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National Organic Standards Board
USDA-AMS-NOP
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Re. MS: Research Priorities

These comments to the National Organic Standards Board (NOSB) on its Spring 2024 agenda are submitted on behalf of Beyond Pesticides. Founded in 1981 as a national, grassroots, membership organization that represents community-based organizations and a range of people seeking to bridge the interests of consumers, farmers, and farmworkers, Beyond Pesticides advances improved protections from pesticides and alternative pest management strategies that eliminate a reliance on pesticides. Our membership and network span the 50 states and the world.

We suggest that research into elimination of plastic—in all aspects of organic production and handling—be made a research priority.

Plastics in organic

Plastic is found in every facet of organic production and handling. Yet, the human and environmental health implications of plastic are becoming increasingly well documented. Scientists are increasingly concerned about the impacts of microplastics—plastic fragments less than 5 mm in size—on a wide range of organisms. Microplastics can cause harmful effects to humans and other organisms through physical entanglement and physical impacts of ingestion. They also act as carriers of toxic chemicals that are adsorbed to their surface. Some studies on fish have shown that microplastics and their associated toxic chemicals bioaccumulate, resulting in intestinal damage and changes in metabolism.[1] Microplastics can increase the spread of antibiotic resistance genes in the environment.[2]

[1] Li, J., Liu, H. and Chen, J.P., 2018. Microplastics in freshwater systems: A review on occurrence, environmental effects, and methods for microplastics detection. *Water Research*, *137*, pp.362-374.
[2] Shi, J., Wu, D., Su, Y. and Xie, B., 2020. (Nano) microplastics promote the propagation of antibiotic resistance genes in landfill leachate. *Environmental Science: Nano*, *7*(11), pp.3536-3546.

Soil organisms and edible plants have been shown to ingest microplastic particles.[3] Earthworms can move microplastics through the soil, and microplastics can move through the food chain to human food.[4] Microplastics can have a wide range of negative impacts on the soil, which are only beginning to be studied, but include reduction in growth and reproduction of soil microfauna.[5] When looking at the impact of microplastics, it is important to include the impact of associated substances. As noted above, they can carry toxic chemicals. A review by Zhu et al. cites several studies showing, "[M]icroplastics can serve as hotspots of gene exchange between phylogenetically different microorganisms by introducing additional surface, thus having a potential to increase the spread of ARGs [antibiotic resistance genes] and antibiotic resistant pathogens in water and sediments." [6]

Additionally, it is critical that the NOSB consider and act on the fact that highly hazardous PFAS (per- and polyfluoroalkyl substances) are leaching out of plastic containers and contaminating food products, according to research published in Environment Technology and Letters.[7] The data confirm the results of prior research focused on the propensity of PFAS to contaminate various pesticide products through the storage containers.[8]

Plastics—both large and small—are introduced into the environment directly from sources like plastic (including biodegradable bioplastic) mulches, but a huge source of plastic is leachate from landfills, where plastic is deposited after use.[9] In addition, there is evidence that we consume microplastics directly from food containers,[10] including baby bottles.[11]

Research continues to raise alarms about the hazards associated with the use of plastic, including the microplastic particles that are distributed in alarming amounts throughout the environment and taken up by organisms, including humans. A study published by researchers at Columbia and Rutgers universities in the January 2024 Proceedings of the National Academy of Sciences reports that the average liter of three brands of bottled water in the U.S. contains

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[3] Zhu, F., Zhu, C., Wang, C. and Gu, C., 2019. Occurrence and ecological impacts of microplastics in soil systems: a review. *Bulletin of environmental contamination and toxicology*, *102*(6), pp.741-749.
[4] He, D., Luo, Y., Lu, S., Liu, M., Song, Y. and Lei, L., 2018. Microplastics in soils: analytical methods, pollution characteristics and ecological risks. *TrAC Trends in Analytical Chemistry*, *109*, pp.163-172.
[5] He, D., Luo, Y., Lu, S., Liu, M., Song, Y. and Lei, L., 2018. Microplastics in soils: analytical methods, pollution characteristics and ecological risks. *TrAC Trends in Analytical Chemistry*, *109*, pp.163-172.
[6] Zhu, F., Zhu, C., Wang, C. and Gu, C., 2019. Occurrence and ecological impacts of microplastics in soil systems: a review. *Bulletin of environmental contamination and toxicology*, *102*(6), pp.741-749.
[7] https://pubs.acs.org/doi/10.1021/acs.estlett.3c00083.
[8] https://beyondpesticides.org/dailynewsblog/2022/09/epa-confirms-pfas-forever-chemicals-leach-into-pesticides-from-storage-containers/ .
[9] Hou, L., Kumar, D., Yoo, C.G., Gitsov, I. and Majumder, E.L.W., 2021. Conversion and removal strategies for microplastics in wastewater treatment plants and landfills. *Chemical Engineering Journal*, *406*, p.126715.
[10] Fadare, O.O., Wan, B., Guo, L.H. and Zhao, L., 2020. Microplastics from consumer plastic food containers: Are we consuming it?. *Chemosphere*, *253*, p.126787.
[11] https://www.theguardian.com/environment/2020/oct/19/bottle-fed-babies-swallow-millions-microplastics-day-study.

