European Commission

Science for Environment Policy

Grazing cows may pick up persistent organic pollutants from soil or surroundings

10 January 2019
Issue 519
Subscribe to free weekly News Alert

Soil is an overlooked source of persistent organic pollutants (POPs) for grazing cows, finds a new study of contaminated farms in Switzerland. The researchers tested a new modelling tool to track two specific environmental POPs — known as polychlorinated biphenyls (PCBs) and dioxins (PCDD/Fs) — as they moved from the farm environment into a cow's body over time. The tool could be used to assess measures designed to decontaminate animals or to prevent contamination, such as grazing regimes that aim to reduce the risk of cows eating soil accidentally.

PCBs and PCDD/Fs are toxic to humans and animals. PCBs are banned, and the release of PCDD/Fs is restricted under both the Stockholm Convention and the EU's POPs Regulation. However, they remain in the environment for many decades, where they can be ingested by animals that are subsequently consumed by humans.

In Switzerland, as in other industrialised countries, some PCBs (and occasionally PCDD/Fs) are often found in meat and dairy products at levels above EU and Swiss regulatory limits[1]. This is both a health and economic concern; in cases of excessive contamination, livestock are slaughtered and products destroyed at the cost of the farmers.

This study focused on two farms in Switzerland which were hosting cattle known to be highly contaminated by PCBs and PCDD/Fs. It investigated the source of this contamination, with a particular focus on dioxin-like PCBs (dl-PCBS — PCBs that have similar toxic effects as dioxins) and their fate in the cattle. One farm was known to be polluted by diffuse sources, whereas the other contained a stable coated in PCB-containing paint.

The researchers measured PCB and PCDD/F contamination in the animals' feed, including concentrate and grass, and soil on the farms over a three-year period. They also measured levels in cows' blood, milk, and fat for both adults and calves. These results were combined with results of a new model that tracked the flow of these contaminants from different sources through to different parts of a cow's body over the 48 months post-birth. The researchers used the model to predict the level of contamination a cow would face over a ten-year period.

Grass was shown to be the main source of dl-PCBs for mother cows, whereas concentrate contained negligible levels. This suggests that farmers should ideally grow grass in fields that are least contaminated, or supplement grass with low-contaminated concentrate, or with grass/hay from non-contaminated land. The second biggest source was soil — a less obvious source, as it is only eaten unintentionally. Farmers with contaminated land could therefore consider grazing cows on longer grass, or lowering the density of cows, to reduce the risk of cows eating grass low to the ground.

Continued on next page.

Source: Bogdal, C., Züst, S., Schmid, P., Gyalpo, T., Zeberli, A., Hungerbühler, K., & Zennegg, M. (2017). Dynamic Transgenerational Fate of Polychlorinated Biphenyls and Dioxins/ Furans in Lactating Cows and Their Offspring. *Environmental Science & Technology*. 51(18): 10536–10545. DOI: 10.1021/acs.est.7b02968.

Contact:
christian.bogdal@chem.ethz.ch

Read more about:
Agriculture, Chemicals, Soil

1.Commission Regulation (EU) No 1259/2011 as regards maximum levels for dioxins, dioxin-like PCBs and non dioxin-like PCBs in foodstuffs https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32011R1259

European Commission

Science for Environment Policy

Grazing cows may pick up persistent organic pollutants from soil or surroundings

(continued)

The researchers say that the model is useful for predicting the effectiveness of measures to reduce or avoid contamination, such as moving cows to less-contaminated and remote mountain pasture over the summer. This is a traditional practice in the Alps, and is shown to reduce dl-PCB contamination by 50% in calf blood and 9% in cow blood over a three-month period.

The study also demonstrated the importance of quickly removing sources of contamination; it indicated that removing the PCB-containing paint from the stable would lead to a reduction in dl-PCB levels in milk by a factor of 2.5 in a single year. This would lower dl-PCB contamination from 6 to 2.4 picograms (pg) per toxic equivalency (TEQ) per gram of fat (pg TEQ/g)[2] — thus bringing it below the regulatory limit of 5.5 pg TEQ/g for all PCDD/Fs and dl-PCBs.

10 January 2019
Issue 519
Subscribe to free weekly News Alert

Source: Bogdal, C., Züst, S., Schmid, P., Gyalpo, T., Zeberli, A., Hungerbühler, K., & Zennegg, M. (2017). Dynamic Transgenerational Fate of Polychlorinated Biphenyls and Dioxins/Furans in Lactating Cows and Their Offspring. *Environmental Science & Technology*. 51(18): 10536–10545. DOI: 10.1021/acs.est.7b02968.

Contact:
christian.bogdal@chem.ethz.ch

Read more about:
Agriculture, Chemicals, Soil

2. Dioxins and dl-PCBs are measured in units of toxic equivalency (TEQ) in toxicity assessments to make their toxicity comparable. This study used the TEQ values set by the WHO in 2005 and as used by Commission Regulation (EU) No 1259/2011.