



What is a GMO?

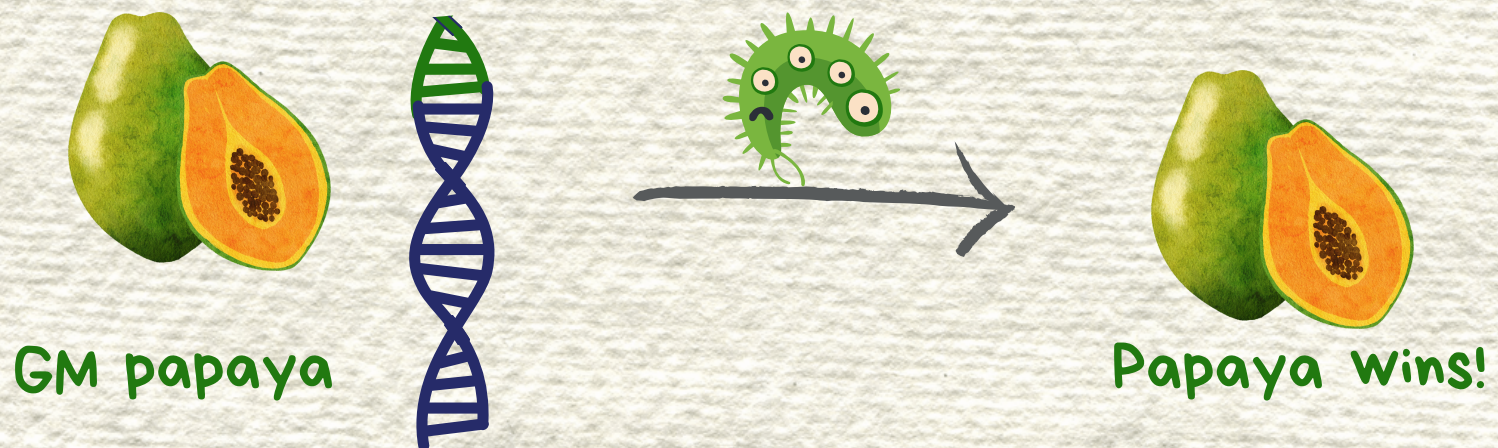
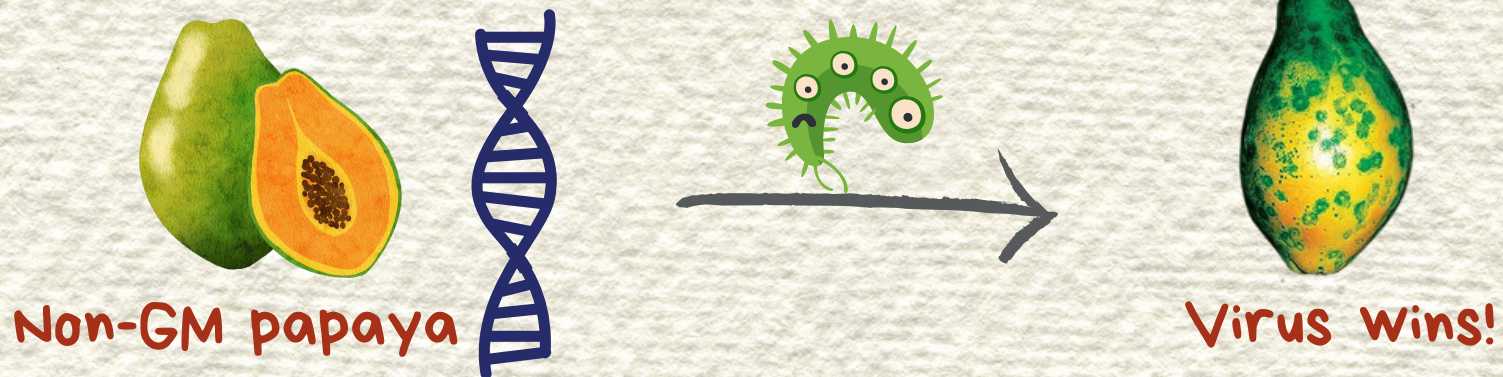


And why all the fuss around it?

