Practice Abstract n°5 : Agricultural plastics, a potential threat due the risks of soils pollution by microplastics. Defining the problem

Agricultural plastics include both conventional fossil-based and biodegradable alternatives used in crop and livestock production. Biodegradable plastics are certified to international standards, ensuring they break down into harmless components. Bioplastics, made from biological raw materials, offer a sustainable alternative with a lower carbon footprint. Despite these benefits, concerns remain about MNPs residuals in soil.

1. Functionalities and composition of modern agricultural plastics

Today's agricultural plastics cover a wide range of products used in crop and livestock production, offering solutions tailored to the specific needs of each application (resistance to UV and agrochemicals, microclimate regulation, reduce inputs, help with soil disinfection or irrigation). Among these products, greenhouse and tunnel films play a central role in protecting crops while improving yields and product quality. Mulch films and fumigation films are also commonly used in agriculture. Bio-based/biodegradable agricultural plastics have been developed for a variety of agricultural uses, responding to the growing demand for environmentally friendly solutions. However, confusion about biodegradable mulching films persists: these materials, treated with pro-oxidant additives, undergo accelerated fragmentation under the effect of UV and heat, but their biodegradability in soil remains unproven.

2. The dynamics of the agricultural plastics market

- **+ 33 Mt**
  Global Plastic Production
  (2016 - 2019)
- **(-)5 Mt**
  EU Plastic Production
  (2016 - 2019)
- **EU Consumption**
  40.5% Global Market Share

The Covid-19 pandemic led to a stagnation in global plastics production in 2020, but gradual recovery in growth was observed from 2021 onwards, with high use of agricultural films for crop production, particularly in southern Europe.

Plastics recycling remains a major challenge, with a large proportion of plastics collected not being reused as part of a circular economy.

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3. The role of agricultural plastics in MNP generation

Soil contamination by microplastics can result from human activities, including the various uses of agricultural plastics. This contamination poses a risk to the ecosystem, disrupting natural nutrient cycles, affecting biodiversity and living soil organisms' health. Best waste management practices and sustainable materials have to be used and promoted. Agri-specific biodegradable plastics have to be designed, while collection and recycling practices must be improved.

4. Risk of soil pollution by MNP from Plastic Additives (PAs)

Agricultural Plastics coming from conventional single-use PAs or introduced through fertilizers are a significant source of MNP in soils. Other MNPs indirect sources are compost and biosolids or sludge, organic fertilizers and wastewater. These "environmentally friendly" practices contaminate the soils, potentially carrying MNPs of non-agricultural origin. A Source-Pathway-Receptor-Consequence-approach using the Red-Amber-Green method has been developed, measuring the PAs impact on sustainability, their leakage potential and effect on the ecosystem. The quantitative data on soil pollution by MNPs comes mainly from China, although similar situations are observed in other countries. The complexity of identifying specific sources of MNP makes the management of soil pollution by agricultural plastics even more complex.

As a reminder, biodegradable plastics are not immune to MN particles generation in soil. On the other hand, their Biodegradation in soil is dynamic, which avoids MNPs' accumulation.

5. Conclusion

The higher use of PAs in agriculture raises soil pollution concerns. Despite the controversy between a positive economic impact and possible negative environmental impacts, there is no official (statistical) registration available of AP and AP waste at national or European level. An integrated approach based on innovative product design, APW end-of-life management and valorization, innovative certified biodegradable APs in soil and/or organic recycling, combined with restrictions on MNPs in fertilizers, is a way forward to help solve this complex problem.

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