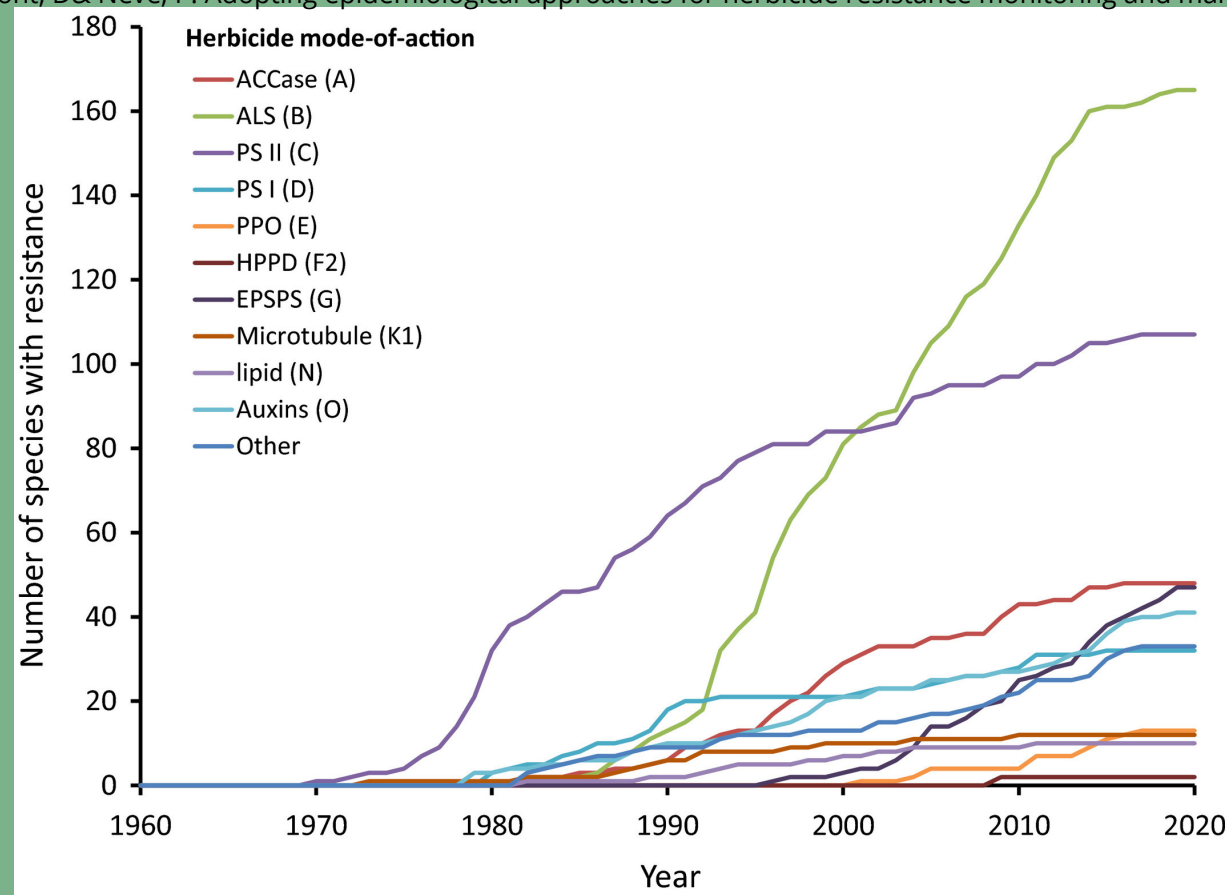




Herbicide resistance

Sarah Etou, Anna Ourth, Anaïs Reynaud - INP ENSAT

Comont, D& Neve, P. Adopting epidemiological approaches for herbicide resistance monitoring and management



The first weeds resistance was reported in **1968**.
269 herbicide-resistant species worldwide (154 dicots and 115 monocots)

Resistance to **21 of the 31 known herbicide sites of actions**
and to **167 herbicides**.

Weed resistance reported on **99 crops in 72 countries**.

In France, we count **41 resistant species**.



- Inefficiency of herbicide and no other alternative
- Affect biodiversity
- Persistence in soils



What increases herbicide resistance ?