A Genetically Modified Organism (GMO) is an organism whose genetic material has been changed using genetic tools to improve or achieve new desired characteristics.



Papaya versus Ringspot Virus



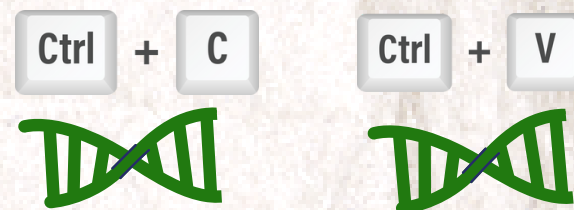
Breeders have learned from natural processes and developed tools to copy a specific gene from a plant or other organism and transfer it, and thereby the desired characteristic (e.g., drought tolerance, disease resistance), to the plant we want to improve.

Resources 1, see last page

1. Find the part of the DNA that expresses a desired trait in an organism. For papaya, they looked for resistance genes and found them in a ringspot virus.



2. Copy that part of the DNA.



3. Insert the part of DNA into the plant that we want to improve.



Papaya's DNA
before improvement

Part of
virus' DNA

Improved DNA with
a virus resistancy

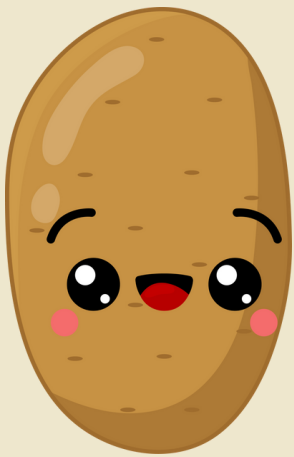


Let's look at the track record of GMOs in Europe.

Amflora Potato was genetically modified to produce a higher proportion of amylopectin. This is a component crucial for industrial purposes such as papermaking.

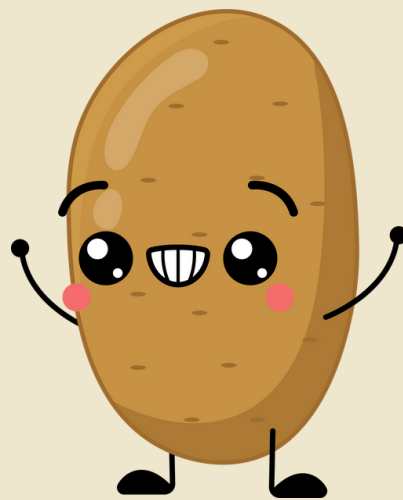
Resources 2, see last page

1996



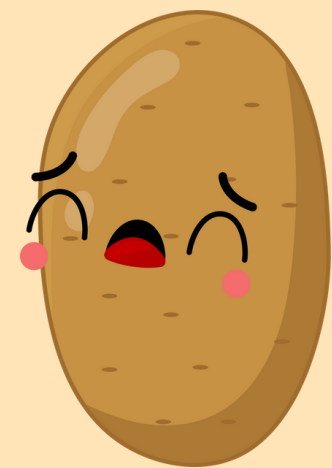
After **2 decades of research**, Amflora Potato was registered.

2010



Approval for cultivation for industrial purposes in the EU was granted.

2012



The potato underwent extensive testing and had great potential. However, it was withdrawn from the market. Why? **Complex regulatory environment in the EU and lack of understanding and acceptance of GM crops.**

It's hard when you see an innovative product go through the loops again and again. **These decisions are not about science but about politics.**

Scientist Susanne Benner, when asked about Amflora



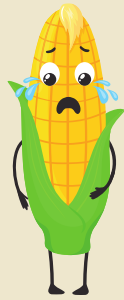
Another example is **Bt maize**. It produces a protein from a soil bacteria largely used in conventional and organic farming, providing resistance against the pests of corn borers. As Bt maize plants are resistant to pests, **they requires fewer insecticide treatments and provide better maize quality.** *Resources 3, see last page*

1998



Approved for cultivation in the EU.

early 2000s



Political resistance and public concerns led to a **decline in cultivation**, some countries implemented national bans.

