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Microplastics in Agriculture: Challenges for Regulation

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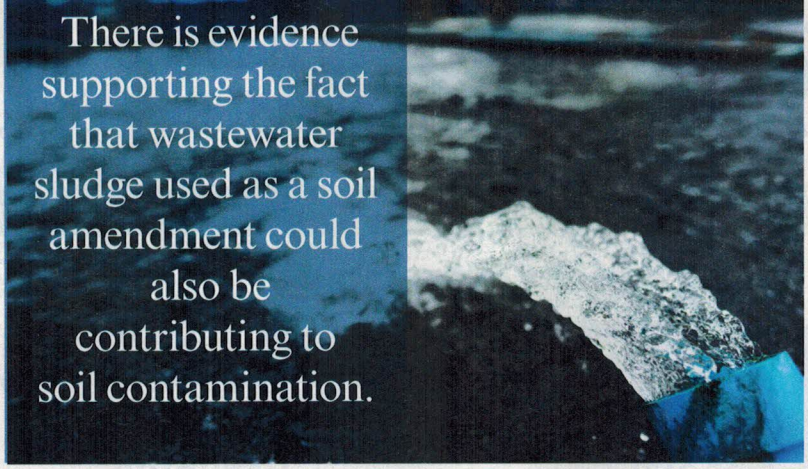
BY PIYATIDA (TUNG) PUKCLAI

MICROPLASTICS, small pieces of plastic, less than 5 mm in length, occur in the environment as a consequence of plastic pollution. Microplastics are increasingly seen as an environmental problem of global proportions. In fact, awareness about this issue is increasing in the policy development. The microplastic issue is already addressed in a few regulations and policy instruments on international and national levels.

While the focus to date has been on microplastics in the ocean and their effects on marine life, microplastics in agriculture have largely been overlooked. Recently, scientists have uncovered that agricultural soils could actually hold more microplastics than the ocean basins. Agricultural lands are likely to be the most plastic-contaminated places outside of landfill and urban spaces. There is evidence supporting the fact that wastewater sludge used as a soil amendment could also be contributing to soil contamination. Fertilizer made from sewage sludge, rain, and airborne fallout are all pathways for these particles to settle into the soil. The long-term impact could include stunted soil biodiversity. The common agricultural practices of disposing of plastic mulching, water pipes, and plastic greenhouse covers have begun to raise concerns.

In addition to microplastic contamination of soil from various sources, "intentionally added microplastics" are an additional serious source that needs to be considered. "Intentionally added microplastics" are those added to consumer and industrial products to serve a functional purpose. Such microplastics are commonly used in both agriculture and horticulture. The main use of intentionally added microplastics in agriculture are nutrient prills for controlled-release fertilizers (e.g., by controlling the rate at which ammonium is converted in nitrate). These prills are a coating often composed of a polymer such as polysulfone, polyacrylonitrile, or cellulose acetate, which encapsulates nutrient combinations for fertilization particles of synthetic polymers that potentially constitute microplastics

are also used in additional agricultural applications such as polymers utilized for capsule suspension plant protection products (PPPs), seed coatings, water-soluble polymers for soil remediation, and water absorbents. In addition, applications where microplastics are potentially contained include soil amendments, which can increase the water-holding capacity of soils, increasing water use efficiency, reducing irrigation frequency and enhancing soil permeability. Considering the concerns of microplastics use in agriculture, it may be necessary to find alternative techniques.



Several scientific journals focus on the impact of microplastics in soils, sediments, and freshwater and the long-term negative effect they could have on such ecosystems. Terrestrial microplastic pollution is much higher than marine microplastic pollution. Scientists estimate that one-third of all plastic waste ends up in soils or freshwater. Most of this plastic disintegrates into particles smaller than 5 mm, and these break down further into nanoparticles (less than 0.1 mm). The problem is that these particles are entering the food chain. Microplastics can interact with soil fauna, affecting their health and soil functions. Chlorinated plastic can release harmful chemicals into the surrounding soil, which can then seep into groundwater or other surrounding water sources, and also the ecosystem. This can cause a range of potentially harmful effects on the species that drink the water.

Legislative Approach

Numerous countries around the world have introduced legislation to ban the manufacture of cosmetics and personal care products containing microbeads, which is a kind of microplastic, but there is no agro-environmental microplastic related legislation in place yet. Last year, the European Chemicals Agency (ECHA) assessed the environmental and health risks posed by the use of intentionally added microplastics and released a restriction proposal on the use of microplastics for agricultural purpose. This proposal aligns with the 2018 European Commission's Plastic Strategy to reduce the effect of plastic as an environmental pollutant. If the restriction is adopted, all importers and downstream users of substances containing intentionally added microplastics with a concentration equal to

or greater than 0.01% (w/w) are expected to comply with the new legislation. Compliance will include a transition period to allow for the substitution of biodegradable alternatives as well as labeling and reporting changes. This includes transitions over time to biodegradable alternatives as well as labeling and reporting changes for derogated products.

Moving Forward

How could the rest of the world set such a policy as well? Due to the complexity of this issue, it is not clear which policy has to act first, which concepts would be necessary, what requirements are needed to promote actions beyond those already initiated, what the accepted definition of microplastics is, etc. While several regulations address plastics, concrete regulations on microplastics are insufficient. The development of regulation strategies for microplastics should consider more options than the simple adaptation of the existing regulation strategies for dissolved chemicals or suspended matter. Possibly, entirely new regulation strategies for microplastics need to be developed.

Knowledge gaps about sources, transport pathways, and the environmental fate of the microplastics must be filled, to define adequate methods for standardized monitoring of microplastics. The adaption of exposure and hazard assessment to evaluate the risk of microplastics is one of the major challenges for regulation and management. Policymakers are very aware of the problems of environmental plastic waste, and these issues are already considered in several regulatory documents. Nonetheless, most regulations do not clearly refer to microplastics. So far, policymakers integrated the microplastic issue into a few regulatory directives on international and national level. These regulations concern diverse fields of policy. The environmental policy provides a long list of instruments, which might be adopted to develop further management options for the issue of microplastic.

Agro-environmental microplastic related policies might be required to react rapidly once defensible and validated results justify an adaptation of agricultural practice to mitigate microplastic emissions into agricultural soils. Evaluation of the situation of microplastics and the design of mitigation policies require interdisciplinary research, which links information from different methods and approaches. The design of effective and efficient mitigation policies requires the consideration of many different sectors. Since plastics influence all parts of society, single fields of science or policy cannot tackle this issue individually. This requires integrative coordination of measures on different statutory, political, economic, and social levels. Only the interplay between all stakeholders from all countries results in success. Although we currently know little about the consequences of microplastics in agricultural systems, we should develop and implement measures to reduce further emissions.

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