Generation ‘unknown’

EXPOSING THE TRUTH BEHIND THE NEW GENERATION OF GMOS

BRIEFING | December 2020

Friends of the Earth Europe

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Friends of the Earth Europe is the largest grassroots environmental network in Europe, uniting more than 30 national organisations with thousands of local groups. We are the European arm of Friends of the Earth International which unites 74 national member organisations, some 5,000 local activist groups, and over two million supporters around the world. We campaign on today’s most urgent environmental and social issues, challenging the current model of economic and corporate globalization, and promoting solutions that will help to create environmentally sustainable and socially just societies. We seek to increase public participation and democratic decision-making. We work towards environmental, social, economic and political justice and equal access to resources and opportunities on the local, national, regional and international levels.

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December 2020. Design: www.onehemisphere.se **Images:** (front cover) Microscopic (200x) view of the leaf surface of Tradescantia. © J. Harshaw / Shutterstock. (Inside): © Shutterstock.

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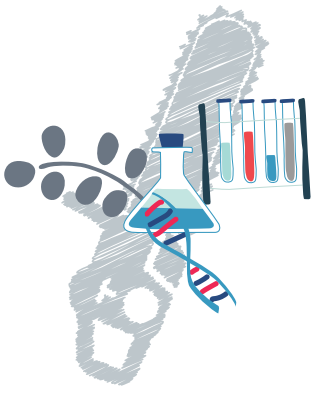
Friends of the Earth Europe

Introduction

1

As Europe's farming sector faces up to the combined challenges of climate change, biodiversity loss and an increasingly globalised market, a new generation of genetically modified organisms (GMOs) is being portrayed as a magical solution. Some have suggested that these new genetically modified crops, animals and microbes should be exempt from GMO safety legislation, introduced to protect consumers and the environment from the risks posed by GMOs. This paper argues that these new forms of genetic modification (including techniques such as gene editing) will not make the farming system more resilient to extreme weather, reduce biodiversity loss, or result in healthier food and fairer incomes for farmers, and because of the risks they pose, must be controlled by the existing laws.

It also asks key questions as to who will benefit from this new generation of GMOs, who does the technology empower, who does it disempower and who owns it? It also argues for support for genuine solutions that will benefit farmers, consumers and nature in our crisis-engulfed world.



New generation GMOs must be controlled by the existing EU laws.

Farming in crisis

2

Europe's farmers are facing numerous challenges. Climate change and biodiversity loss are affecting production, and at the same time the economics of large-scale production, and increased global competition is making it harder for farmers to survive.

But the farming sector also is part of the problem. Globally, agriculture accounted for 13% of carbon dioxide emissions, 44% of methane emissions and 82% of nitrous oxide emissions between 2007 and 2016, according to the Intergovernmental Panel on Climate Change (IPCC).[1]

Almost a quarter of farmland globally has been degraded to such an extent that it is reducing food production and in Europe an area of soil the size of Berlin is lost every year.[2] Up to $577 billion of annual global crop production is at risk from the loss of pollinating insects.[3] The Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES) has warned that while global agricultural production has increased since 1970, 14 out of 18 vital natural functions have declined.

Footnotes:

1 Intergovernmental Panel on Climate Change, 2019, *Special Report on Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food Security, and Greenhouse gas fluxes in Terrestrial Ecosystems. Summary for Policymakers.* Approved Draft, August 2019. https://www.ipcc.ch/srccl-report-download-page

2 Panagos, P; Borelli, P,. All That Soil Erosion: the Global Task to Conserve Our Soil Resources, 2017. p. 20-21, https://ec.europa.eu/jrc/en/publication/soil-erosion-europe-current-status-challenges-and-future-developments

3 IPBES. 2019. *Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.* S. Díaz *et al.*(eds.).

While the EU's Farm to Fork strategy proclaims a greener approach to agriculture, intensive production methods are currently resulting in devastating impacts for communities and the environment. Intensive meat and dairy production generate vast quantities of ammonia and nitrogen-rich manure, which pollutes water supplies, damages wildlife and creates a nuisance for local communities.

The reliance on a limited number of breeds and crops varieties leaves farmers vulnerable to changes in the climate. As a result of prioritising characteristics such as high yield or high protein content, arable farming is dominated by a small number of crops with limited genetic and general diversity, and this is particularly true when looking at the limited number of crops used for crop rotation. In the livestock sector, one breed accounts for 83% of dairy cattle in Europe, and just three breeds account for 75% of pigs.

At the same time, providing feed for livestock farms is also driving deforestation, biodiversity loss and human rights abuses in South America, where soy crops for animal feed are expanding into forest areas, adding to farming's climate impacts.

For small-scale farmers in particular, survival has become increasingly difficult. Forced to compete with large-scale, industrial farms, they struggle to cover production costs, with more than a quarter (27.5%) of all farms in the EU lost between 2003 and 2013.[4]

Increasingly globalised agro-commodity chains, alongside free trade deals such as the EU-Mercosur agreement, exacerbate this situation. They encourage the large-scale production of cheap raw materials for industrialised processing and often result in lower prices for farmers. Against this backdrop, new techniques in genetic engineering and new GMOs are being seized on by some farmers' organisations and others as a way to avoid making their farming methods sustainable. The agro-chemistry industry also presents these new techniques as a sustainable solution, seeking to protect their market for industrial commodities and seeds.