almost a quarter of a million bits of microplastics, of which 90 percent are at the nanoscale.[12] The other ten percent are slightly larger, at microscale.

Last December, researchers at Norway's MicroLEACH project published a study that analyzes the components of 50 items in common use—plastic bags, disposable cups, dishwashing gloves, car tire granules, children's toys and balloons.[13] The researchers found, as in previous studies, that many hazardous chemicals are in the plastics as well as many that **could not be identified** because they were not listed in the major chemical substance databases. Only 30 percent of the chemical compounds identified in the study were present in two or more products. This suggests that most plastics contain many unidentified chemicals, far beyond the known impurities, metabolites and degradation products. Further, it suggests that in the environment plastics are chemically reactive and forming new compounds no one has anticipated and whose toxicity is unknown.

In the Columbia/Rutgers study, the researchers checked for seven types of plastic, but they were only able to identify about ten percent of the nanoparticles they found. Polyethylene terephthalate (PET) was a common ingredient, probably because many water bottles are made of it. However, they also found polyamide, polystyrene, polyvinyl chloride, and polymethyl methacrylate. (Tap water also contains microplastics in many places, although in much lower concentrations.) The team found that the number of individual chemical compounds varied wildly among products, ranging from 114 to 2,456, leading them to conclude that "assessing the toxicity of plastic chemicals present in a product based on testing individual target chemicals has limited value." The Norwegian scientists also exposed cod eggs, embryos and larvae to water containing microplastics. The toxic effects they observed include spinal deformities reminiscent of scoliosis in humans.

In other new studies, out of a total of 257 patients who completed the study, polyethylene was detected in carotid artery plaque of 150 patients (58.4%), with a mean level of 2% of plaque; 31 patients (12.1%) also had measurable amounts of polyvinyl chloride, with a mean level of 0.5% of plaque.[14] Microplastic particles have even shown up in brain as well as placenta.[15]

We need research into ways to replace all forms of plastic in organic production and handling.

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[12] Qian N, Gao X, Lang X, Deng H, Bratu TM, Chen Q, Stapleton P, Yan B, Min W. Rapid single-particle chemical imaging of nanoplastics by SRS microscopy. Proc Natl Acad Sci U S A.

[13] Summary at https://phys.org/news/2023-12-toxicity-standard-plastic-products.html.

[14] Marfella R, Prattichizzo F, Sardu C, Fulgenzi G, Graciotti L, Spadoni T, D'Onofrio N, Scisciola L, La Grotta R, Frigé C, Pellegrini V, Municinò M, Siniscalchi M, Spinetti F, Vigliotti G, Vecchione C, Carrizzo A, Accarino G, Squillante A, Spaziano G, Mirra D, Esposito R, Altieri S, Falco G, Fenti A, Galoppo S, Canzano S, Sasso FC, Matacchione G, Olivieri F, Ferraraccio F, Panarese I, Paolisso P, Barbato E, Lubritto C, Balestrieri ML, Mauro C, Caballero AE, Rajagopalan S, Ceriello A, D'Agostino B, Iovino P, Paolisso G. Microplastics and Nanoplastics in Atheromas and Cardiovascular Events. N Engl J Med. 2024 Mar 7;390(10):900-910. https://www.nejm.org/doi/full/10.1056/NEJMoa2309822.

[15] https://www.nytimes.com/2024/03/09/health/microplastics-sxsw-health-plastic-people.html.

Thank you for your consideration of these comments.

Sincerely,

Terry Shistar, Ph.D.
Board of Directors