

AFCP Student Forum March 20, 2013
Abstracts of Papers

An investigation into the effect of traffic and tillage on soil properties and crop yields

Emily Smith Harper Adams University

Agricultural production systems are increasingly characterised by extensive in-field trafficking of larger and heavier field machinery. The random nature of trafficking, covering 80-90% of the field area, that is characteristic of commercial practice inevitably leads to negative impacts on soil, water and crop characteristics. Emerging technologies and engineering solutions have stimulated a recent shift towards reduced tillage methods coupled with the development of traffic management systems, aided by Precision Agriculture. A multidisciplinary long-term project was established at Harper Adams University College (UK) in October 2011 to investigate the interaction between traffic and tillage on soil, crop and energy responses in a randomised and replicated study to determine the effects of Random Traffic Farming, Controlled Traffic Farming and Low Ground Pressure with conventional, minimum and zero tillage. Results from the first year of this research will be reported.

Keeping soil in the field; optimising erosion and runoff control from UK row crops

Joanna Niziolomski Cranfield University

Inappropriate soil and water management, generally caused by a lack of adoptable and practical options, can lead to accelerated soil erosion. This study, incorporating both field trials and controlled laboratory experiments, aims to develop a cost effective and adoptable runoff and erosion management system for row crops. The permanence of an asparagus stand (10-12 years) lends itself as a suitable row crop for this study.

In an initial proof of concept study in collaboration with a Herefordshire asparagus grower (Cobrey Farms), the runoff and erosion control effectiveness of two surface mulches (composed of cereal straw and PAS 100:2005 compost) were individually tested against a bare soil control. The mulches were also tested in combination with shallow soil disturbance. From this proof of concept study further research using a similar though refined methodology is being conducted to fully optimize this management option.

Determination of cation exchange capacity through gamma-ray spectroscopy

Edward Carnell Cranfield University

Acquiring fine-scale information on the variation of soil properties through conventional laboratory techniques is a time consuming and expensive exercise. Proximal and remote sensors have demonstrated their potential to inexpensively, rapidly and simultaneously characterise certain soil properties, making the acquisition of this fine-scale information more viable. At the short wavelength/high frequency end of the spectrum, gamma (γ)-ray sensors penetrate vegetation cover to capture soil at depth. γ -ray spectrometry works on the basis that different rock types contain varying amounts of terrestrial-radioisotopes, as do the soil profiles to which they weather. In this paper we look at calibrating hyperspectral γ -ray signal to predict cation exchange capacity (CEC). 276 soil samples were collected from Bedfordshire and their full γ -ray spectrometry signals were determined in the

laboratory. Smoothing and de-noising of the γ -ray spectra was required to uncover the relationship with CEC. Good calibrations ($R^2 = 0.72$) of CEC were made through PLSR with leave-one-out cross-validation and strong independent predictions made ($R^2 = 0.66$).

Site-specific land management of cereal crops based on proximal soil sensing

Graham Halcro Cranfield University

Traditional management zone (MZ) delineation methods cannot characterise the variation in yield-limiting properties in a timely and cost-effective manner. This research sought to evaluate the efficiency and effectiveness of three fertiliser application schemes, each derived from different MZ delineation approaches. The farmer's usual uniform-rate (UR) scheme was used alongside two using variable-rate (VR). The first, (VR1) attempted to replicate the traditional method of mapping MZ (fertility zones) commonly used by commercial companies. The second was an innovative approach (VR2) which employed high-resolution proximal sensor systems to map both soil and crop properties for MZ delineation. The innovative method would have provided the farmer with 3.32 tonnes more OSR yield than his normal uniform application, if adopted over the whole field, while saving 440 kg of fertiliser.

This study suggests that site-specific data fusion from proximal sensor surveys can enable the delineation of MZ which better characterise the field-wide fertility.

Evaluating phosphorus availability in soils receiving organic amendment application using the Diffusive Gradients in Thin-films (DGT) technique.

David Kane Cranfield University

Phosphorus is a resource in finite supply. Use of organic amendments as a source of P in agriculture can be a sustainable alternative to inorganic P, provided it can meet crop requirements. The Diffusive Gradients in Thin-films (DGT) technique is based on natural diffusion of P via a hydrogel and sorption to a ferrihydrite binding layer; which should accurately represent soil P (C_{DGT}) in a plant available form. The aim of this research was to evaluate changes in soil P availability, following the addition of organic amendments, cattle farmyard manure (FYM), green waste compost (GW), cattle slurry (SLRY) and superphosphate (SP) using Olsen P and DGT. This study bridges this gap in knowledge about transfer of P between organic amendments to soil and its influence on plants showing a good relationship between soil P available by diffusive supply following treatment additions, and its influence on root and shoot dry matter yield and total P uptake.

Measurements of multiple gas emissions from environmental systems

Matthew Downie Cranfield University

Better understanding of soil carbon turnover and resulting GHG emissions is needed for emission models and inventories. This research addresses complex instrumental development for the Wolfson Field Laboratory at Cranfield - an automated system comprising 24 lysimeters and isotope ratio mass spectrometry for studying plant and soil carbon dynamics and GHG emissions.