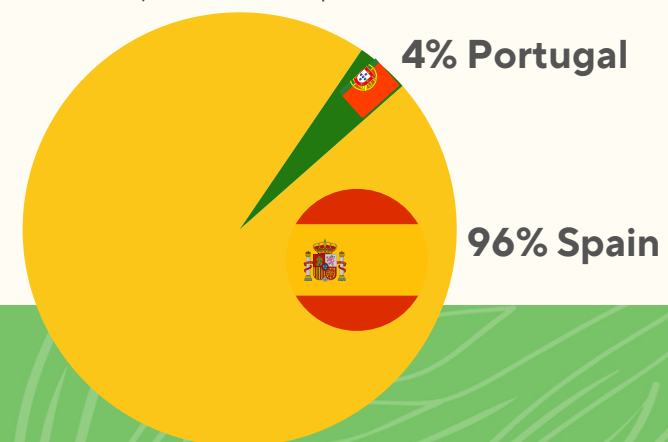
In spite of the bans, there have been no environmental or safety issues with Bt maize and it has been safely grown for decades in Spain and Portugal.

2023



99,5%
Conventional
Maize

0,5% Bt
Maize



4% Portugal

96% Spain



Do we grow any other GM crop in Europe?

New GMOs cultivated since 2001

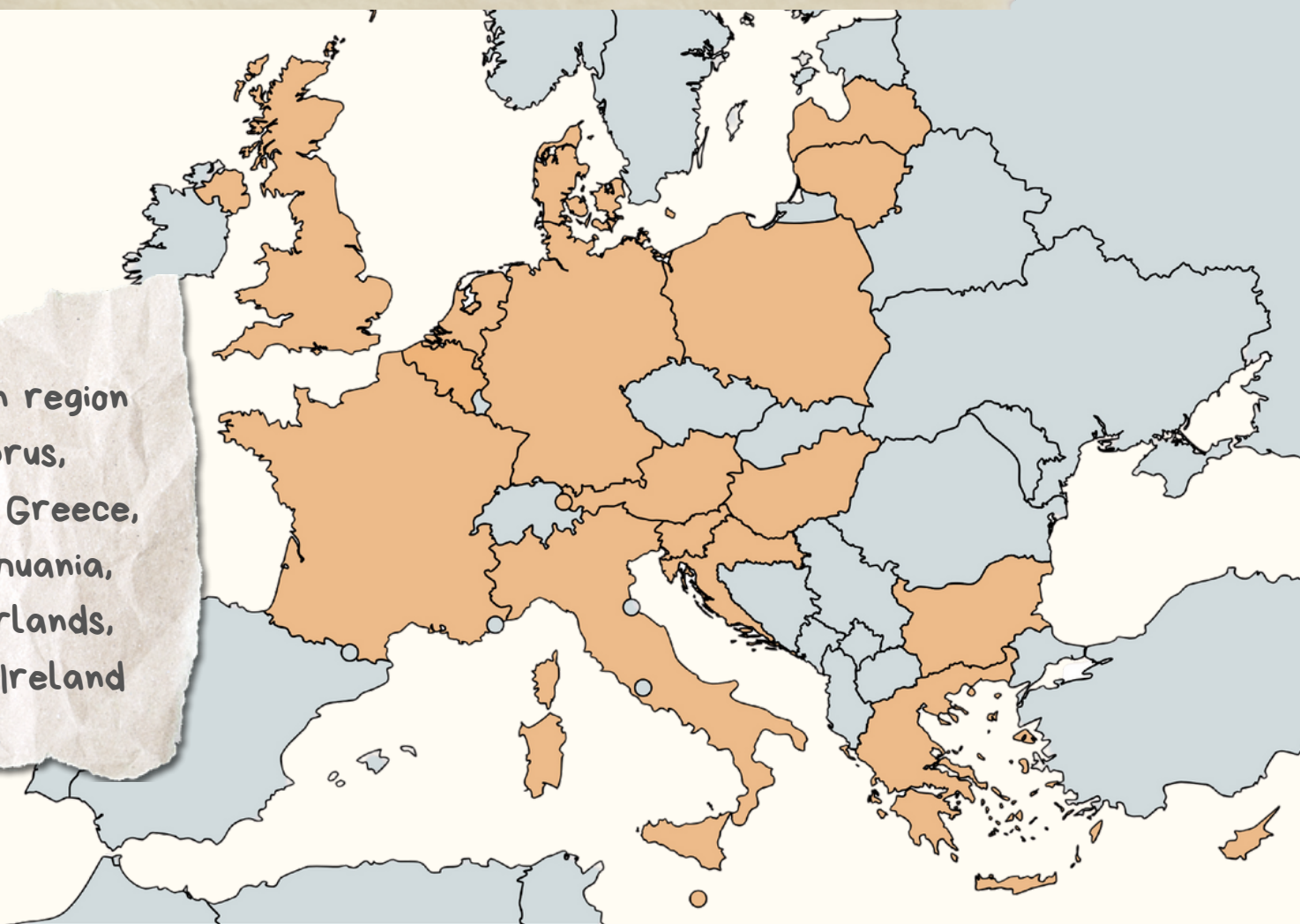
0

Countries in the EU that do not allow cultivation

19/27

Resources 4, see last page

Austria, Bulgaria, Wallonian region of Belgium, Croatia, Cyprus, Denmark, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Slovenia, Northern Ireland

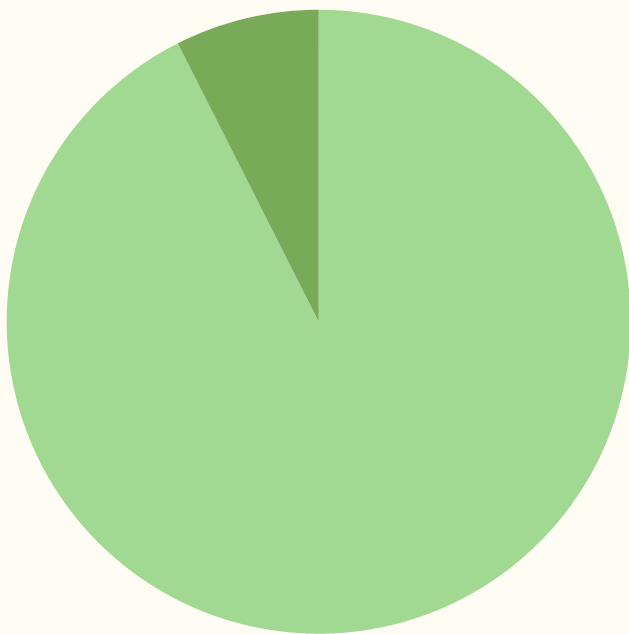


What about imports of GMOs into the EU?

The EU imports a great amount of GM crops, like maize, cotton, soy, oilseed rape and sugar beet which are mostly used for feed.

EU-produced Soy (non-GM soy)

7.5%



Imported Soy (mostly GM soy)

92.5%

For example, in 2021 the EU imported **33.5 million metric tonnes of soy, mostly from South America**, where GM soy is widely grown.

Resources 5, see last page

Let's address some of the concerns brought up regarding GMOs!

Resources 6, see last page

GMOs have negative environmental impacts! ❌



Research suggests that **GMOs aren't harmful to the environment**; in fact, they have shown **positive impacts** in many ways.