The reliance on a limited number of breeds and crops varieties leaves farmers vulnerable to changes in the climate.

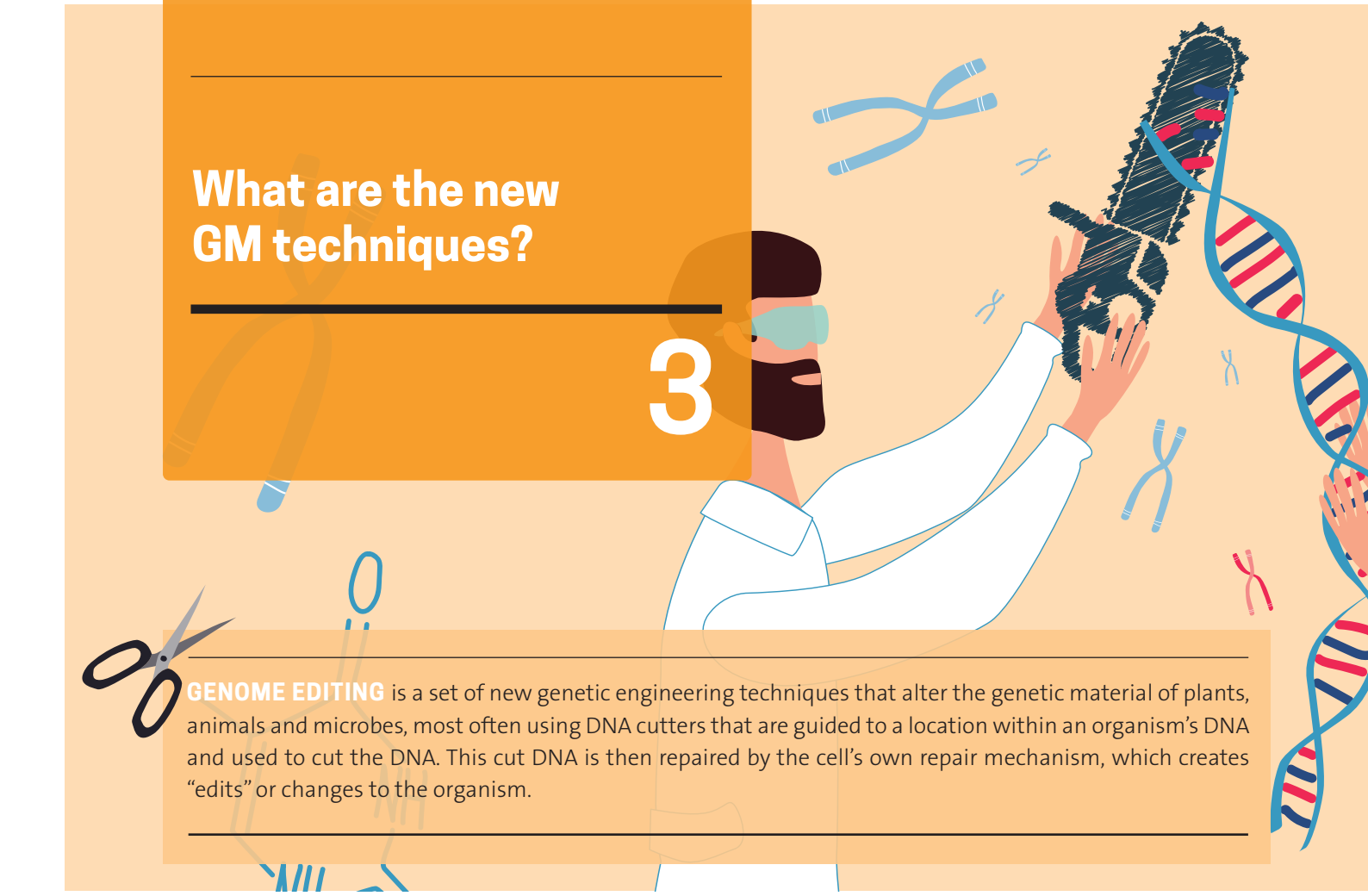
How industrial farming drives deforestation. **© FoEE**

Footnotes:

4 Small and large farms in the EU - statistics from the farm structure survey, 2013, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Archive:Small_and_large_farms_in_the_EU_-_statistics_from_the_farm_structure_survey#Structure_of_the_farm_labour_force

What are the new GM techniques?

3



GENOME EDITING is a set of new genetic engineering techniques that alter the genetic material of plants, animals and microbes, most often using DNA cutters that are guided to a location within an organism's DNA and used to cut the DNA. This cut DNA is then repaired by the cell's own repair mechanism, which creates "edits" or changes to the organism.

