Fast-track to failure

Will new GMOs reduce pesticide use?... NO!

THE EVIDENCE IS CLEAR, NEW GM CROPS WILL NOT REDUCE PESTICIDE USE

BRIEFING | May 2022

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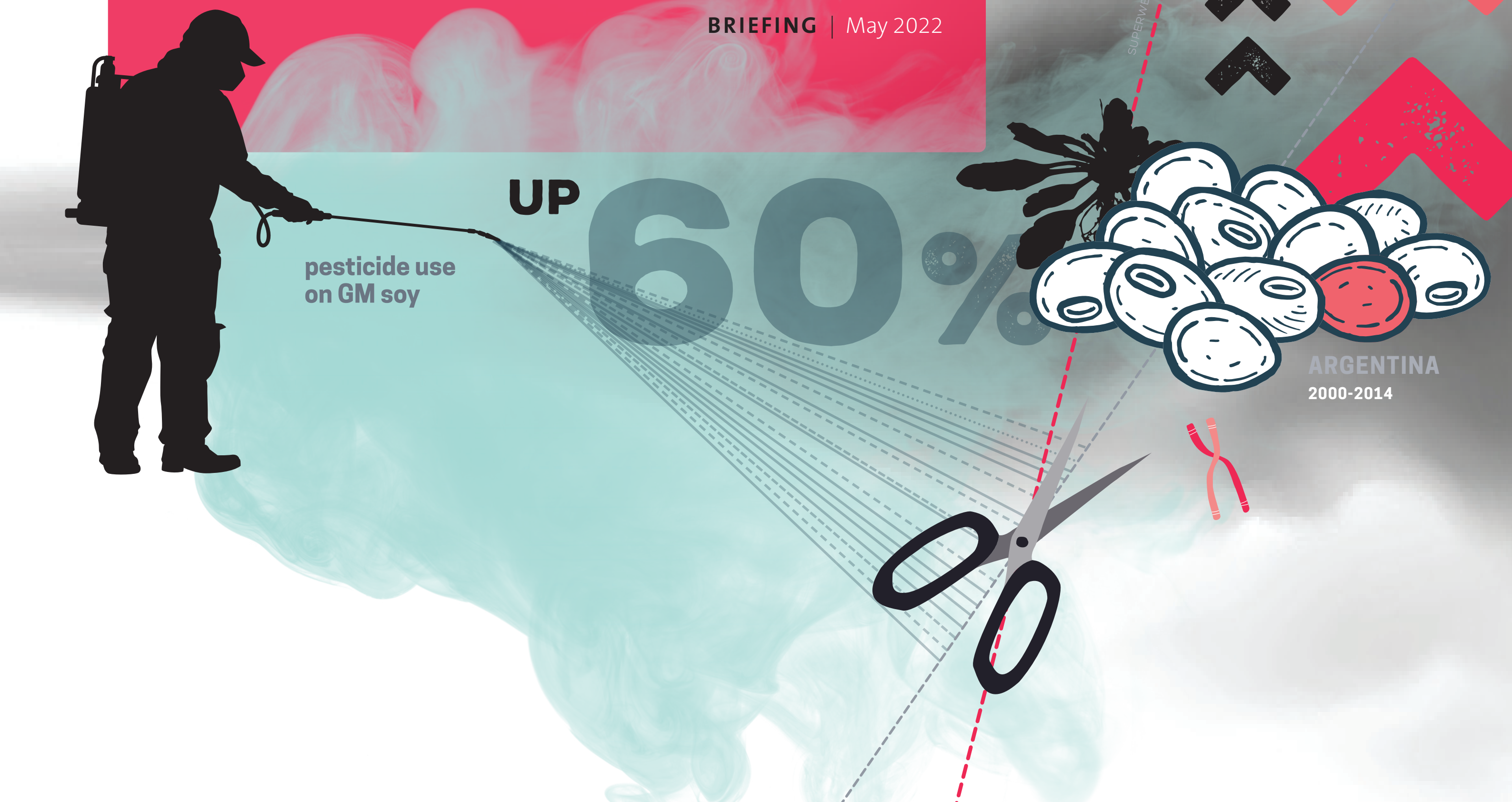