Eating GMOs is a danger to our health! ❌



Major international expert institutions and academies agree that **food produced from authorised GM crops is as safe** as their counterparts and after 25 years there are no specific safety risks or health concerns that can be attributed to their consumption.



GMOs are the cause of widespread monoculture farming and loss of biodiversity! ❌



Monocultures existed well before GMOs. Farmers often prefer monocultures because they

- make **mechanical harvesting** easier
- provide generally **higher yields** compared to intercropping



Ask your questions to Plantastic Discoveries

🌱 Got questions about plant science & breeding? We've got answers!

Join Plant ETP's educational campaign to feed your curiosity! 🌿

Ask your questions here:



t.ly/gLLGr

Resources



Resources 1:

- <https://new.nsf.gov/news/understanding-genomic-modifications-transgenic>
- Azad, Md. Abul Kalam, Latifah Amin, and Nik Marzuki Sidik. "Gene Technology for Papaya Ringspot Virus Disease Management." *The Scientific World Journal*, vol. 2014, Article ID 768038, 2014, <https://doi.org/10.1155/2014/768038>.

Resources 2:

- https://fundacion-antama.org/wp-content/uploads/2009/12/2009.10.29.Amflora_Starch_Facts.pdf
- <https://www.nytimes.com/2007/07/24/business/worldbusiness/24spuds.html>
- <https://en.wikipedia.org/wiki/Amflora>

Resources 3:

- Matías García, Carlos García-Benítez, Félix Ortego, Gema P Farinós, Monitoring Insect Resistance to Bt Maize in the European Union: Update, Challenges, and Future Prospects, *Journal of Economic Entomology*, Volume 116, Issue 2, April 2023, Pages 275–288, <https://doi.org/10.1093/jee/toac154>
- https://fundacion-antama.org/wp-content/uploads/2022/04/20220418-INFORME-BENEFICIOS-1998-2021-english_FINAL_.pdf

Resources 4:

- <https://www.europarl.europa.eu/legislative-train/theme-union-of-democratic-change/file-possibility-for-member-states-to-prohibit-cultivation-of-gmos-on-their-territory>
- https://food.ec.europa.eu/plants/genetically-modified-organisms/gmo-authorisation/gmo-authorisations-cultivation/restrictions-geographical-scope-gmo-applicationsauthorisations-eu-countries-demands-and-outcomes_en

Resources 5:

- https://agriculture.ec.europa.eu/system/files/2023-01/agricultural-outlook-2021-report_en_0.pdf
- <https://www.idhsustainabletrade.com/uploaded/2023/09/IDH-Soy-Monitor-2021-Final.pdf>
- https://fefac.eu/wp-content/uploads/2021/12/FF_2021_final.pdf

Resources 6:

- Brookes G, Barfoot P. Environmental impacts of genetically modified (GM) crop use 1996-2018: impacts on pesticide use and carbon emissions. *GM Crops Food*. 2020;11(4):215-241.
- Meftaul IM, Venkateswarlu K, Dharmarajan R, et al. Controversies over human health and ecological impacts of glyphosate: Is it to be banned in modern agriculture? *Environ Pollut*. 2020;263(Pt A):114372.
- Klumper W, Qaim M. A meta-analysis of the impacts of genetically modified crops. *PLoS One*. 2014;9(11):e111629.
- <https://agbiotech.ces.ncsu.edu/do-gmos-contribute-to-monoculture/>
- <https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2020.6302>
- National Academies of Sciences, Engineering, and Medicine . Genetically engineered crops: experiences and prospects. Washington (DC): The National Academies Press; 2016. doi: 10.17226/23395. [PubMed] [CrossRef] [Google Scholar]
- European Commission, Directorate-General for Research and Innovation . A decade of EU-funded GMO research (2001-2010), Publications Office, 2010; <https://data.europa.eu/doi/10.2777/97784> [CrossRef] [Google Scholar]