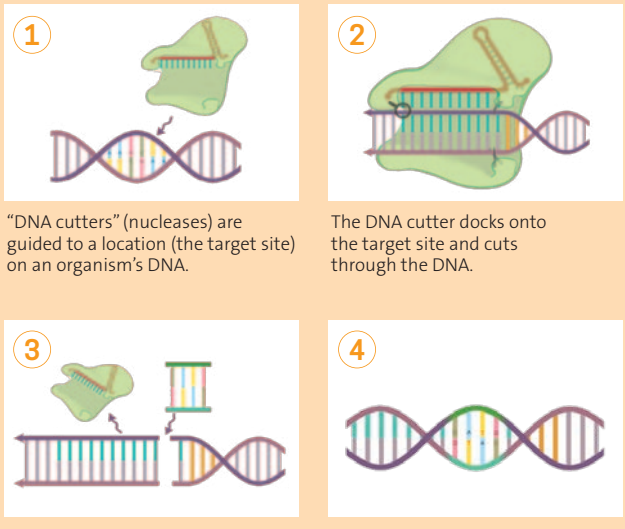
The new generation of GMO techniques are often referred to as 'gene editing', 'new breeding techniques' or 'precise breeding'. These different techniques are used to alter the genetic material of plants, animals and microbes. All use a synthetic molecular guide with the goal of changing the organism's DNA, i.e., in situ. This change in the organism's genetic material is achieved not through the breeding process (as in conventional breeding), but directly and artificially by humans. This means that gene editing techniques, like genetic modification, produce GMOs.

What is new is that techniques such as CRISPR, TALEN, ODM and ZFNs do not necessarily introduce DNA from a different organism. They 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.

As such, these new gene-editing techniques modify the DNA of plants, animal cells and microbes, changing the organism's genetic material in ways that do not occur naturally or through conventional plant breeding. They create specific new risks and consequences.

For this reason, they are considered to be a type of genetic engineering, resulting in the creation of genetically modified organisms (GMOs),[5] as confirmed by a ruling by European Court of Justice (C-528/16) July 2018.[6]

HOW GENOME EDITING WORKS



1. "DNA cutters" (nucleases) are guided to a location (the target site) on an organism's DNA.
2. The DNA cutter docks onto the target site and cuts through the DNA.
3. The repair of DNA is then initiated and occurs either with (SDN-2) or without (SDN-1) a synthetic repair template. Alternatively, genes can be inserted (SDN-3).
4. The DNA is now "edited". However, in reality, **genome editing is prone to creating unintended changes and errors that can lead to unexpected effects in the genome-edited organism.**

Old promises – emperor's new clothes

4

The biotech industry claims that targeted genetic variations can result in higher yields, tolerance against diseases, better resilience towards salt or drought, and so can reduce pollution, protect nature and provide healthier food (see box for examples of industry claims).[7]

FAMILIAR PROMISES

In April 2019, 22 agribusiness lobby groups wrote to national experts saying:

"The introduction of targeted genetic variation in crops and other organisms can help to achieve important sustainable development goals and to contribute to a cleaner environment, to healthy diets, and the protection of biodiversity. It can also contribute to making crops more resilient and better withstand climate change."[8]

The European Seeds Association - a European lobby group of plant breeders which includes the biotech firms Syngenta, BASF, Bayer and Corteva - claimed the benefits included:

"increasing and securing crop yields while reducing the use of plant protection products, fertilizers and other inputs. Prolonging the shelf life of fresh produce supports healthier diets and ... is key to achieve the goals of a more sustainable and productive agriculture that simultaneously protects and preserves scarce natural resources."[9]

Footnotes:

5 Genome-editing in food and farming, CBAN, July 2020, https://cban.ca/wp-content/uploads/Genome-Editing-Report-2020.pdf

6 Ruling of the European Court of Justice, 25 July 2018, Case C 528/16,http://curia.europa.eu/juris/document/document.jsf?text=&docid=204387&pageIndex=0&doclang=EN&mode=req&dir=&occ=first&part=1&cid=709582

7 Agri Food Chain Coalition letter to Commissioner Kyriakides, 13 March 2020, https://www.europabio.org/sites/default/files/Letter-to-Stella-Kyriakides-on-Consultation-on-Farm-to-Fork-Strategy-1.pdf

8 Open Letter to Member States on the EU Court Ruling on Mutagenesis, 23 April 2019: https://amfep.org/_library/_files/Letter_to_Member_States_at_Scopaffs_-_April_2019.pdf

9 Second Birthday of the ECJ ruling – two years of "rest in peace" for Plant Breeding Innovation, EuroSeeds, 23 July 2020, https://www.euroseeds.eu/news/second-birthday-of-the-ecj-ruling-two-years-of-rest-in-peace-for-plant-breeding-innovation

These industry claims are reminiscent of the claims made for the first generation of GM crops. Industry claimed that these crops would require less pesticides. Yet the experience in North and South American countries where they are grown is that farmers have increased pesticide use. And while there were also claims that the new crops would be drought tolerant, 95% of the GM crops grown are simply herbicide-resistant or insect-resistant GM crops.[10]

There is also currently no evidence that the new generation of GMOs will deliver on any of these promises. Most are still in the research and development phase, meaning there is no evidence of how they will perform outside of the laboratory.