Co-evolution of *Rhynchosporium* species on the *Lolium* species in the UK

Kevin King Rothamsted Research

Rhynchosporium is the causative agent of the economically important disease leaf blotch of barley crops and other grasses. This study aimed to establish if grasses, other than barley itself, could provide a source of *Rhynchosporium* inoculum able to cause disease on barley crops. To achieve this aim, this work investigated the recent discovery by Zaffarano et al. (2011) that the genus *Rhynchosporium* consists of at least four host-specialised species with no cross-infectivity. Results obtained in the present study suggest that there are generally four highly similar yet host-specialised species of *Rhynchosporium* found on different grass hosts, and novel species-specific PCR diagnostics were developed to discriminate between them. However, *Rhynchosporium* isolates obtained from previously unexamined *Lolium* species revealed the co-evolution of two distinct species of *Rhynchosporium* on this host. The practical implications of these results will be discussed.

Development of tools to detect anthelmintic sensitivity in UK cattle nematodes Claire McArthur Moredun Research Institute

Grazing cattle are infected with a variety of gastrointestinal nematodes and methods of control rely heavily on the use of anthelmintics (also known as wormers or drenches). There have been a number of reports of anthelmintic resistance in cattle nematodes abroad, but little is known about the prevalence or sensitivity of these parasites to anthelmintics in the UK. This project has taken steps to address this lack of information. A questionnaire study has been conducted to ascertain parasite management practices, in conjunction with testing of an injectable ivermectin treatment in a cohort of farms. Two nematode isolates found to be resistant to ivermectin have been further characterised through an *in vivo* trial, have been investigated using an *in vitro* lab based test and are currently undergoing molecular analysis.

The isolation and identification of feeding stimulants within honey bee pollens

Richard Bridgett Keele University

Numbers of honey bees have fallen sharply over recent years across Europe and North America. As much as 33% of all our food could be derived from primarily bee pollinated crops. This could be equivalent to £140bn worth of global agricultural produce annually.

One theory for the decline is that colony strength is reduced over the winter period, resulting in bees becoming more susceptible to disease and starvation. To combat this, beekeepers may feed high protein artificial/supplemental diets to colonies to increase nutrient diversity, and stimulate brood production. Unfortunately, bees are often reluctant to feed on these unless some pollen is mixed in.

It is believed that pollens contain naturally occurring feeding stimulants which increase bee feeding. The addition of pollen to diets carries additional risks to bees, and so identifying phagostimulants could contribute to the production of palatable artificial diets. These would allow beekeepers to strengthen colonies more safely.

Opportunities for charities to partner with BBSRC in supporting agricultural research students.

Dan Godfrey BBSRC

The Biotechnology and Biological Sciences Research Council (BBSRC) receives an annual budget from Treasury of approximately £450M per year to support research and training in the biosciences. BBSRC supports a great deal of agricultural research through its three Research and Technology Clubs in this area; the Animal Health Research Club (ARC); the Crop Improvement Research Club (CIRC) and the Horticulture and Potato Initiative (HAPI). These funding schemes support research projects that are relevant to agricultural businesses and also support PhD students to train alongside the researchers. In this way, BBSRC is developing the next generation of scientists who will tackle the many important issues the agriculture sector is facing. Charities can partner with BBSRC to support a student by making an annual contribution of £1000. This will help them to gain additional experience during their PhD, e.g. access to business training, company visits or international conference attendance. Over the next few months BBSRC will be awarding 10 new studentships, equally split between horticulture and animal health. The AFCP will circulate details of the studentships to all of its members inviting you to partner with BBSRC in supporting them – we would love to hear from you!

AHDB studentship scheme

Alice Sin AHDB

Currently AHDB offers post graduate studentships through its 6 divisions: BPEX (pigs), EBLEX (beef and lamb), DairyCo (milk), HGCA (cereals and oilseed), HDC (horticulture) and Potato Council (potatoes). These aim to produce high-quality research outputs leading to benefits to the agricultural and horticultural industry, and for employment within both the commercial and academic arenas. An overview of the divisional schemes, as well as opportunities for working with AFCP partners including co-funding will be covered. AHDB is launching a co-ordinated programme of post-graduate studentships in Summer 2013.

Posters

Severity of phoma leaf spotting and stem canker on *Brassica napus* cultivars with *Rlm7* resistance against *Leptosphaeria maculans* in the UK

Georgia Mitrousia University of Hertfordshire

The development and use of RNA interference (RNAi) for selective gene knockdown and vaccine candidate identification in the ectoparasitic mite *Psoroptes ovis*

Edward Marr Moredun Research Institute

Next generation biogas production – maximizing efficiency and stability

Dorota Dobrzanska University of Warwick

Incidence and genetic variation of an important virus in Europe that reduces oilseed rape yields

Max Newbert University of Warwick