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Editorial: Emerging pollutants in the environment: impact and challenges for agriculture and nutritional security

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Editorial on the Research Topic

Emerging pollutants in the environment: impact and challenges for agriculture and nutritional security

The agricultural ecosystem provides food, forage, and energy essential for human well-being. However, in recent years, it has faced numerous challenges in abiotic and biotic stresses, soil and water pollution, and climate change. Besides these factors, several novel harmful chemicals and compounds have been generated, and their increasing concentration is a severe concern for agriculturists. These emerging pollutants (EPs) or contaminants consist of naturally and anthropogenically generated novel compounds such as heavy metals, y-30 electronic wastes, pesticides, biomedical wastes, pharmaceuticals etc. and are not regulated under the current environmental laws. Emerging pollutants are widely distributed, toxic and bioaccumulative, thus impacting the stable ecosystem and ecosystem services. These EPs are produced and intensified anthropogenically and reach water bodies and soil surfaces, where they cause soil and water pollution. Later, their drastic responses were observed in the crucial plant process and functions, ultimately reducing major crops' yield potential. Several scientific reports highlighted these pollutants' causes, effects, and management on the agricultural ecosystem. Due to urbanization, industrialization, and modernization practices, the concentrations of EPs are swiftly increasing in the environment and becoming major contaminants for the living system. The COVID-19 pandemic also brought our attention to anthropogenically generating biomedical wastes emerging as novel EPs. Therefore, it is urgent to manage these EPs through holistic efforts/approaches on their occurrence, intensification, and effect on the biotic and abiotic components of the environment before reaching critical concentrations.

In this context, the topic was edited to combine the current understanding of EPs for their impact and challenges in agriculture. The Research Topic received five research and two review

articles. Heavy metal-related contamination of agriculture farms has raised concerns for yield and sustainability. These EPs have been studied by Hossain et al. in aquaculture farms sediments of the coastal area of the northern Bay of Bengal. Different heavy metals (Cd, Cu, Cr, Mn, Ni, Pb, and Zn) were estimated by the authors from different aquaculture farm sediments and found significantly less contamination of heavy metals. Interestingly enough, authors have tracked the sources of heavy metals, which were found to be anthropogenic. These results indicate the importance of monitoring heavy metal mobility from feed to aquaculture farms to maintain environmental sustainability and prevent heavy metal contamination of our food. Pesticides and pesticidal residue contamination of our food emerged as major problems for agricultural produce. Ren et al. studied fluopyram fungicide residual behavior and dietary risk in cowpea and found its maximum residue limits (MRL) under the permissible value (0.01–1.00 mg/kg) according to europian commission pesticides database. The authors have also included different vegetables and fruits for estimating fluopyram contamination in this study. They found that most contain maximum residue limits under the permissible value of fluopyram for dietary risk and consumption. Therefore, improvement of analysis methods for specific detection of fungicides and such pollutants and broader risk assessment for human consumption and dietary risk are needed for future research, as suggested by the authors.

Contamination of the environment, specifically agriculture, requires management of the EPs. Therefore, mitigation strategies against environmental contamination by EPs include plant growth regulators and resource management to optimize plant yield. Islam et al. highlighted the foliar application of GA3 on mungbean is used as a mitigation strategy to overcome water scarcity and increase the yield contributing factors of the crop. Plant types determine the distribution of light and other natural resources due to differences in their growth habits and development. Zhang et al. highlighted the mechanism of canopy light distribution (CLD) in wheat for proper utilization of light obtained by the crop. CLD affects the plant's photosynthetic performance, ultimately determining the plant's yield. Increased row efficiency of wheat plantation resulted in increased CLD, better photosynthetic performance, and better crop yield. The authors suggested an increase in the expression of proteins associated with photosynthetic machinery at the molecular level responsible for better plant yield. Mbarki et al. investigated the solid waste compost (CO) and farm yard manure (M) remediation potential in sorghum and alfalfa crops for heavy metal and salinity stress. Authors have applied CO and M in the saline soil, which resulted in increased biomass of the crop in the case of M application due to increased nitrogen and potassium ion concentration and decreased sodium ions, reducing the adverse effects of salinity. However, at the higher salinity, CO application improves the nitrogen, potassium, and phosphorus content but cannot reduce the sodium ions resulting in less effectiveness for plant growth. Organic matter supplementation to mitigate heavy metal and other abiotic stresses could be a potential strategy for managing these stresses and increasing crop yield.

Reviewing the prospects of managing anthropogenically degraded land through agroforestry applications, Jinger et al. explained different agrotechnologies and agroforestry interventions that could address this problem. The article provides case studies with agroforestry-mediated reclamation of degraded lands, which is helpful in the context of constantly emerging global land degradation. Khosla et al. reviewed the emerging biomedical waste as a pollutant due to the COVID-19 pandemic. The authors provided insight into the biomedical waste upsurge, the lack of institutional facilities for its disposal, and behavioral changes needed at the organizational level to manage it properly.

In conclusion, the Research Topic provides insight into the ongoing research on various facets of emerging pollutants from agriculture, aquaculture to medical fields. While heavy metal-related contamination has increased in modern agriculture, it risks food contamination with toxic metals. Along similar lines, pesticide residues pose a threat by entering the food system. Scientists and farmers should employ plant growth regulators and other mitigation strategies for optimum crop yield and keeping these contaminants at bay. These practices include integrating well-established methods such as agroforestry to reclaim the anthropogenic degraded land unsuitable for agriculture. Biomedical waste also emerged as a possible contaminant and needed our attention in the post-pandemic scenarios to develop better management practices, infrastructure, and awareness. The challenges in dealing with EPs include a lack of understanding, awareness, and scarcity of scientific studies and methods for their estimation. Progress in this direction will lead the researcher to unravel the mechanisms that will help devise efficient strategies to manage EPs.

Author contributions

RS: Conceptualization, Methodology, Project administration, Visualization, Writing – original draft, Writing – review & editing, Supervision. SP: Conceptualization, Methodology, Validation, Visualization, Writing – original draft, Supervision, Project administration, Writing – review & editing. SS: Investigation, Project administration, Supervision, Visualization, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The author(s) declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

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