In the USA just two new GM crops are being grown (see testing and detection). The first of these, manufactured by Cibus, is a herbicide-resistant rapeseed, grown in North America. The second is a soybean with increased levels of oleic acid, sold in the US by Calyxt.

The industry is also seeking to introduce genetically-modified microbes to the market for use in the production of nitrogen-binding crops, animal feed, human food, and detergents. This would release genetically-modified microbes that have previously been controlled in laboratories into the wider environment. Microbes can spread much faster than animal and plants, and scientists do not yet fully understand all of the mechanisms involved. Their introduction to farming could have wide-ranging impacts.

The reality

The idea that high-yielding crops will allow areas to be protected for conservation appears to ignore the reality of the situation in Europe, where wildlife has adapted over centuries to low intensity farming methods that work with nature – rather than against it.

High input, intensive agricultural systems also tend to result in high levels of greenhouse gas emissions,[11] rather than a sink as suggested by the claims.

High input, intensive agricultural systems also tend to result in high levels of greenhouse gas emissions,[11] rather than a sink as suggested by the claims.

Footnotes:

10 Benbrook, C., Do GM crops mean less pesticide use? November 2001,Pesticide Outlook 12(5):204-207, DOI: 10.1039/b108609j, Soares de Almeida *et al*., Use of genetically modified crops and pesticides in Brazil: growing hazards, Ciênc. saúde coletiva vol.22 no.10 Rio de Janeiro out. 2017, https://doi.org/10.1590/1413-812320172210.17112017; Bardocz, Z., Genetically Modified Crops: Seeds of Hope or Deception? February 2018, http://www.fao.org/cfs/home/blog/blog-articles/article/en/c/1104228

11 Aneja, V.P.; Schlesinger, W.H.; Li, Q.; Nahas, A.; Battye, W.H. Characterization of the global sources of atmospheric ammonia from agricultural soils. J. Geophys. Res. Atmos.2020, 125, e2019JD031684.; Grossi, G.; Pietro, G.; Andrea, V.; Adrian, G.W. Livestock and climate change: Impact of livestock on climate and mitigation strategies. Anim. Front.2018, 9, 69–76 European anthropogenic AFOLU greenhouse gas emissions : A review and benchmark data, Petrecu *et al*, Earth System Science Data 12 (2020)2. - ISSN 1866-3508 - p. 961 - 1001. https://doi.org/10.5194/essd-12-961-2020

Specific risks from new GMOs

5

Advocates of new techniques to create GMOs claim they are more precise, and so the products are less risky than older GMOs. While these new techniques do make it possible to target specific regions of the genome more precisely, the entire process still involves many random events whose end results cannot be predicted. It also relies on older techniques to introduce the gene-editing machinery into the cell and to grow organisms from modified cells as a starting point, adding further elements of randomness and uncertainty.

This unpredictability was one of the main arguments for the strict regulation originally introduced for GMOs and this risk remains with the new generation.[12] This means a thorough understanding of the potential health and environmental impacts is necessary.

Multiple studies have shown that gene editing can unintentionally change genes with DNA sequences that are similar to the gene that was originally targeted for modification - known as 'off-target effects'.[13,14] Because cell DNA repair mechanisms play an important part in the process, and because these mechanisms involve a certain amount of randomness, it is impossible to reliably predict the exact outcome even in the targeted gene(s).

The ability to simultaneously change multiple genes with similar sequences (whether intentionally or unintentionally) represents one of the biggest novelties with these techniques and poses new challenges for assessing the risks as it can result in patterns of genetic change that are highly unlikely to arise naturally (i.e. by random mutation). Such results would be practically impossible to achieve using older techniques.[15]

Footnotes:

