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Effect of different paddy soil management strategies on production and surface water and groundwater quality in Lomellina (northern Italy)

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Abstract. Enhancing the sustainability of rice cultivation is a significant challenge in Lomellina's monoculture systems in northern Italy. This study aimed to evaluate the impact of various agronomic practices on crop productivity and the quality of the final grain, as well as the environmental fate of pesticides.
In a two-year field trial, four treatments were compared in separate experimental paddy fields: liming, compost application, green manure incorporation (*Vicia villosa* and *Lolium multiflorum*), and an untreated control. To monitor pesticide dynamics, water samples of irrigation inflow, paddy water and soil pore water (at 15 and 70 cm depth through porous cups) were collected at seven time points during cultivation. Soil samples were characterized before and after each cropping season. The four fields were moreover characterized from a hydrological point of view by opening a soil profile and determining the hydraulic parameters on soil samples taken, conducting infiltration tests, and measuring the groundwater level in two piezometers.
Green manure and compost produced the best results in terms of yield in 2025. Conversely, a temperature drop in September 2024 negatively affected these higher vigor treatments. The incorporation of green manure was associated with increased total arsenic concentration in white rice, although further investigation is required to confirm this finding.
Regarding the dynamics of pesticides in soil and water, azoxystrobin emerged as the most critical compound in water, whereas glyphosate and its metabolite AMPA remained below the detection limit in all samples collected. Overall, no significant effect of the treatments on the behavior of the monitored pesticides was observed.

Keywords: agronomic practice, pesticide fate, yield, rice grain quality, water sampling