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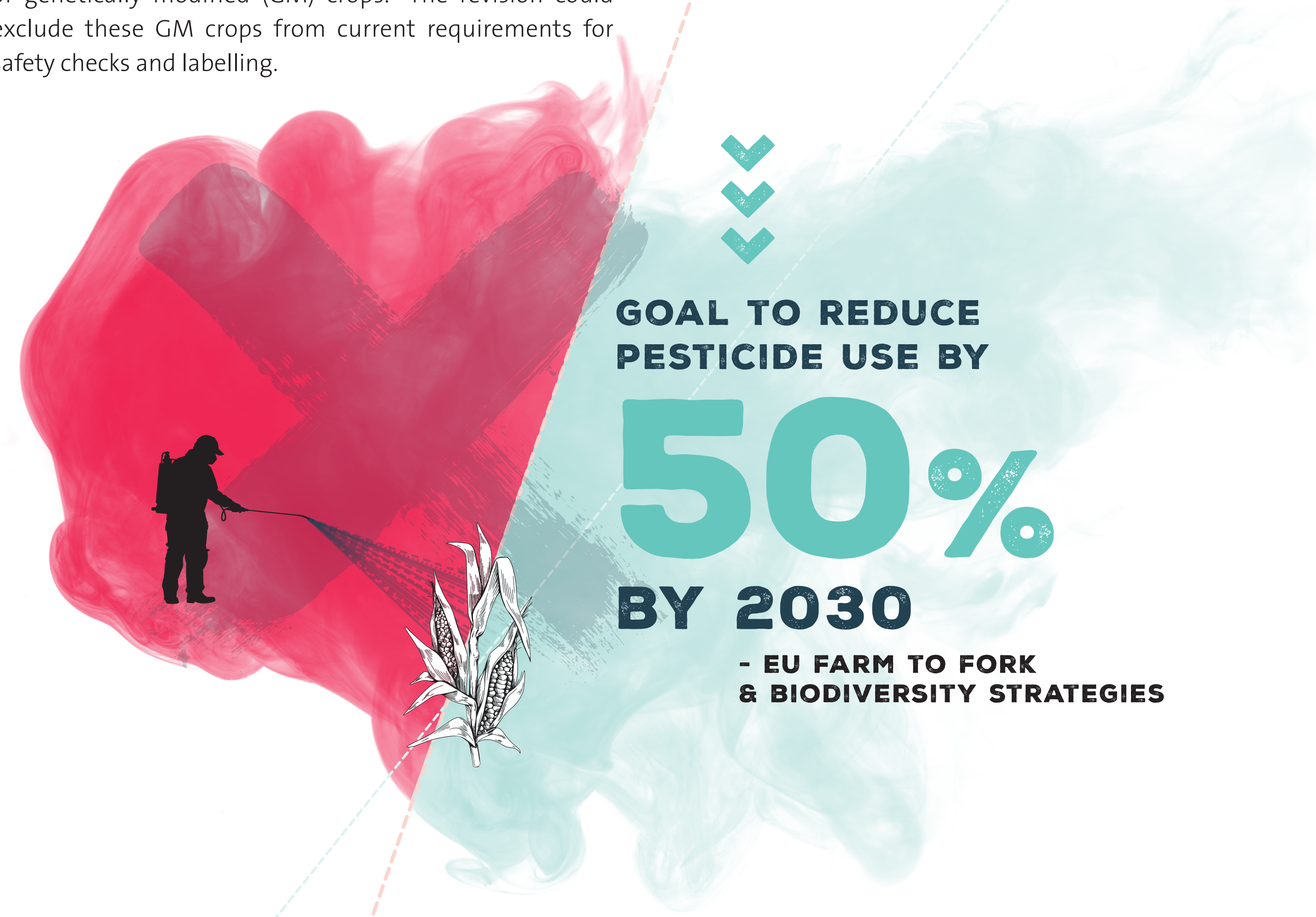
Summary

Reducing pesticide use by 50% by 2030 is a central goal of the EU Farm to Fork and Biodiversity Strategies, which aim to improve the sustainability of the food and farming systems and reverse environmental degradation.[1]

The health branch of the European Commission, DG SANTE, claims that crops produced with new genetic modification techniques, also called new genomic techniques, can help achieve that.[2] The Commission has launched a revision of the EU's GMO regulations – which it calls "not fit for purpose" – to speed up the roll-out of this new generation of genetically modified (GM) crops.[3] The revision could exclude these GM crops from current requirements for safety checks and labelling.