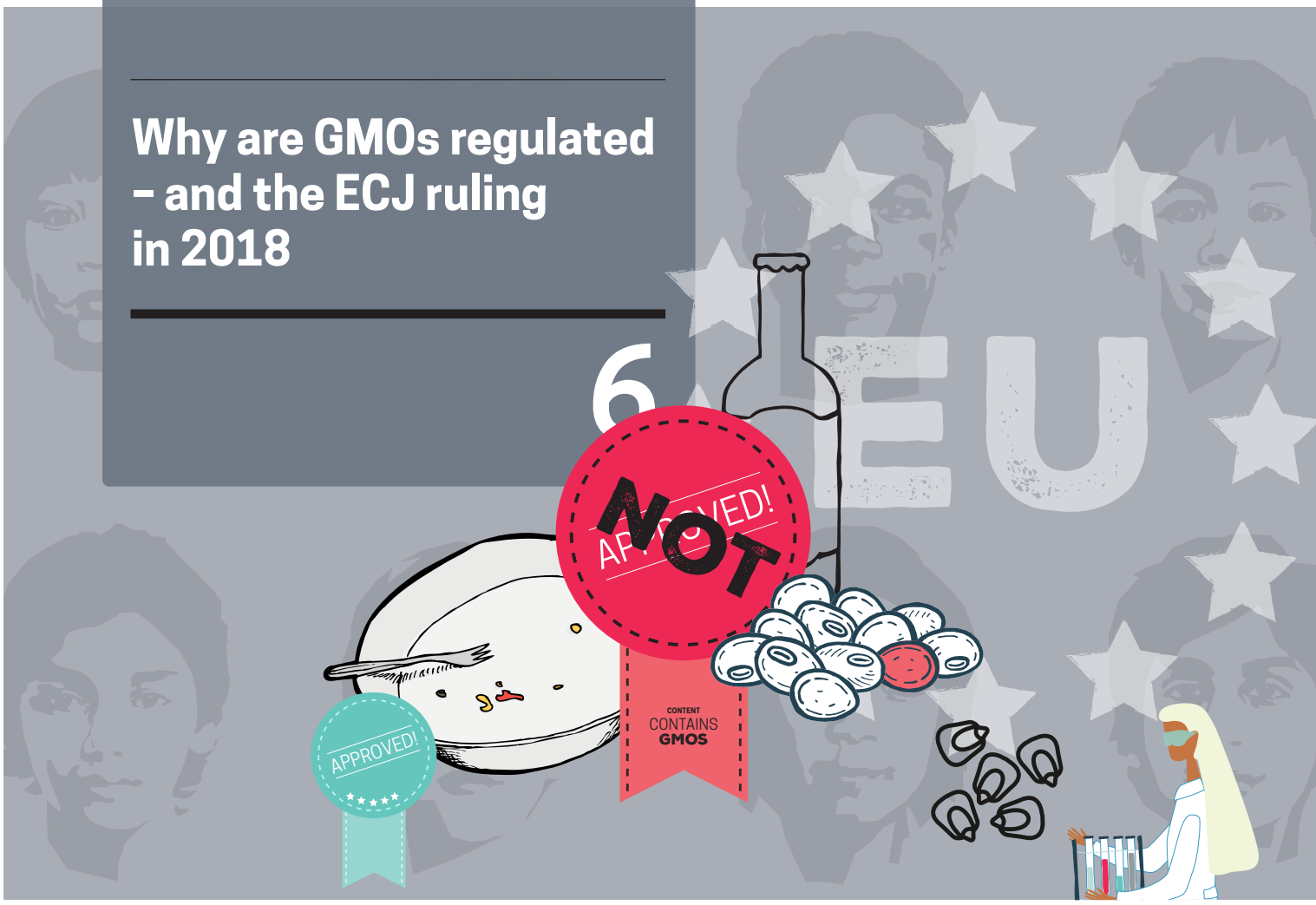
12 Testbiotech, Why New Genetic Engineering needs to be regulated, October 2020, https://www.testbiotech.org/en/news/why-new-genetic-engineering-needs-be-regulate

13 Kawall, K., Cotter, J. & Then, C. Broadening the GMO risk assessment in the EU for genome editing technologies in agriculture. Environ Sci Eur32, 106 (2020). https://doi.org/10.1186/s12302-020-00361-2

14 GMWatch, Gene editing: Unexpected outcomes and risks, August 2020 https://www.gmwatch.org/en/19499-gene-editing-unexpected-outcomes-and-risks

15 What is not genetic engineering, Testbiotech, https://www.testbiotech.org/sites/default/files/TBT_what_is_not_genetic_eng.pdf

Why are GMOs regulated – and the ECJ ruling in 2018



Many food- and feed-related products are checked for safety before they can be sold on the European market. The aim is to protect human and animal health as well as the environment.[16]

In addition, the EU's GMO rules ensure that labelling and traceability applies from the breeder to the farmer to the final consumer (regulations 1829 and 1830/2003). This means that any problem can be traced back to the source.

In July 2018, the European Court of Justice (ECJ) ruled that existing EU GMO safety law apply to the new generation of gene-edited GMOs. This means they must face safety checks, comply with the authorisation processes and labelling, and must be authorised as a GMO seed if cultivated.

These processes ensure that farmers, breeders and consumers are able to take informed decisions on whether they want to use GMOs, knowing that there have been tests on the likely impacts on the environment. The risk assessment focuses on the methods/process used to change the organisms, not on the final product.

The ECJ ruling is not a ban: it simply means that new GMOs are regulated and any cultivation or import as food and feed follows existing EU rules. This means consumers retain their right to take well-informed decisions about the food on their plates and farmers, breeders and food processors will be able to tell whether a product is a GMO or contains GM ingredients.

