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Effect of plastic mulching on the accumulation and distribution of macro and micro plastic particles in the soil - A case study of two farming systems in North West China

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Plastic mulching is a common farming practice in arid and semi-arid regions. Inappropriate disposal of plastic films can lead to the contamination of macroplastics (MaPs) and microplastics (MiPs) in the soil. To study the effects of plastic mulching on the contamination of soil with MaPs and MiPs and the role of farm management on this contamination, research was done on two farming systems in Northwest China, where plastic mulching is intensively used. Farming in Wutong Village (S1) is characterized by small plots and low-intensity machinery tillage while farming in Shihezi (S2) is characterized by large plots and high-intensity machinery tillage. Soils were sampled to a depth of 30 cm and analysed. The results showed that MaPs ranged from 30.3 kg·ha⁻¹ to 82.3 kg·ha⁻¹ in S1 and from 43.5 kg·ha⁻¹ to 148 kg·ha⁻¹ in S2. The main macroplastics size categories were 2-10 cm² and 10-50 cm² in S1 and < 2 cm² and 2-10 cm² in S2. In S1, we found that 6-8 years of continuous mulching practice resulted in the accumulation of more MaPs as compared to the use of intermittent mulching over the span of 30 years. For S2, 6 to 15 years of plastic mulching use led to MaPs accumulation in fields but from 15 to 18 years, the MaPs number and content in soils dropped due to further fragmentation of the plastic and its dispersal into the environment. MiPs were mainly detected in fields with > 30 years of mulching use in S1 and discovered in all fields in S2, this indicated that long-term cultivation and high-intensity machinery tillage could lead to more severe microplastic pollution. These results emphasized the impacts of farm management on the accumulation and spread of MaPs and MiPs in the soil and regulations are needed to prevent further contamination of the soil.