

FDI Feature Interview

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Professor Alex McBratney – Plastics in Soil: A Challenge

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Key Points

- Plastic pollution in soils is not well understood.
- In agriculture, plastics are introduced to soils from materials used as mulching and as wrapping or binding for hay and similar products.
- The agricultural use of plastics is increasing however, there is a lack of scientific understanding of the long-term effects in soils and the wider terrestrial environment.
- As plastics breakdown in soil, they become micro-plastics which may be transported to the water table to in turn, pollute rivers, lakes and streams.

Introduction

Soil that is polluted by plastic is a problem that has only recently received attention. While there has been research for a decade or more about the build-up of plastic in our seas and oceans and how it might eventually severely impact on the marine ecosystem, until recently there has been relatively little about plastics and [terrestrial ecosystems](#). In the last two to three years scientific papers have started to appear looking at the implication of plastics in soil. The majority of papers are from China and there are also studies from Europe. According to the [Global Soil Partnership](#) one third of the plastic produced globally ends up in soils, degrading them of their structural condition and through the effects of introduced and possibly toxic, chemicals.

Interview

FDI - Are plastics entering soils and what is causing this to happen?

Professor McBratney - There have been no real surveys on the movement nor on the nature of plastic entering soil. cursory examination of [peri-urban](#) agricultural soils used for cropping however, will generally reveal impressions of plastic. There are two main sources of this plastic. In agriculture, and particularly horticulture, plastic films are used as mulches to control soil temperatures or to protect plants and soil from storm events.



Figure 1: Plastic covering on strawberries, reducing weeds and retaining moisture. Source: Georges al-Jammal, Flickr

The use of such plastic films is increasing, and they are now being used in broadacre crops such as corn and cotton. Some of these are designed to be removed and some are designed to be biodegradable. There are a few long-term studies on the fate of such plastic materials. Likewise, plastic films are used in agricultural wrapping and binding materials for forage, for example for hay and straw bales.

Remnants of such materials are visible across the agricultural landscape. Once again, there are few studies of long-term fate and the use of such materials is also increasing. In the peri-urban environment there is the increasing addition of plastic to soil through the use of compost from waste recycling schemes. Many of these composts made from mixed sources contain a proportion (< 10 per cent) of plastic. Such composts tend to be applied at high concentrations and frequently added to soil close to built-up areas.



Figure 2: Plastic-wrapped hay bales. Source: Flickr

FDI - What is the negative impact of plastics in our soils?

Professor McBratney - So why is there a concern about having plastic in soil? Plastics are synthetic compounds that are not found in nature and, generally speaking, we are always concerned about the behaviour of any such compounds in the natural environment; the materials are un-natural and, presumably, micro-organisms cannot readily consume them. Soils are typically hugely microbially diverse however, and it is likely that organisms exist that will further evolve to breakdown the plastics. It can be argued that plastics with a long [half-life](#) in the soil can be thought of as a carbon store, thereby mitigating greenhouse gases. What must be considered however, is the breakdown of the plastic to very fine materials, termed micro-plastics. These can move and be transported through the soil water to ground water tables, streams, rivers and lakes, and possibly in the crop plants. Some of the products formed through the process of breakdown of the plastic may themselves be toxic. For example, polyacrylamide (a water-soluble molecule) is relatively harmless in the environment while, the monomer acrylamide is toxic. So, we might imagine existing in any soil a range of plastic materials (polythene, polypropylene, etc) in various stages of degradation. These have the potential of posing a range of environmental threats, depending on concentration. The biggest problem is that we have little conception of the scale of this issue.

FDI - What steps might we take to prevent plastics entering our soils and how would we recover soils that have been affected by plastics?

Professor McBratney - National surveys are needed to understand the extent of the problem. For plastics used in agriculture we need to know the long-term fate of each and the long-term outcome and impact on the environment needs to be understood. For instance, do they need to be removed after their intended use? This must be a part of a best-management practice for their use in rural applications.

Compost made from recycled materials requires plastic to be removed at source. If we become plastic-aware in agriculture and horticulture and in relation to soil, we may well be able to stop this from becoming a problem - once again, we are unclear about how large a problem it may be at present but without measurement and management intervention, there is little doubt that it could turn out to be a major issue in the future.

About the Interviewee:

Alex McBratney is a world-renowned soil scientist. He is Director of the Sydney Institute of Agriculture and Professor of Digital Agriculture and Soil Science. He holds BSc, PhD and DSc degrees in soil science from the University of Aberdeen in Scotland, and the DScAgr degree from the University of Sydney for research in precision agriculture. He has made major contributions to soil science and agriculture through the development of the concepts of Pedometrics, Digital Soil Mapping, Precision & Digital Agriculture, and Soil Security.

Any opinions or views expressed in this paper are those of the individual interviewee, unless stated to be those of Future Directions International.

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