An Investigation into the Mechanistic Impacts of Conventional and Alternative Plastics on Plant Growth and Carbon Dynamics.

Amy Wright*[1]

[1]Anglia Ruskin University – School of Life Sciences Anglia Ruskin University East Road Cambridge CB1 1PT, United Kingdom

Abstract

Despite their increasing application as mulching films, knowledge on the ecological risks of biodegradable plastics is limited: preliminary research shows they may have equal impacts to conventional polymers, but there exists a strong research focus on the effects of fibrous microplastics, with films neglected. Many unknowns in the underlying mechanisms of microplastic effects exist; information on polymer additives is rare, with little research on the effects of aged microplastics within soil ecosystems.
This project researches the effects of conventional versus alternative polymers on plant performance indicators, as measured by shoot and root biomass and chlorophyll content, and soil health indicators, as measured by organic matter content, soil respiration and pH. Polyethylene, polypropylene, polyhydroxyalkanoate and polylactic acid films were added to soil and rye grass was grown. It is hypothesised that the biodegradable polymers will be as negatively impacting as the conventional polymers on plant and soil performance and health indicators.

The initial experiments found the majority of polymer treatments to significantly reduce root biomass, chlorophyll a and b content, organic matter content and pH, significantly increasing respiration rate, relative to controls. In some cases, the biodegradable plastics were found to experience a greater decrease in organic matter content and a greater increase in respiration rate. The mechanisms behind the decrease in soil organic matter, a proportion of which will be organic carbon, as well as the increased soil respiration rate CO2 flux from the soils to the atmosphere will be an important pathway to explore.
Additional research will expand these ideas by experimenting with aged microplastic films, as opposed to the new films used in the described study. Furthermore, plastic leachate will be added to soils to test the chemical effects of microplastic pollution, contrasting the physical effects being tested, as described here.

Keywords: Microplastics, microfilms, biodegradable plastics, carbon dynamics

*Speaker