

Science for Environment Policy

German soil monitoring programme could assess impacts of GM crops

Effective regulation of genetically modified organisms (GMOs) calls for monitoring of the potential environmental risks. This study explored whether the German permanent soil monitoring programme could be a useful tool for this purpose. The researchers say the programme has potential to monitor the effects of GMOs on local soil communities, but that adaptations would be necessary.

The first genetically modified plant was produced in 1983¹. Since then, the ability to modify DNA has advanced further, and genetic engineering now has many agricultural applications. It has enabled farmers to breed crops that are resistant to disease and tolerant to herbicides, for example.

However, concerns regarding the potential effects of GM crops have led to intense regulation on their release. In Europe, all food or feed that is made up of more than 0.9% GMOs must be labelled. Furthermore, the European Directive² on the deliberate release of GMOs into the environment states that monitoring of potential adverse effects on human health or the environment must be carried out once a GMO is placed onto the market. It also states that data from existing monitoring networks should be used, where suitable.

In this study, researchers asked whether the German permanent soil monitoring programme (PSM) — which monitors the condition of soils in Germany to detect harmful changes — could fulfil this latter requirement, and contribute to GMO monitoring. To answer this question, the authors addressed four key issues, the first of which was the relevance of the programme's site and soil measurement parameters.

They found that the programme focuses on environmental and soil measurements at the expense of biological parameters. Datasets contain minimal soil biological data and lack data for most organism groups. The authors say existing data on the occurrence of soil organism groups is therefore insufficient for GMO monitoring.

The authors next asked whether the sites are representative of the major regions of Germany. While they say PSM sites are representative of different soil types and ecological regions in Germany, information on some habitat types is missing.

As previous exposure to GMOs could preclude sites from being used in a monitoring programme, the researchers then investigated potential contact with GM crops. As the only GMO which was grown on a large scale in Germany (until its cultivation was prohibited in 2009), they used the insect-resistant maize variety MON810 as an example, and assessed exposure in four federal states.

As data is not available on where GM crops have been cultivated on PSM sites, the researchers measured the external influence of GM crops, via pollen dispersal. Using pollen dispersal radii of 50, 150 and 1000 metres (reflecting various European buffer zone regulations), the authors investigated the distribution of PSM sites and MON810 field sites in the federal states. Only 3.7% of sites were likely to have been exposed to GMOs, all of which were located in Brandenburg.

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1. Source: University of Michigan, US. See: <http://www.globalchange.umich.edu/globalchange2/current/workspace/sect008/s8g5/history.htm>

2. Directive 2001/18/EC. See: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32001L0018>

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Brandenburg had the most intense MON810 cultivation in the past and 20% of PSM sites located within the State had been exposed to this maize variety. However, in the remaining three states, MON810 cultivation was much lower and none of the PSM sites were exposed. Based on this example, the researchers suggest that potential future intensification of GMO cultivation in Germany would likely expose more PSM sites on arable land to GMOs. To be able to use PSM sites as reference sites for GMO monitoring, the authors say exposure must be prevented, by prohibiting GMO cultivation on PSM sites and setting up GMO-free 'buffer zones' for example.

Overall, the authors say the programme provides a good basic framework for monitoring the effects of GMO on soil communities due to the vast existing network (almost 800 sites), measurement of basic parameters needed for such a monitoring programme, and representation of different soil types and eco-regions.

The researchers say PSM sites should be used to develop reference values, for the abundance of relevant species of soil organisms for example. Based on these reference values, threshold values should be defined, to describe the limit of acceptable change to soil organisms for instance. However, this would require standardised methods to characterise sites and sample selected soil organism groups.

As the various federal state PSM programmes currently differ in their data collection, management and evaluation, there is a need for harmonisation, including establishing standards for data management. The authors also say sites should be selected in a way that allows integration with European monitoring programmes.

Although these findings were made based on a German case study, the researchers say the recommendations are useful for biological soil monitoring in general. They also directly relate to the implementation of the European Directive concerning the release of GMOs, providing recommendations for implementing the monitoring it requires.