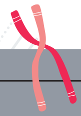
This briefing examines the history of first-generation, currently grown GM crops, as well as the new GM crops that are commercialised and in the pipeline. Based on the evidence, new GM crops will not reduce pesticide use. Some are even designed to increase it.



European debate on pesticide reduction heats up

EU governments were asked to reduce their pesticide use as far back as 2009, but implementation of the Sustainable Use of Pesticides Directive[4] failed widely and it is now slated for revision.[5] In March 2022, the EU Commission even delayed its proposal on binding reduction targets. The urgency of shifting away from the use of synthetic pesticides has wide societal, political and scientific consensus.

Scientists warn that chemical pollution has exceeded safe limits for humanity, threatening the stability of global ecosystems.[6] A wide range of civil society organisations are asking for the new legislation to "exclude the incentivisation of precision farming and genetic engineering techniques, which will only maintain an industrial farming model and structural dependency on pesticides."[7]



PLANT BREEDING: OVERSIMPLIFIED SOLUTIONS DON'T LAST

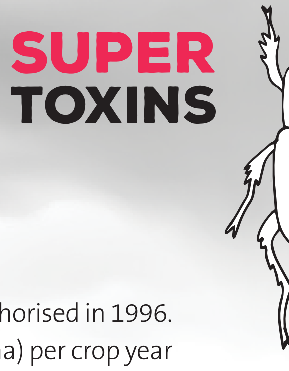
Plant breeders wish to achieve broad-spectrum and long-lasting pest and disease resistance, to which pests and pathogens cannot easily adapt. These are genetically complex traits, involving many genes acting in networks, which cannot be conferred by manipulating one or a few genes through genetic modification. Pests and pathogens evolve rapidly to escape narrowly targeted methods, which is why attempts to genetically engineer pest and disease resistance into plants have failed or proven short-lived.[8]

SCIENTISTS WARN THAT

CHEMICAL POLLUTION HAS EXCEEDED SAFE LIMITS FOR HUMANITY

THREATENING THE STABILITY OF GLOBAL ECOSYSTEMS

First-generation GM crops have increased pesticide use



First-generation GM crops were introduced over 20 years ago with the same promises of pesticide reductions[9] that are now being made for new GM crops. However, the data show that this first-generation of GM crops has increased pesticide use in countries where they are widely grown.

The huge majority of GM crops are either

- **Herbicide tolerant**, which means they are modified to survive pesticide spraying, while other plants and weeds are harmed;
- **Insect-resistant**, which means they are modified to produce a toxin that mitigates the harm caused on them by plant pests.

In both cases, either weeds from the GM crop's ecosystem or plant pests have in their turn evolved to become resistant or tolerant.

Other promises to adapt plants to droughts, or changes in their composition did not work in reality or were achieved using conventional plant breeding techniques.

Herbicide-tolerant GM crops lead to skyrocketing pesticide use

USA: Due to the adoption of GM herbicide-tolerant crops (mostly to glyphosate herbicides, such as Roundup), herbicide use between 1996 and 2011 increased by an estimated 239 million kg.[10] Nearly 67% of agricultural glyphosate herbicide use since 1974 occurred between 2005 and 2014, as GM glyphosate-tolerant crops became widespread.[11]

Brazil: GM herbicide-tolerant soy was authorised in 2003. Overall pesticide use increased 1.6-fold between 2000 and 2012 and use on soybeans increased 3-fold, prompting scientists to state, "The adoption of GM crops in Brazil has led to an increase in pesticide use with possible increases in environmental and human exposure and associated negative impacts."[12]

