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Agropollutants fate in the fields scale

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Pesticides are used worldwide to support food security for the growing world population. In Israel thousands of tons of pesticides are applied every year and find their way to the entire catchment: soil, surface water, interflow and groundwater. In addition, the treated waste water applied for irrigation convey pharmaceuticals that are distributed in the catchments as well. Previous studies focused one or a few pollutants, which limit the scope of the chemical features on the pollutants fate. Other research focused a certain flowpaths: the stream and tributaries, or groundwater pollutants. This study provides a wide scope of the all 3 main flowpaths (surface water, interflow, groundwater) and the fate of over 70 pesticides in the field scale, including time series in short temporal resolution for groundwater and interflow.

The study took place during irrigation (Apr 2021) and during winter 2022, focusing two winter storms (Jan 2022). The study fields border the Kishon, the 2nd largest coastal stream in Israel. Both fields have subsurface drainage system to address high water level and bad drainage soils. The subsurface drainage system provides direct approach to the subsurface water. Water collected from the pipe outlet of the system represent subsurface, but also from manholes, which are the approach to the subsurface system. Groundwater was collected from piezometers to deep and shallow aquifers in both fields, according to accepted protocol for ground water sampling, utilizing a metal bailor. Surface water was collected from field surface, applying RCU-Runoff Collector Units and also from secondary and primary surface drainage trenched in the field. All water were collected in glass bottles, and were analyzed by LC/MS.

In this study the spatial distribution in the field scale was demonstrated, including the vertical direction. Samples that were collected from surface water, interflow and groundwater show the dominant flowpath of each compound, where the chemical characteristics were critical to obtain the compound pathway. For example, imidacloprid was applied only a few weeks before the storm and found in high concentration in surface water. Interflow water collected from subsurface drainage system show imidacloprid concentrations which are order of magnitude lower for the entire winter. On the other hand, diflufenican was applied more than two years ago was found in high concentration in surface water, as a result of low degradability and low mobility, yet subsurface concentrations were negligible. Both compounds were in high concentration near the

application area (onion section of the field). Time series (interflow, groundwater) were key data, where taken before, during and after water enter soil column during irrigation or a rain event. All data clustering analysis, showing pairs of compounds vs each other was operated. A clear clustering, in most cases, fit the spatial distribution establishing 4 groups: 1. surface runoff from field and all trenches 2. Subsurface water pipe (and manholes in most cases) 3. Groundwater 4. Stream

This research provides a large data base, including temporal and spatial point of view which are innovative and provide a comprehensive scope for field-scale processes.