As such, the ECJ ruling is good news for European consumers as well as EU companies in the food sector, which are cautious about potential GM contamination in their supplies. But it does not eliminate the problem. The costs for the monitoring and analyses required to keep their chain free from unwanted GMOs still have to be paid by the producers of conventional and organic food. More than two years after the ruling, the European Commission has not taken steps to ensure that national authorities are able to detect these new GMOs or that they can be controlled in imports from third countries.[17]

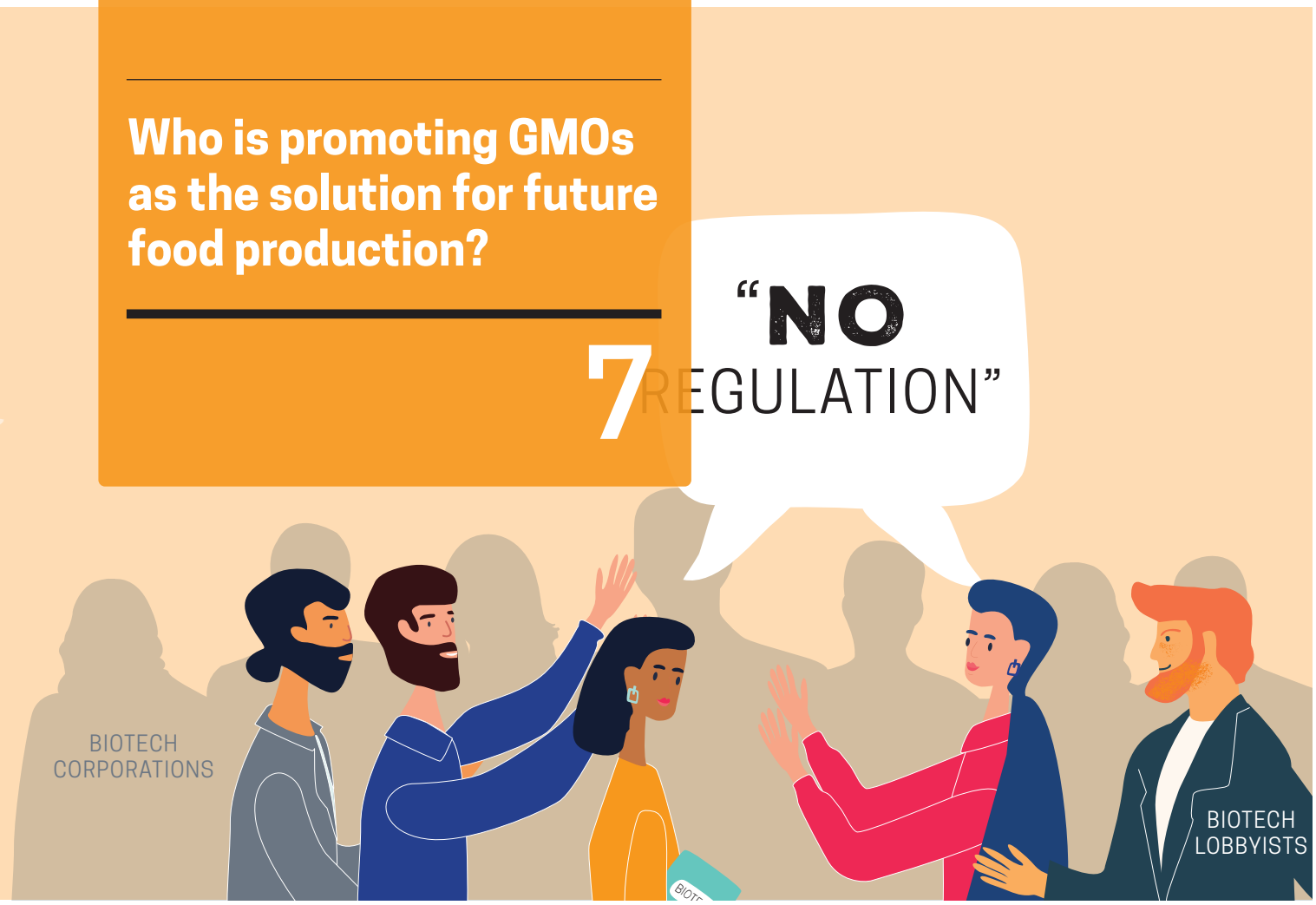
Footnotes:

16 The regulation 178/2002 has a clear objective, Art 1 states: Regulation provides the basis for the assurance of a high level of protection of human health and consumers' interest in relation to food, taking into account in particular the diversity in the supply of food including traditional products, whilst ensuring the effective functioning of the internal market. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32002R0178&from=EN https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32002R0178&from=EN

17 Report on the 27thENGL plenary meeting 6-7 April 2017, https://gmo-crl.jrc.ec.europa.eu/ENGL/docs/ENGL-Plenary-27th.pdf

Who is promoting GMOs as the solution for future food production?

7



Some scientists and scientific organisations have been particularly vocal in demanding that the new generation of GMOs should not be regulated in the same way as existing GMOs because they argue this will allow innovation and research in Europe.[18] But investigations have shown that global biotech corporations are behind this argument, providing guidance on how biotech and other plant breeding companies should talk about new GMOs.[19]

Lobbyists representing cereal, potato, sugar beet and other producers have argued in letters to the authorities the application of existing GMO law to the new generation of technologies would be a major threat to their economic interests, to innovation in Europe, and to the European farming sector,[20] or that it will be impossible to guarantee that their production chains are free of new GMOs.

