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Extent of macro and microplastic pollution in strawberry farms across central region of California, U.S.

DR. EKTA TIWARI AND DR. SEETA SISTLA

California Polytechnic State University

Presenting Author: etiwari@calpoly.edu

Application of single-use plastic in the agriculture sector has increased tremendously, covering millions of acres of land worldwide. U.S. farms are expected to generate nearly 860 million pounds of plastic waste annually, with single-use low-density polyethylene (LDPE) mulches used in row crops contributing a significant amount to total plastic waste. Due to its thin and pliable nature, LDPE mulch tends to stick with soil particles and form aggregates, challenging removal from farm soils and also complicating the potential to recycle recovered mulch material. Further, mulch remains within the soil get fragmented into smaller particles (< 5mm, microplastics (MP)) and may become a serious threat to the environment and human health as these particles accumulate in the agricultural soil environment.

The negative impacts of macro and MP fragments on soil biophysical health have become a topic of interest for the scientific community. But how these changes relate to the extent or duration of plastic mulch use remains unknown. Therefore, monitoring the abundance of plastic particles in the agricultural soil system should be the first crucial step in addressing these knowledge gaps. To address this knowledge gap, we explored the abundance and composition of both macroplastic and MP fragments in different strawberry farms which employed LDPE mulch across the central region of California, U.S. The concentration of macroplastic fragments ranged from 3909 ± 614 particles/ha to 213500 ± 33730 particles/ha in surface soil following normative mulch removal. Our preliminary data suggests the MP concentration reached 352 ± 36 particles/kg dry weight of soil; we are currently exploring the relationships between plastic concentration and a suite of soil biogeochemical traits. Polyethylene was found to be the dominant polymer type among extracted macro/microplastics, confirming mulches can be a major source of plastic pollution in agricultural fields. This study provides baseline data to understand the extent of plastic pollution in the U.S. agriculture system and can help improve land management practices by assessing the biogeochemical consequences of plastic accumulation in agricultural soils.