EFFECTS OF PLANT PROTECTION PRODUCTS ON HUMANS, ANIMALS AND ECOSYSTEMS: REVIEWING THE EVIDENCE

Understanding what we already know about the effects of plant protection products, also known as pesticides, on human, animal and ecosystem health is key to SPRINT's ability to build on the science. To do this, in collaboration with the CAMRADES group, SPRINT partners have developed the data platform SPRINT-SOLES to visualise and analyse all the relevant existing research.

Using this, SPRINT partners have written a series of scoping reviews, giving us a clear idea of the state of the research on the health impacts of pesticides.

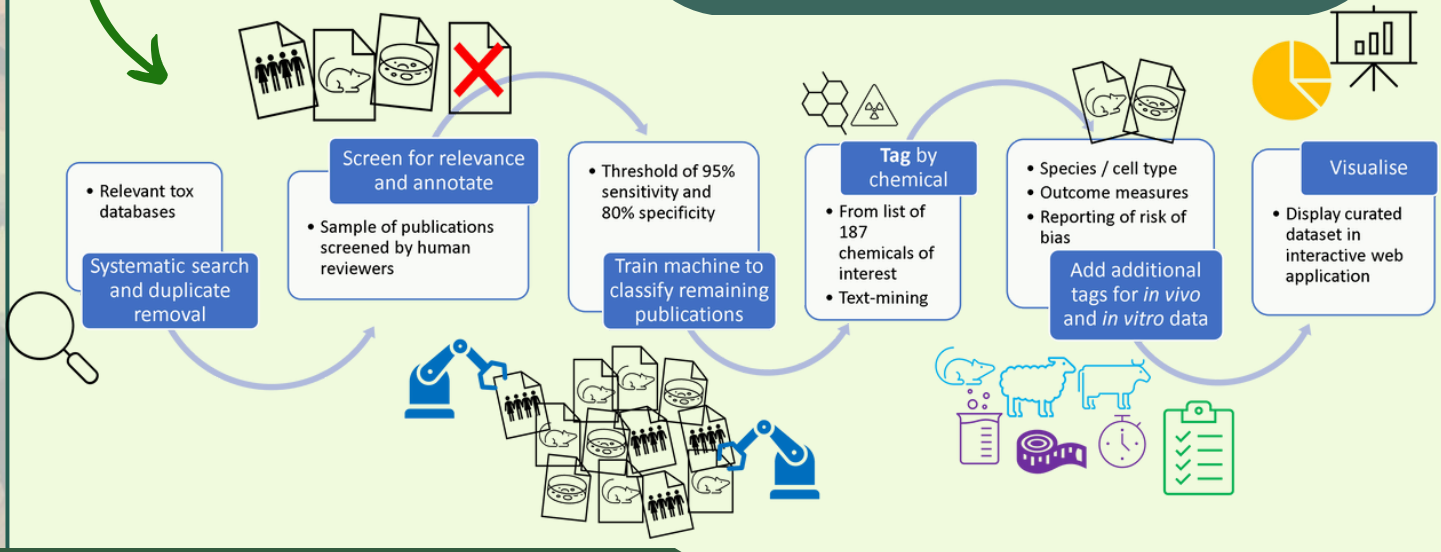
The Method

Each review used the PRISMA scoping review methodology. The authors developed SPRINT SOLES, a data mining platform using machine learning to retrieve published articles that describe the effect of pesticides on health outcomes, comprehensively map the available evidence, and identify gaps in knowledge. SPRINT SOLES is available for use online here.

SPRINT SOLES

Developed with the CAMRADES group, this online tool is for the systematic review and meta-analysis of data from experimental studies on pesticides. The searchable database contains over 300,000 studies on pesticides published since 1951. It generates clear charts helping us understand which pesticides have been studied most, and in what organisms. Relevant research is collected and processed using this workflow:

How does SPRINT-SOLES work?



