respectively.

The pending moves of the world class soil engineering and recently completed off-road traction laboratories from Silsoe Campus to Cranfield Campus will again result in new laboratories to house the equipment for tillage, traction and compaction, and erosion studies.

The long term tenure of Spray Applications Group laboratories currently at Wrest Park, Silsoe, is currently being discussed with BBSRC. It is imperative that this world leading facility is transferred and then maintained and developed at the most appropriate and stable location for its future role.

The "Soil Hall" at Harper Adams University College is a valuable national resource for teaching and short courses. Further investment would increase its value for applied research and doctoral studies.

ADAS is maintaining a presence at a number of former Experimental Husbandry Farms to undertake applied research and development work across England and Wales.

b) Expertise

As many of the key soil and water engineering researchers have now retired, there is a shortage of those with the practical skills to "engineer" sustainable solutions so the biggest challenge is in renewing the pool of professionals who can identify and conduct the applied research, deliver

practically oriented teaching, provide extension advice and deliver short course training for farmers.

How can UK soil and water management capability be sustained, provided with more resources and integrated with capacity elsewhere in the EU and the world?

- There needs to be change in national policy from being predominantly environment driven to production in an environmentally sensitive framework;
- Ensure that a greater proportion of those with sound agriculture, science and engineering backgrounds are engaged in the formulation of the strategy;
- Government/Defra/Environment Agency should source adequate applied work to ensure that the national capability for the production of food and fuel, whilst meeting environmental requirements, is optimised to reduce the UK dependence on international factors.
- Convince the Agriculture and Horticulture Development Board (AHDB) that soil is important to all and work to ensure that the proposed mechanism for integrated applied research and development flourishes;
- The UK's link to the EU and other parts of the world has been excellent; this is based on the parity of esteem between the international cadre of scientists and engineers involved in soil and water management. In order for this to continue the UK needs respected scientists and engineers to both share ideas and be capable of evaluating them to ensure they satisfy UK soil and weather conditions;
- It is recommended that RASE work with the AHDB, Agri Food Charities Partnership (AFCP) and individual Charities to create a postgraduate research scholarship fund for a minimum period of 5 years to enable the development of good applied soil physicists and engineers. These projects should have commercial/agri-business and/or research station partners.

Are sufficient people being attracted to soil and water management and related areas as a career?

The answer is a very definite “no”. Experience suggests that there may be a sufficiently large group of individuals who would be attracted if there was a career structure and rather more job security.

The RASE should generate a fund in conjunction with other charities to provide “small top-up” grants for undergraduate engineers at Harper Adams in a similar manner to a number of equipment companies, and to fund soil and water projects.

The lack of postgraduate scholarships restricts the number of applicants and this must be addressed by Government agencies with help and input from a number of the agricultural charities and the AFCP.

Is there a career structure which will help to retain them in the discipline/in the UK?

Currently there is no sensible career structure in the UK and in recent years it is probably only Cranfield University that has provided one through an academic route. This has enabled the progress of a number of top quality masters students to post doctoral graduates and through to junior researchers and postgraduate teachers. Those staying in the UK are, however, few.

Nationally there needs to be a vision for a career structure available to encourage graduates at all levels to enter the profession. Initially this is most likely to be within the education sector, but possibilities could exist in bodies such as the Environment Agency. The education sector can

offer applied research, teaching and extension under one umbrella and give career progression with further opportunities arising in the government, commercial and private sectors.

Within a body such as the Environment Agency, a section could be established which would allow the requirements of profitable production agriculture to be considered and developed alongside those of the environment. A graduate's inputs and experience in this section might start largely within extension, then progress into policy and strategy matters.

Consideration should be given to the selection of one base for a pilot scheme and Harper Adams University College is one that would appear to have the key requirements as the only undergraduate agricultural engineering department in the country and a keen interest to develop its activity in soil and water management

Other College (or Former ADAS EHF) based units at say 3 other regional centres could develop with time to accommodate regional and catchment differences.

Is there sufficient capacity of the right quality in the education system to train the appropriate soil and water managers of the future?

The answer to this question is "no, and the existing capacity is diminishing quite rapidly". The major problem is that the experienced professionals have retired and their successors are not obvious because of the lack of mid-career professionals to take on leadership roles.

Currently Harper Adams University College is moving to position itself centrally in national agricultural strategy. However, there is a need to recruit new blood to undertake the educational role and have much more direct engagement with farmers in soil and water management. It is critical that this is undertaken in the very near future so that the existing cadre of retirees can help mentor the incoming group. Currently Reaseheath College, in Cheshire, provides a progression of students from their First and National Diplomas into the HND/Foundation Degree and Degree programmes at Harper Adams in agricultural engineering. The Principal of Reaseheath College is open to further discussion on extending these to encompass aspects of soil and water management providing satisfactory accreditation procedures can be established.

Do farmers and contractors receive reliable information about soil and water management?

In most cases the answer to this is "yes" but there are circumstances where both quality and reliability could be improved. The situation could deteriorate in future as experienced providers retire. This is further exacerbated by the lack of a centre of excellence from which farmers and advisers can obtain sound practical professional advice.

If so, how and from where, and is there more that can be done?