Argentina: GM herbicide-tolerant soy was authorised in 1996. Estimated glyphosate use rates per hectare (ha) per crop year rose from 2.83 kg/ha in 2000 to 4.45 kg/ha in 2014, that is to say a 60% increase.[13] Glyphosate spraying on GM soy is linked to increased rates of cancers and birth defects in people.[14]

Superweeds and the pesticide treadmill

As GM glyphosate-tolerant crops became widely planted in some countries and glyphosate use increased, weeds evolved to become resistant to the herbicide. Farmers at first sprayed more glyphosate, but this failed to control the resistant weeds. Glyphosate-resistant "superweeds" are the main cause of increased pesticide use with GM crops.[15]

In response, biotech companies have introduced multi-herbicide-tolerant crops that survive being sprayed with additional herbicides such as dicamba, 2,4-D, and glufosinate. But weeds have already developed resistance to these herbicides as well,[16] overtaking US farms.[17] Dicamba is the focus of lawsuits brought by farmers whose crops have been destroyed by the herbicide drifting off-target.[18]

Keeping farmers tied to a pesticide treadmill only benefits the big GMO developer companies – Bayer (owner of Monsanto), Corteva (formerly DowDuPont), Syngenta, and BASF – as they also dominate the global pesticide markets.

Glyphosate-resistant "Superweeds" are the main cause of increased pesticide use with GM crops

SUPER TOXINS

Biotech corporations claim that the Bt toxins introduced into GM crops are natural proteins that are toxic only to narrow groups of insect species. They say that they are identical to the natural Bt toxins sprayed by organic farmers to control insect pests[27] and can be safely eaten by humans and animals.[28] But GM Bt toxins are different from natural Bt toxins. Monsanto designed the GM forms to be "super toxins" – meaning they are more toxic to insects and affect more species.[29] Studies confirm that GM Bt toxins and crops containing them are toxic to diverse insects[30] and can cause signs of toxicity in mammals.[31]

GM Bt crops ineffective within only a few years

GM Bt crops are genetically engineered to contain an insecticide called Bt toxin. This toxin is built into the plant, so that any plant pests eating any part of the plant are harmed. On the basis of some selected studies, GMO advocates claim they have reduced chemical insecticide use.[19] However, this claim proves itself to be false when a long-term and comprehensive view is taken.

GM Bt crops initially caused a modest reduction in sprayed insecticides in the US, but this proved to be temporary, as targeted pests quickly evolved resistance to GM Bt toxins and other types of pest that were not targeted by the Bt toxin increased in Bt crops in the US, China, India and Brazil.[20] In India, pest resistance drove cotton farmers to spend more on insecticides today than they did before the introduction of GM Bt cotton.[21] Farmers are the ones paying the high price for GM Bt seeds that will only function for a few years, while biotech companies profit from their failed and fake promises.

Claims that Bt crops have reduced pesticide use[22] are misleading for multiple reasons:

- The data are mostly from the early years of Bt crops, before pests developed resistance, forcing farmers to return to spraying chemical insecticides. Some never stopped.[23]
- GM Bt toxin is itself an insecticide and the amount of toxins produced by GM Bt plants is far more than the amount of sprayed insecticide it is meant to displace.[24]

In 2020, the US Environmental Protection Agency (EPA), which is not known for being critical about GMO farming systems, proposed phasing out many Bt maize and some Bt cotton varieties within the next years due to concerns over resistant plant pests.[25] A long-term analysis thus concludes that first generation GM crops led to an intensified pesticide use and increased resistance among plant pests, not to a reduction.

Pesticide toxicity increasing in GM crops

A US-based study found that the toxic impact of pesticides used on GM crops is increasing over time and is the same as in non-GM crops. Toxicity per hectare of insecticides applied to Bt maize was equal to that for conventional maize. Herbicide-tolerant GM crops have led to a strong increase in glyphosate use, resulting in a steady rise in toxicity in GM soybeans.[26]

GM crops led to an intensified pesticide use and increased resistance among plant pests, NOT to a reduction.

New GM crops will not reduce pesticide use

Big biotech and GMO advocates claim that new GM crops are different from the first-generation ones and that they will reduce pesticide use. But once again, the evidence suggests otherwise.

