

## Impact of Seed Treatment with Neonicotinoids on Soil, Plants, Bees and Hive Products

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### Abstract

This paper presents studies performed for the monitoring of imidacloprid, clothianidin and thiamethoxam residues applied as seed treatment in rapeseed (*Brassica napus* ssp. *Oleifera*), maize (*Zea mays*) and sunflower crops (*Helianthus annuus*). The experiments were located in representative areas of the mentioned crops. Residue levels were determined in plant samples at different phenological development stages, including flowers, as well as in bees and hive products (pollen, honeycomb, honey) by liquid chromatography/tandem mass spectroscopy (LC-MS/MS). The analyses were performed in ISO 17025-accredited laboratories, referring to the limit of quantification (LOQ), characteristic of the method used to determine the residues. In 2019, the percentage of samples that contained residues of the three substances, applied to the seed, was 16.39%, representing 20 samples out of the total of 122 analyzed samples. In 2020, 10 samples contained neonicotinoid residues above the LOQ, including 5 soil samples and 5 plant samples, representing 6.17% of the total samples. In 2021, from 149 samples with neonicotinoid applied as seed treatment, residues were identified in 12 soil samples and 11 plant samples, representing 15.43% of the total number of samples. In 2022, only 12 soil samples and 1 pasture sample contained residues above the LOQ. The results show that the highest percentage of samples with residues above the LOQ was recorded by the soil samples, while the flower and bee samples had the lowest percentages of samples with residues above the LOQ; no residues of the three neonicotinoid substances were identified in the honey samples.

**Keywords:** monitoring; neonicotinoids; residues; oilseed rape; maize and sunflower; hive products