Farmers generally obtain their information from the following sources:

- Press articles - these are not structured and are published when the material is available;
- Privately retained agronomists;
- Courses such as the BASIS Soil and Water Management course;
- Speakers at Farmer Discussion Groups, although the supply is diminishing;
- Workshops and Conferences;
- Events such as "Tillage" and "Cereals";
- Specialist publications from machinery companies. Usually these are well written but of necessity focus on the issues surrounding a particular range of products;
- Cranfield University for booklets on irrigation and water resources;

- Staff of FWAG, Natural England and the Environment Agency provide some advice in the course of their other advisory duties. These, however, are generally focused on environmental issues and not on production.
- LEAF Audit and associated publications;
- Long course agricultural training programmes.

The most critical aspect here is to ensure that there is a nucleus of professionals engaged in practical soil and water management who can “feed” all of the above. They need to be present across the sector, from Government Agencies, through educational establishments to extension services. The potentially more senior grades should be encouraged to undertake a Masters degree or be recruited from such a programme. Provision needs to be made for studentships to support the studies and a path provided towards worthwhile careers afterwards.

Unfortunately since the withdrawal of Rycotewood College there is no vocational (equivalent to OND/C or HND/C) programme in the topic and soil and water issues are not always effectively covered in basic agricultural programmes. This latter situation could be rectified by extending the specialist work at Reaseheath and Harper Adams University College and encouraging other Universities and Colleges to give more attention to soil and water management than at present.

Possibilities also exist to develop the BASIS course to provide more detailed information in specific areas.

Do they take notice of such information and implement “good practice”?

From our experience the answer to this is generally “yes”, especially when they receive practical affordable solutions that fit within their farming system. The problem is, as mentioned before, the lack of providers.

One of the key areas that drive farmers to change and make decisions is legislation, the Good Agricultural and Environmental Condition (GAEC) regulations within the Common Agricultural Policy are having a big impact on what farmers do as are farm assurance schemes such as the Red Tractor and LEAF Marque which make key recommendations to farmers against which they are inspected.

If not, what should be done and by whom to encourage this?

Ensure that there are sufficient trained professionals available to undertake development work and provide advice. This work should be centrally coordinated either by DEFRA, one of its agencies, AHDB or the RASE acting for and supported by DEFRA coordinating an industry wide group. Such personnel would be the equivalent of the former ‘Drainage Officers’ of the past, but many fewer in number and broader in remit.

Are there specific knowledge transfer actions which the Royal Agricultural Society of England should consider taking?

Yes: Possible actions include the following:

1. Work to encourage DEFRA to be more proactive to embrace production alongside environmental issues.
2. Work with:
 - The Institution of Agricultural Engineers - Soil and Water Group (SAWMA);
 - Soil Management Initiative (SMI);
 - Research, education and extension providers (e.g. TAG and AICC);
 - Machinery companies and the Agricultural Engineers Association;
 - Soil consultants;
 - LEAF;
 - FWAG;
 - The Association of Drainage Authorities (arterial drainage systems);
 - The farming press;

- NFU;
- Local and national radio and television.

To:

- i. Formulate an effective Soil and Water Management network to rekindle the aims of SMI and SAWMA and its Journal, with farmer groups. If funding permits, the revised Journal should be in both hard copy and electronic format. The RASE should also consider making available an electronic library of relevant soil and water management articles.
 - ii. Organise an event; integrating sections on drainage – irrigation – soil erosion control - tillage/compaction on an annual or biennial basis as a standalone activity and to discuss working with AEA to extend the remit of the “Tillage” event. Historically SAWMA would have a ½ day Technical Workshop ahead of the annual Farmers Weekly “Drainage Event”. Have a display at “Cereals”.
 - iii. Consider the formation of a series of county, regional or catchment based “Landcare” groups and/or Soil and Water Management Districts akin to the Australian/New Zealand and US models. The aim would be to stimulate soil and water related activity to enable profitable and efficient production together with good environmental management. These groups function extremely well, but they need good coordinators who are funded for their input. This might be possible through the Regional Development Agencies such as Yorkshire Forward who have shown strong leadership in this area.
3. Request that the Department for Children, Schools & Families ensures that agriculture and soil and water issues are included in school syllabi.

Are soil and water management issues understood and their importance taken into account sufficiently by policy makers?

Having discussed this question with Defra it is fair to report that the key major national issues are well understood by the leading policy makers and where they require further assistance they refer to stakeholder and strategy forums.

In recent years the official policy has been focused on the environmental issues associated with climate change and the decline in levels of soil carbon, erosion risks and the protection of soil and water from diffuse pollution. Discussion with Defra indicates that their proposed Soil Strategy does consider the anticipated national requirements to improve food security and to provide for the increase in production of biofuels.

If the answer to the question above is “No”, then how can soil and related issues be highlighted to policy makers and advisors?

The answer to the above question is not a categorical “No”. It is sensed, however, that the practical agriculture community believe that in developing government policy there has been insufficient focus on ensuring food security whilst meeting the soil, water and environmental objectives. This deficiency appears to have arisen through a lack of connectivity between farmers, soil and water engineers, and soil specialists working closely with Defra, and has resulted in the absence of a robust ‘advisory mechanism’. This is despite a Soils Advisory Forum involved in policy development and implementation. Bringing these parties still closer together and the provision of an advisory mechanism would appear vital.

The RASE should discuss the findings of this report both internally and with Defra, Natural England, Environment Agency, NFU, CLA, and research and education bodies. This could be extended to a symposium inviting other pre-eminent speakers, to call for change. The Society should also try to ensure the group advising the policy makers has full access to individuals capable of providing sound advice on soil and water management aspects related to both production and environmental issues.