The DOUGLAS BOMFORD Trust
SUPPORTING AGRICULTURAL ENGINEERING

Mentoring and collaboration with researchers, universities and industry

Dr Paula Misiewicz
(Snr Lecturer, Harper Adams University)

What the Trust has done for Us
Mentoring and collaboration with researchers, universities and industry

Paula Misiewicz, colleagues & students
Harper Adams University

What the Trust has done for me

- Funded my PhD (2006-2010)
- Assisted in developing my love for soils
- Assisted in developing my passion to do research
- Continues funding my research projects
- Provides continuous mentoring and support

CRANFIELD UNIVERSITY

SCHOOL OF APPLIED SCIENCES
Natural Resources Department

Doctor of Philosophy

2010

PAULA ALEKSANDRA MISIEWICZ

The evaluation of the soil pressure distribution and carcass stiffness resulting from pneumatic agricultural tyres

Supervisors:
Prof. Richard J. Godwin
Dr. Terence E. Richards

3 August 2010

This thesis is submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

Long Term Traffic & Tillage Long Term Project

- DBT co-funded the Traffic & Tillage Projects
- Field experiment started in 2011 at HAU, Shropshire, UK
- Aim: To compare the effects of alternative traffic and tillage systems on soil health, crop growth and yield, and system economics over an extended period
- Internationally unique project
- National and international interest

PhD's based on the Traffic & Tillage Project

1. **Emily Smith (2011 – 2014):** focused on soil properties such as bulk density and water infiltration, as well as crop grow and yield. Currently Director of KE at Trinity AgTech.

2. **Anthony Millington (2014-2017):** focused on soil physical properties such as total porosity and soil structure. Currently Postdoctoral Researcher at HAU.

3. **Magdalena Kaczorowska-Dolowy (2018-2021):** focused on root development, soil organic matter and microbial biomass carbon (as a measure of "soil health"). Currently Postdoctoral Researcher at HAU.

4. **Ana Prada (2021-2024):** focused on soil carbon dynamics and carbon sequestration potential by looking at soil organic matter, microbial biomass carbon and particulate and mineral associated carbon. Currently PhD Student at HAU.

Traffic & Tillage Four Satellite Experimental Sites

Hargreaves et al., 2016

Martlew et al., 2015

Traffic & Tillage Four Satellite Experimental Sites

Dolowy, 2022

Shaheb et al., 2019

Linking academia, industry, charities & farmers

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UCD DUBLIN
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Ireland's Global University

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URBANA-CHAMPAIGN

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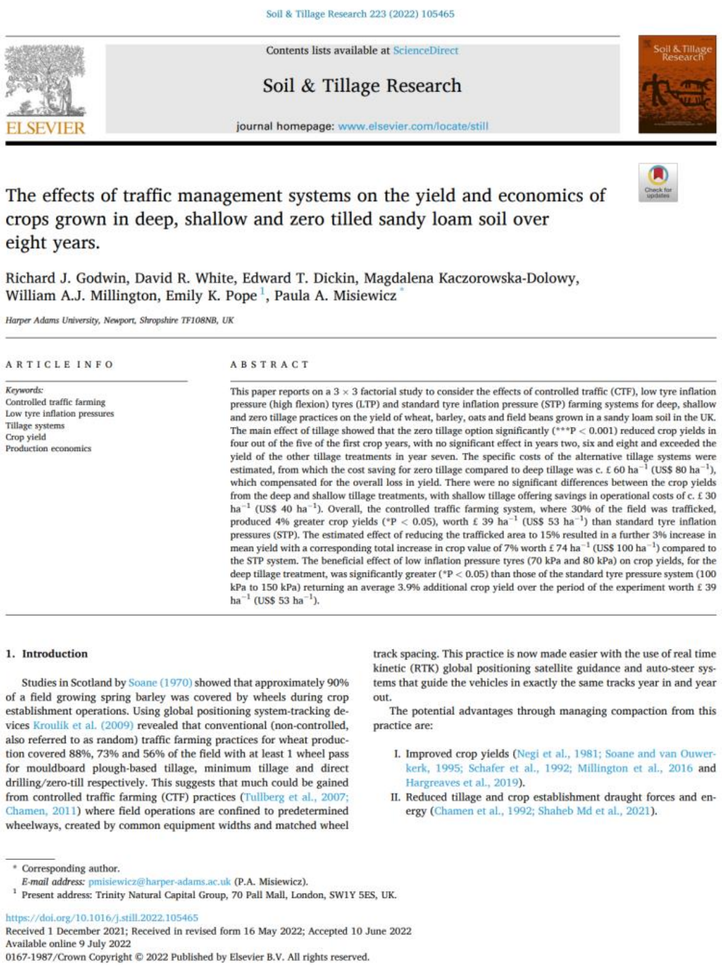
Dissemination and academic development

- Dr. Ed Dickin
- Mr. David White
- Prof. Dick Godwin
- Dr. Keith Chaney
- Dr. Simon Jeffery
- Many others…

Dissemination and academic development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The effects of traffic management systems on the yield and economics of crops grown in deep, shallow and zero tilled sandy loam soil over eight years.