New herbicide-tolerant GM crops: Designed to increase pesticide use

Many new GM crops currently in the commercialisation pipeline are designed to increase herbicide use. A review by the European Joint Research Centre (JRC), based on information from GMO developers, found that the largest trait group (6 out of 16 plants) of new GM plants close to commercialisation is herbicide-tolerant.[32] The first application for EU approval of a CRISPR-edited[33] plant is for a maize that is tolerant to glufosinate herbicide and produces an insecticidal toxin (not Bt).[34] A commercialised herbicide-tolerant canola[35] will also enable more herbicide use.

This is not surprising, since the business model of many biotech corporations[36] is geared to herbicide-tolerant crops and the pesticides they are sold with.

New non-herbicide-tolerant GM crops: Irrelevant to pesticide use

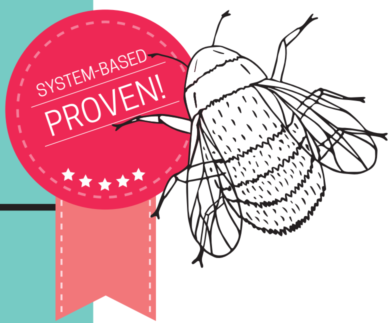
Some commercialised new GM organisms are not herbicide-tolerant – but will not reduce pesticide use either. Among them are Calyxt's soybean modified for an altered fat profile,[37] a tomato engineered to contain high levels of a sedative substance,[38] and a fish engineered to produce more meat.[39]

An overview based on public sources of new GM plants in the commercialisation pipeline[40] shows changes in the plants' composition like altered fatty acids, starch, and protein. They are geared to industrial and fast food uses and not for more environmental friendly farming systems.[41] Individual crops include potatoes with improved storage qualities and blackberries without seeds.[42] These are some examples of how the commonly used new GMO tool, CRISPR, is used in plant breeding.

A few projected new GM plants are genetically modified for resistance to plant pests or diseases and could theoretically reduce pesticide use. Cibus plans gene-edited crops engineered for disease and nematode resistance, as well as herbicide tolerance.[43]

However, it is not known how many of them will actually enter the market, as announced products regularly disappear from the development pipeline without explanation. As of now, this is research is far from any commercial use, while real solutions like agroecology have been proven to work with nature and to achieve drastic reductions in pesticide use.

Proven solutions



Pursuing false GM "solutions" for pesticide reduction distracts from proven approaches. These are system-based (as used in agroecological and organic farming), rather than focused on isolated genetic traits.

Insofar as genetics are important, conventional breeding, which benefits from whole genome pest and disease resistance, continues to top genetic modification.[44] For example, conventionally bred resistant maize hybrids are as effective as neonicotinoid insecticides against the pest that carries a destructive virus.[45]

SYSTEM-BASED SOLUTIONS INCLUDE

Soil building with organic matter. Benefits include improving crop resilience to pests and diseases by delivering nutrients in a form plants can use, stimulating the growth of beneficial soil organisms, reducing soil erosion and pesticide/fertiliser runoff, retaining water, protecting against flooding, and reducing salinity.[46]

Crop rotation, which prevents the buildup of pests and weeds and maintains soil health.[51] Rotation is an effective alternative to the use of neonicotinoid insecticides, keeping pest populations below the economic damage threshold.[52]

Natural biological controls, such as planting flower strips to attract pollinators and beneficial insects that control insect pests.[47] This technique, combined with installing pheromone strips to repel aphids, can keep aphid populations in cereal and brassica crops below levels that cause economic damage.[48] Biological controls are integral to Integrated Pest Management (IPM) systems.[49]

Mechanical weeding tools, recently also weeding robots, can potentially replace the use of herbicides by 100%.[53]

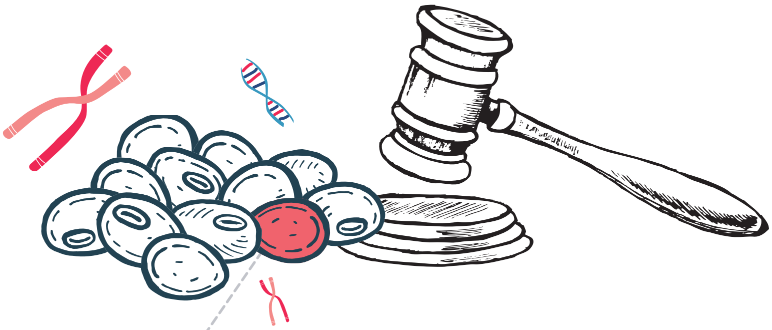
Integrated Weed Management, which can reduce herbicide use without harming productivity.[57]

