



Impact of orchard and tillage management practices on soil leaching of atrazine, potassium, magnesium, manganese, iron, ammonium, nitrates and phosphates

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The experiments were carried out on an Orthic Luvisol developed from loess, over limestone, at the experimental field of Lublin Agricultural University in Felin (51°15'N, 22°35'E), Poland.

The investigation deals with the problems of leaching's rate of atrazine (2-chloro-4-ethylamino-6-isopropylamino-1,2,3-triazine), potassium, magnesium, manganese, iron, ammonium, nitrates and phosphates from two management systems of soil: (i) conventionally tilled field with main tillage operations including stubble cultivator (10 cm) + harrowing followed by mouldboard ploughing to 20 cm depth, and crop rotation including selected cereals, root crops and papillionaceous crops, (ii) 35-year-old apple orchard field (100x200m) with a permanent sward that was mown in the inter-rows during the growing season. The conventionally tilled plot was under the current management practice for approximately 30 years. Field sites were close to each other (about 150 m). Core samples of 100 cm³ volume and 5 cm diameter were taken from two depths 0-10 cm and 10-20 cm, and were used to determine the soil water characteristic curve.

It was observed that management practices impacted on the physic-chemical properties of soils. pH (in H₂O) in tilled soil ranged from 5.80 to 5.91. However soil of orchard soil revealed higher values of pH than tilled soil and ranged from 6.36 to 6.40. The content of organic carbon for tilled soil ranged from 1.13 to 1.17%, but in orchard soil from 1.59 to 1.77%. Tillled soil showed broader range of bulk density 1.38-1.62 mg m⁻³, than orchard soil 1.33-1.34 mg m⁻³.

The first-order kinetic reaction model was fitted to the experimental atrazine, potassium, magnesium, manganese, iron, nitrates, ammonium and phosphates leaching vs. time data. The concentrations of leached chemical compounds revealed linear curves. The correlation coefficients ranged from -0.873 to -0.993. The first-order reaction constants measured for the orchard soils were from 3.8 to 19 times higher than calculated in tilled soils. Half time of studied substances in tilled soils ranged from 2.55 to 8.71 h, but in orchard soils these parameters were significantly lower and ranged from 0.22 to 0.49 h. It seems that managements practices significantly influences on the rates of leaching for all investigated compounds.