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Tillage systems
Crop yield
Production economics

ABSTRACT

This paper reports on a 3 × 3 factorial study to consider the effects of controlled traffic (CTF), low tyre inflation pressure (high flexion) tyres (LTP) and standard tyre inflation pressure (STP) farming systems for deep, shallow and zero tillage practices on the yield of wheat, barley, oats and field beans grown in a sandy loam soil in the UK. The main effect of tillage showed that the zero tillage option significantly (***P < 0.001) reduced crop yields in four out of the five of the first crop years, with no significant effect in years two, six and eight and exceeded the yield of the other tillage treatments in year seven. The specific costs of the alternative tillage systems were estimated, from which the cost saving for zero tillage compared to deep tillage was c. £ 60 ha^{-1} (US$ 80 ha^{-1}), which compensated for the overall loss in yield. There were no significant differences between the crop yields from the deep and shallow tillage treatments, with shallow tillage offering savings in operational costs of c. £ 30 ha^{-1} (US$ 40 ha^{-1}). Overall, the controlled traffic farming system, where 30% of the field was trafficked, produced 4% greater crop yields (*P < 0.05), worth £ 39 ha^{-1} (US$ 53 ha^{-1}) than standard tyre inflation pressures (STP). The estimated effect of reducing the trafficked area to 15% resulted in a further 3% increase in mean yield with a corresponding total increase in crop value of 7% worth £ 74 ha^{-1} (US$ 100 ha^{-1}) compared to the STP system. The beneficial effect of low inflation pressure tyres (70 kPa and 80 kPa) on crop yields, for the deep tillage treatment, was significantly greater (*P < 0.05) than those of the standard tyre pressure system (100 kPa to 150 kPa) returning an average 3.9% additional crop yield over the period of the experiment worth £ 39 ha^{-1} (US$ 53 ha^{-1}).

1. Introduction

Studies in Scotland by Soane (1970) showed that approximately 90% of a field growing spring barley was covered by wheels during crop establishment operations. Using global positioning system-tracking devices Kroulik et al. (2009) revealed that conventional (non-controlled, also referred to as random) traffic farming practices for wheat production covered 88%, 73% and 56% of the field with at least 1 wheel pass for mouldboard plough-based tillage, minimum tillage and direct drilling/zero-till respectively. This suggests that much could be gained from controlled traffic farming (CTF) practices (Tullberg et al., 2007; Chamen, 2011) where field operations are confined to predetermined wheelways, created by common equipment widths and matched wheel track spacing. This practice is now made easier with the use of real time kinetic (RTK) global positioning satellite guidance and auto-steer systems that guide the vehicles in exactly the same tracks year in and year out.

The potential advantages through managing compaction from this practice are:

I. Improved crop yields (Negi et al., 1981; Soane and van Ouwerkerk, 1995; Schafer et al., 1992; Millington et al., 2016 and Hargreaves et al., 2019).
II. Reduced tillage and crop establishment draught forces and energy (Chamen et al., 1992; Shaheb Md et al., 2021).

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Further support to HAU

- Funding or co-funding of research projects

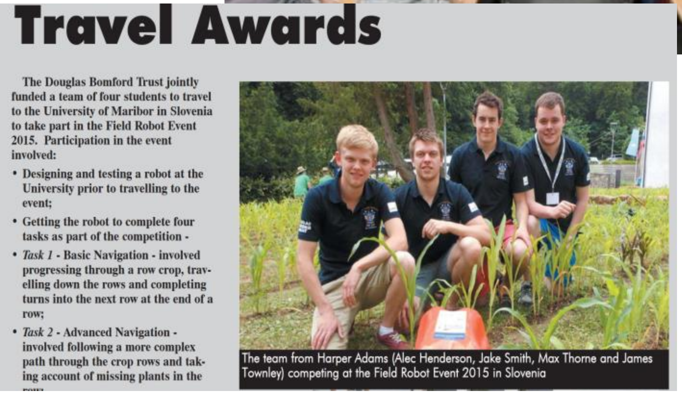
- Initial funding of the AEIC Building which helped lever additional, including government, funding. A major teaching resource/facility for the past decade

- Travel awards for many years:
    - trips to Agritechnica (Germany)
    - SIMA (France) exhibitions
    - Field Robot Event
    - Ag Eng Conferences

- DBT Scholarships. Typically 5 or 6 per year

- DBT pays IAgrE student membership fees for engineering students at HAU (and other institutions) and 1 year following graduation

- Continued mentoring and friendship with many of us



Travel Awards

The Douglas Bomford Trust jointly funded a team of four students to travel to the University of Maribor in Slovenia to take part in the Field Robot Event 2015. Participation in the event involved:

- Designing and testing a robot at the University prior to travelling to the event;
- Getting the robot to complete four tasks as part of the competition -
- *Task 1* - Basic Navigation - involved progressing through a row crop, travelling down the rows and completing turns into the next row at the end of a row;
- *Task 2* - Advanced Navigation - involved following a more complex path through the crop rows and taking account of missing plants in the

The team from Harper Adams (Alec Henderson, Jake Smith, Max Thorne and James Townley) competing at the Field Robot Event 2015 in Slovenia