Footnotes:

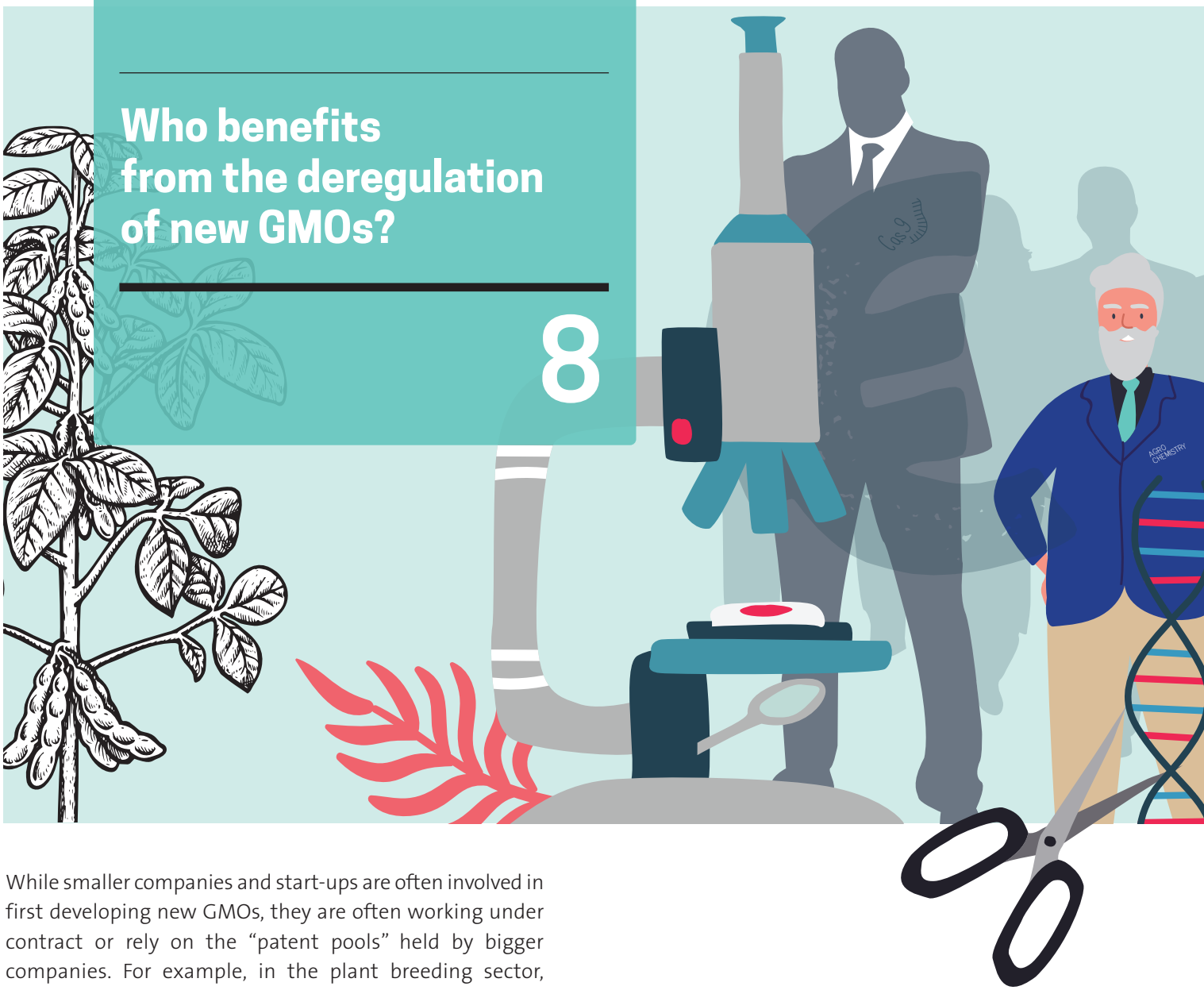
18 Like the letter to Commission president Juncker: http://www.vib.be/en/news/Pages/European-scientists-unite-to-safeguard-precision-breeding-for-sustainable-agriculture.aspx, https://sciencefordemocracy.org/initiative/give-crispr-a-chance , https://www.mpg.de/13748566/position-paper-crispr.pdf

19 Corporate Europe Observatory, #EmbracingNature? - Biotech industry spin seeks to exempt new GMOs from regulation, May 2018, https://corporateeurope.org/en/food-and-agriculture/2018/05/embracingnature

20 Open Letter to Member States on the EU Court Ruling on Mutagenesis, 23 April 2019: https://amfep.org/_library/_files/Letter_to_Member_States_at_Scopaffs_-_April_2019.pdf. http://www.euronews.com/2018/07/27/bayer-basf-to-pursue-plant-gene-editing-elsewhere-after-eu-ruling, https://www.feednavigator.com/Article/2018/07/30/A-harmonized-science-based-legal-framework-is-needed-for-NPBTs?utm_source=copyright&utm_medium=OnSite&utm_campaign=copyright

Who benefits from the deregulation of new GMOs?