Barrier methods against insect pests, which can (for example) prevent insect pests laying eggs in soil.[50]

Barrier methods against weeds, including mulching.[54]

Intercropping (growing different crops in the same field at the same time) and cover cropping (planting crops primarily to cover soil), which can suppress weeds by reducing the area of bare soil.[55] Intercropping also reduces soil erosion.[56]

System change



The effective way to reduce pesticide use is system change, which alone can provide lasting solutions to weed and pest problems. The longest-running comparison of organic and conventional grain cropping systems in North America found that organic systems give yields that are competitive with conventional ones after a 5-year transition period. Yields are also 40% higher in times of drought – without chemical pesticides.[58] And research carried out on farms in France showed that reducing pesticide use is compatible with high productivity and profitability in 77% of farms studied.[59]

Decision makers must take steps to shift agriculture away from fossil fuel-dependent production in huge monocultures controlled by a handful of corporations. This should include greater public investment in agroecological farming, which offers benefits including higher incomes for farmers,[60] resilience in the face of climate change,[61] protection of biodiversity,[62] and improved food security and nutrition.[63]

To achieve pesticide reduction goals, decision makers should take the following actions:

- **Recognise that biotech industry promises are not proven**, but are simply research and marketing ideas with no evidence. Meanwhile, real solutions like agroecology are proven, but lack support from policymakers.
- **Support real solutions** to pesticide reduction and promote change in public policy. Legislation in the areas of research, agriculture, and the environment should be geared towards pesticide reduction.
- **Regulate new GMOs under existing GMO laws** to ensure freedom of choice for consumers, farmers, and breeders, and subject the products of new technologies to stringent pre-market safety checks and labelling.

Endnotes:

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33 CRISPR tools identify specific locations on an organism's DNA and use cutting enzymes to edit the DNA at those locations. The cell then uses its own repair mechanisms, which are prone to occasional mistakes and can result in new traits being introduced. This process can also be 'assisted' by introducing foreign template DNA.

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40 The main companies that make their "new GM" plans public are Cibus and Bioheuris, perhaps because they need to attract investors. The larger companies – Bayer, Corteva, BASF, and Syngenta, seldom make their plans public.

41 Examples include Corteva's waxy corn (altered starch profile); Cargill's rapeseed with lower content of saturated fatty acids, designed to reduce trans fats when hydrogenated; and Calyxt's soybean engineered for higher protein content.

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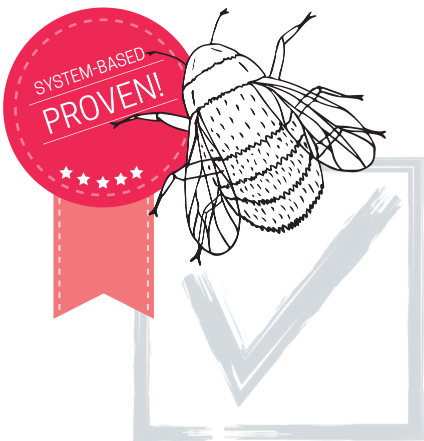
Demands

TO ACHIEVE PESTICIDE REDUCTION GOALS, DECISION MAKERS SHOULD TAKE THE FOLLOWING ACTIONS:

- **Recognise that biotech industry promises are not proven**, but are simply research and marketing ideas with no evidence. Meanwhile, real solutions like agroecology are proven, but lack support from policymakers.
- **Support real solutions** to pesticide reduction and promote change in public policy. Legislation in the areas of research, agriculture, and the environment should be geared towards pesticide reduction.
- **Regulate new GMOs under existing GMO laws** to ensure freedom of choice for consumers, farmers, and breeders, and subject the products of new technologies to stringent pre-market safety checks and labelling.



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