

Sources and fates of perchlorate in soils in Chile: A case study of perchlorate dynamics in soil-crop systems using lettuce (*Lactuca sativa*) fields.

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Perchlorate occurs naturally in the environment in deposits of nitrate and can be formed in the atmosphere and precipitate into soil. However, little is known about the occurrence and levels of perchlorate in soils and fertilizers in Chile and its impacts on agricultural systems and food safety. In this study, concentrations of perchlorate were determined in 101 surface soils and 17 fertilizers [nitrogenous (n = 8), nitrogen-phosphorous-potassium (NPK; n = 3), phosphate (n = 2) and non-nitrogenous (n = 4)] collected across Chile from 2017 to 2018. Our results show that perchlorate was detected mainly in agricultural soils (mean: 0.32 ng g⁻¹), grassland rotation sites (0.41 ng g⁻¹) and urban locations (0.38 ng g⁻¹). Interestingly, elevated concentrations of perchlorate (9.66 and 54.0 ng g⁻¹) were found in agricultural soils. All fertilizers contained perchlorate: nitrogenous fertilizers (mean: 32.6 mg kg⁻¹), NPK (mean: 12.6 mg kg⁻¹), non-nitrogenous fertilizers (mean: 10.2 mg kg⁻¹) and phosphates (mean: 11.5 mg kg⁻¹). Only one type of nitrogenous fertilizer (KNO₃: 95.3 mg kg⁻¹) exceeded the international regulation limit (50 mg kg⁻¹). For two agronomic practices, the content of perchlorate in lettuce increased as the fertilizer application rate increased, with fertigation promoting a more significant accumulation. However, the concentrations generally remained below regulatory values. Our results suggest that fertilizers constitute an important source of perchlorate in soils. © 2020 Elsevier Ltd

Fertilizers

Food safety

Perchlorate

Soil contamination

Agricultural robots

Agriculture

Nitrogen fertilizers

Potash

Potassium Nitrate

Soils

Urban growth

Agricultural soils

Agricultural system

Agronomic practices

Elevated concentrations

Fertilizer applications

International regulations

Nitrogen phosphorous

Urban locations

Phosphate fertilizers

nitrogen

perchlorate

phosphate

phosphorus

potassium

fertilizer

perchlorate

agricultural soil

concentration (composition)

environmental fate

leafy vegetable

nitrogen

perchlorate

soil-vegetation interaction

source identification

Article

bioaccumulation

Chile

concentration (parameter)

controlled study

cropping system

fertigation

fertilizer application

food intake

grassland

health hazard

human

lettuce

nonhuman

population exposure

soil pollution

urban area

vegetable

agriculture

soil

Chile

Lactuca

Lactuca sativa

Agriculture

Chile

Fertilizers

Lettuce

Perchlorates

Soil