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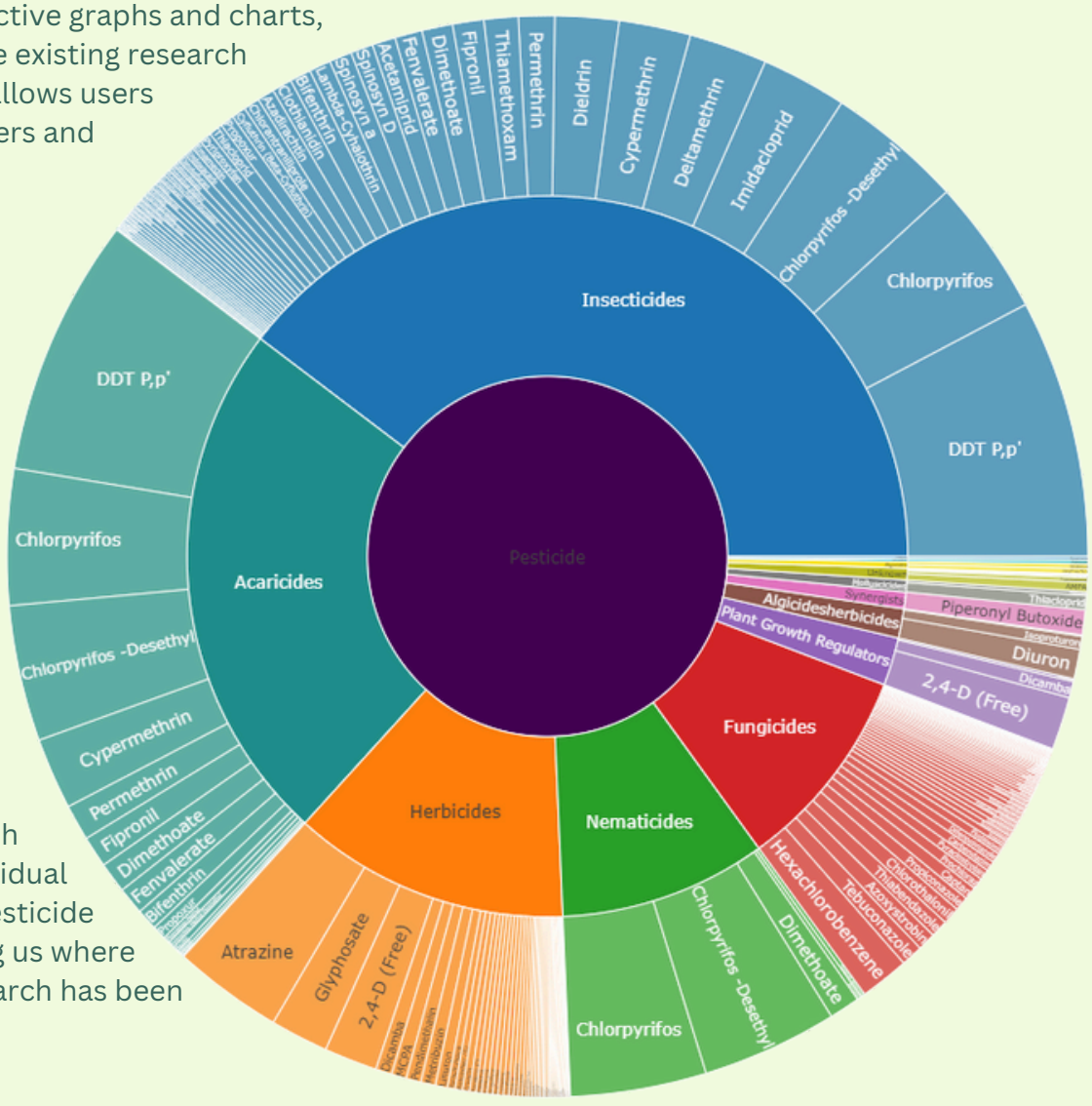
SPRINT
SUSTAINABLE PLANT PROTECTION TRANSITION

In the live version of SPRINT-SOLES, accessible here, you can create interactive graphs and charts, to visualise all the existing research on pesticides. It allows users to input parameters and see the results of the analyses dynamically.

This can help us understand how the existing body of research is spread across different subject areas. For example, the chart generated (right) indicates the spread of research on different individual pesticides and pesticide categories, telling us where the focus of research has been since 1951.



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Using SPRINT-SOLES, SPRINT researchers wrote three systematic scoping reviews collecting together and synthesising all the existing literature on the effects of pesticides on humans, animals, and plants. This allowed us to to gain a firm understanding of the existing science and inform our work going forwards.

Findings

Human Health:

The largest evidence base links maternal (and to some extent paternal) exposure to pesticides with adverse effects on birthweight, malformations, fertility, and cognitive/behavioural development in early life. Limited evidence suggests potential effects on blood cancers, breathing, and chronic kidney disease.

Inconsistent or insufficient findings are reported for neurogenerative and cognitive diseases, mental health effects, non-cancer blood diseases, immune system, and gut microbiome. There are significant gaps in knowledge on currently licensed non-persistent pesticides, and a lack of studies on pesticide mixtures, a subject at the core of SPRINT's work. Future research should focus on the later-life effects of perinatal pesticide exposures of children.

Farm Animal Health:

Inadequate studies exist for cattle, goats, pigs, chickens, and sheep to draw conclusions about the effects of pesticide exposure through feed or the environment. Most available research emphasizes the efficacy of pesticides for parasite or infection control. Experimental findings reveal effects of pesticides on the gut microbiome in animals.

Ecosystem Health:

Aquatic ecosystem studies show strong evidence of pesticide impacts on non-target species, causing lethal and sublethal effects at various biological levels. Terrestrial ecosystem studies indicate pesticide effects on enzymatic activity in microbiota, with additional impacts on plant growth, reproduction, and community abundance in soil invertebrates.

More research is required on the effects of pesticide mixtures on terrestrial ecosystems, and more field testing is needed to better comprehend real-world complexities of pesticides in ecosystems as many studies are currently conducted in the lab.

Review Conclusions

Overall, pesticides encompass a diverse group of biologically active substances with varied impacts on human, animal, and ecosystem health. Confirmation of these impacts, especially for new non-persistent pesticides, is crucial. Future research should focus on these currently licensed non-persistent pesticides, using established exposure assessment methods.

Effects of pesticides on non-target species are due better research, particularly considering mixtures at realistic doses in real-world situations such as in house-dust. Finally, integrating the various streams of evidence on pesticides will be vital for gaining a comprehensive understanding of the effects of pesticides on human, animal and ecosystem health.

Based on: Deliverable 3.1 Plant protection product effects on human, animal and ecosystem – systematic scoping reviews

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