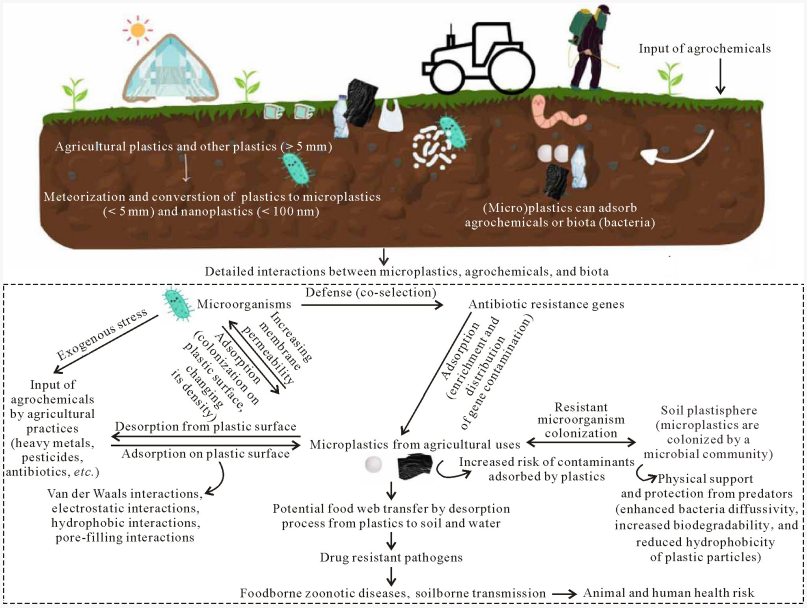
Microplastics: hidden carriers of antibiotic resistance in agricultural soils

GA, UNITED STATES, July 1, 2025 /EINPresswire.com/ -- Microplastics, tiny plastic particles increasingly found in agricultural soils, are raising alarms for their role in spreading antibiotic resistance. These pollutants, commonly introduced by agricultural practices, are more than just an environmental issue—they are also carriers of antibiotic resistance genes (ARGs). By absorbing antibiotics, which are frequently used in livestock farming, microplastics facilitate their movement and persistence in soil ecosystems. This newly discovered link between microplastics and ARGs poses a serious risk to soil health, agricultural productivity, and public health. Researchers are calling for urgent studies to understand these interactions and mitigate the risks they present to the environment and human health.



Relationships between microplastic pollution, agrochemicals, antibiotic resistance genes, and potential pathogen-microplastic interactions in agricultural soils.

Plastic pollution, particularly microplastics, is now ubiquitous in agricultural soils, but their impact extends beyond soil contamination. While their physical effects on soil structure have been documented, their potential to carry antibiotic resistance genes has been largely overlooked. Antibiotics applied through manure or wastewater are known to enter soils, but microplastics exacerbate this problem by adsorbing and transporting these chemicals. This combined contamination can alter microbial communities, fostering the growth of antibiotic-resistant bacteria. Given the increasing prevalence of microplastics in agricultural settings, there is an urgent need to explore how they interact with antibiotics and contribute to the spread of resistance, which could jeopardize both food safety and public health.

In a new perspective article Published in Pedosphere on January 31, 2025, researchers from Universidade de Vigo and Lund University warn of the overlooked threat of microplastics in

agricultural soils. The study underscores the urgent need to investigate how MPs interact with antibiotics and contribute to the spread of antibiotic resistance genes (ARGs). By exploring these interactions from a One Health perspective, the authors call for expanded efforts to understand and mitigate risks to agriculture, ecology, and human health.

The study delves into the role of microplastics as carriers of antibiotics in agricultural soils, shedding light on a potentially significant environmental health crisis. Microplastics, once incorporated into soil, can adsorb antibiotics like tetracycline and oxytetracycline—commonly used in livestock farming—and serve as conduits for their spread. These antibiotics, often introduced through manure or wastewater, are known to disrupt soil microbial activity, but microplastics enhance this effect by allowing the antibiotics to persist in the soil longer. Over time, the microplastics break down, increasing the bioavailability of these antibiotics and promoting the growth of antibiotic-resistant bacteria. The research points to a dangerous feedback loop: as antibiotics remain in the soil, they encourage resistance in microbial populations, which can then be passed on to crops and potentially enter the food chain. The study also emphasizes the need for further research on less-studied antibiotics, like clarithromycin, and their interactions with microplastics in soil. It calls for a more comprehensive understanding of how these combined pollutants affect soil ecosystems and contribute to the proliferation of drug-resistant pathogens.

Dr. Andrés Rodríguez-Seijo, one of the lead researchers on the study, commented, "Microplastics in soil are often seen as a purely physical pollutant, but our research reveals their deeper implications. These tiny particles not only degrade soil quality but also facilitate the spread of antibiotic resistance, a growing global health threat. As our study shows, microplastics can act as carriers for antibiotics, helping to spread resistance through soil microbiomes and agricultural systems. This issue needs immediate attention, as it could exacerbate antibiotic resistance and affect public health for generations."

The findings of this study are crucial for shaping future agricultural and environmental policies. The discovery that microplastics facilitate the spread of antibiotic resistance in soils highlights the need for stricter regulations on plastic waste in agriculture. Additionally, the overuse of antibiotics in farming practices must be addressed to prevent further contamination of soils and reduce the spread of resistant bacteria. Policymakers and researchers must collaborate to create sustainable farming practices that limit the use of plastics and antibiotics. The study also underscores the importance of conducting more research under varying environmental conditions, particularly considering the effects of climate change on the behavior of microplastics and antibiotics in agricultural soils.

References
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