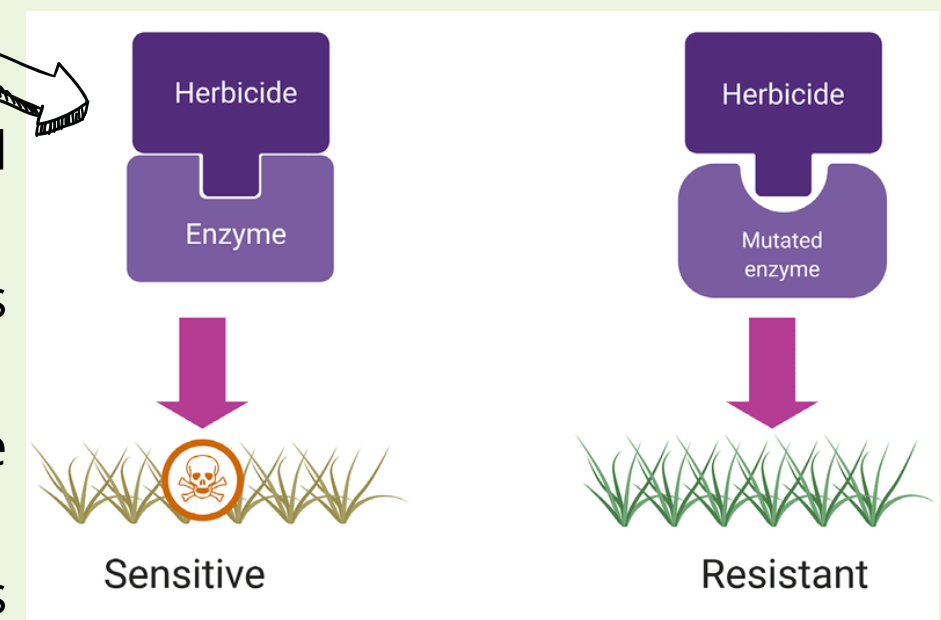
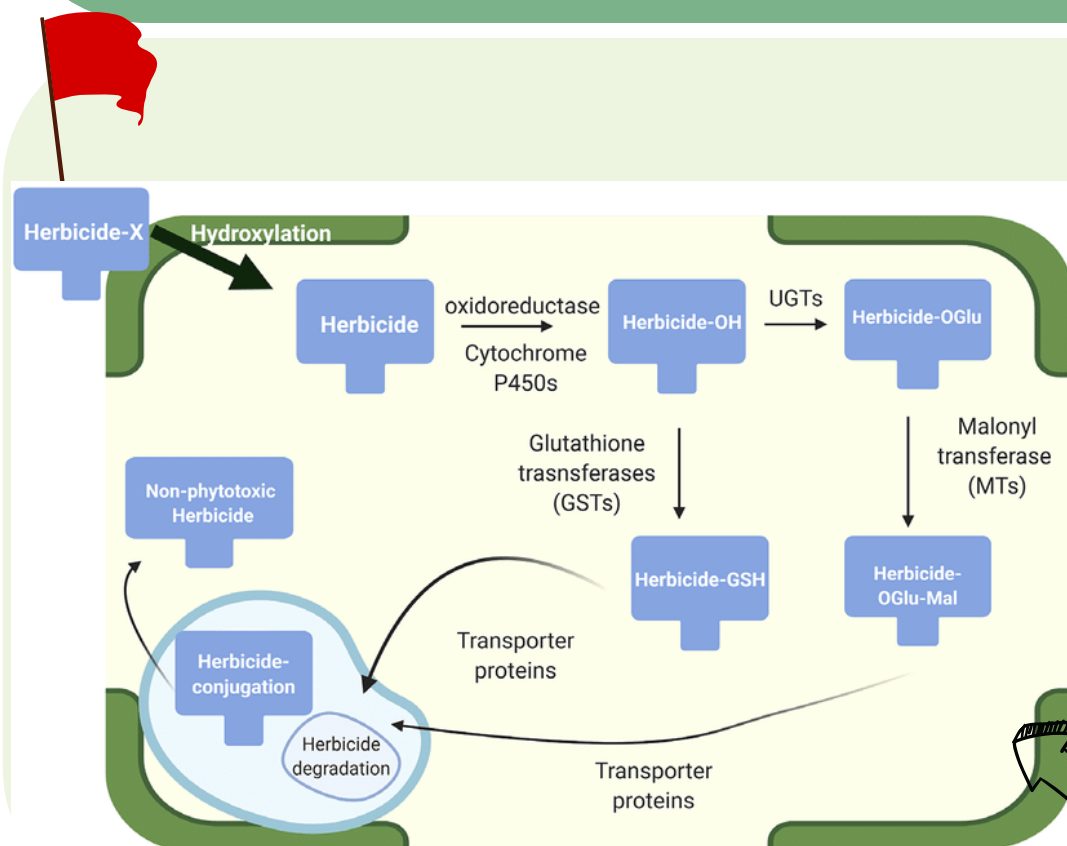
- Using the same herbicide or the same family of herbicides over time
- Monoculture such as corn crops or low diversity in crop rotations.
- The high seed production of weed annual species

Two types of resistance

Target-linked resistance: mutation of the target enzyme.

Non-target resistance (enhanced detoxification) :

- Modification of the epidermis (hairiness, thicker cuticle, etc.)
- Production of enzymes that degrade the molecules.
- Sequestering of molecules in cells vacuoles by binding them to toxins.



Edwards and Onkokesung, 2020

Focus on the rye grass (*Lolium perenne*)

Resistance to the three main families of herbicides :

- Diclofop-methyl against the acetyl-CoA carboxylase (fatty acid synthesis)
- Iodosulfuron-methyl-sodium against the ALS (synthesis of valine, leucine and isoleucine)
- Glyphosate against the EPSPS (synthesis of phenylalanine, tyrosine and tryptophan)

Mainly acquired by mutations (for example, a mutation happening at the site 106 of the EPSPS). Moreover, some rye grass produce more EPSPS enzyme.



Integrated weed management

- Preventative measures : master factors such as tillage, irrigation, sowing methods, planting density, farm equipment sanitation, cultivar, cropping system, mulching and plant spacing.
- Cultural weed control : Crop rotations, intercropping, cover cropping
- Mechanical control.
- Biological control : bioherbicides, livestock grazing, allelopathy.
- Chemical control : diversification of the chemical families used and clever management.



What does the literature say ?

A study conducted by Lehnhoff et al. showed the effectiveness of combining integrated grazing and herbicide use on Cheatgrass when compared to the herbicide used alone .

Sorghum-wheat rotation decreased dry weed biomass due to the accumulation of sorgoleone. Other crops such as alfalfa, sunflower, corn and wheat have been found to reduce weed densities when included in a crop rotation cycle due to the presence of allelochemicals.

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