8



While smaller companies and start-ups are often involved in first developing new GMOs, they are often working under contract or rely on the "patent pools" held by bigger companies. For example, in the plant breeding sector, Corteva controls many of these patents and effectively employs smaller companies to carry out development.[21] Their dominant market position means it can control the access of its competitors to the patent for the Crispr technology, this includes setting the price for the access to the technology.

Footnotes:

21 Testbiotech, Patent cartel for the large companies, June 2019, https://www.testbiotech.org/en/news/patent-cartel-large-companies

TESTING AND DETECTION

National and EU officials and some agribusiness lobbyists have argued that the new generation of GMOs cannot be detected and so should not be regulated as GMOs.[22] In response, the European Council requested a study to explore the practical implications of the ECJ ruling,[23] including how to ensure compliance with the relevant GMO[24] regulations in cases where gene-edited products "cannot be distinguished, using current methods, from products resulting from natural mutation".

Under EU GMO law, biotech companies are required to provide a testing method for each GMO. The biotech sector has not as yet applied for any new GMOs to be marketed in the EU.

EU GMO law also states that imports must not be contaminated by any traces of non-authorised GMO. This is also the case for the new GMOs. This regulation was put to the test in 2006, when an unauthorised GM rice developed by Bayer entered the EU. Only imports with certificates proving that they did not contain the illegal GM rice were permitted to enter the EU.[25] The same approach was applied when imports of illegal GM linseed from Canada were found in 2009.

As of December 2020, imports of soybeans and rapeseed from North America are not being tested for contamination with the two gene-edited varieties that are being grown commercially in Canada and the US because the EU authorities and national experts have not developed a validated testing method. And as a result national governments are also unable to test imports for contamination. In April 2017 the European Commission's food safety branch – DG Sante – blocked research into the testing of these GMOs.[26]

It is also not possible to identify some of the older generations of GMOs in imports. The EU's Joint Research Centre said in 2017 that the most efficient way to test imports was to check authorisations in other countries, patent applications and other information to apply a targeted approach.[27] A European register of all existing GMOs (including those created using new techniques) would help authorities test for genetic changes, as recommended by EU law.[28]

In September 2020, a testing method for the strain of GM rapeseed that is suspected to contaminate imports from Canada to the EU was published,[29] which has been validated by the Austrian testing authorities.[30] In response, the Canadian company who developed it for the North American markets denied that it was gene-edited.

Footnotes:

22 Many gene-edited products may be indistinguishable from products changed by natural processes or with conventional breeding techniques, see lobby letter: https://legacy.euroseeds.eu/22-european-business-organisations-ask-eu-pro-innovation-rules-plant-breeding

23 Council Decision (EU) 2019/1904, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019D1904&from=EN

24 Directive 2001/18/EC on the deliberate release into the environment of genetically modified organisms, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32001L0018

25 'Member States shall allow the first placing on the market of the products referred to in Article 1 only where an original analytical report based on a suitable and validated method for detection of genetically modified rice 'LL RICE 601' and issued by an accredited laboratory accompanying the consignment demonstrates that the product does not contain genetically modified rice 'LL RICE 601 See: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32006D0601&from=en

26 Report on the 27thENGL plenary meeting 6-7 April 2017, https://gmo-crl.jrc.ec.europa.eu/ENGL/docs/ENGL-Plenary-27th.pdf

27 European Networkof GMO Laboratories, 2017, JRC technical reports - Detection, Interpretation and Reporting on the presence of authorised and unauthorised genetically modified materials, materials. https://gmo-crl.jrc.ec.europa.eu/ENGL/docs/WG-DIR-Final-Report.pdf

28 The traceability regulation 1830/2003 requires to set up a register for all GMO authorised in the EU as well as 'contain, where available, relevant information concerning GMO which are not authorised in the European Union, Art 9, para 3. https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32003R1830

29 Chhalliyil, P. *et al*, A Real-Time Quantitative PCR Method Specific for Detection and Quantification of the First Commercialized Genome-Edited Plant, Foods 2020, 9(9), 1245; https://doi.org/10.3390/foods9091245

30 Umweltbundesamt, 2020, GMO detection in food and animal feed, https://www.umweltbundesamt.at/en/services/laboratory-services/analyses/gmo-detection-in-food-and-animal-feed

Time to focus on real solutions

9

While the new generation of GMOs does not provide the promised silver bullet for Europe's farming sector, other solutions can help Europe develop a more resilient farming sector that protects nature, adapt to the challenges of climate change and provide fair incomes for farmers.

Natural varieties of crops can be developed to adapt to the changing climate, and less intensive forms of agriculture will allow us to feed people in a sustainable way. More support is needed for research into developing these solutions, and EU policymakers need to develop a coherent long-term vision for agroecology. This support should also include community-supported agriculture and grassroots initiatives to maintain and strengthen local knowledge and innovation. Investment for research and development should be prioritised in these areas, rather than targeting resources for the biotech industry.

Local, seasonal and organic food is the healthiest option

So far, neither the new nor the old generations of GMO technologies have been able to produce crops with significant health benefits. Nor have they been able to shift agriculture away from the current input heavy, environmentally damaging model – and it is unlikely that they will be able to do so any time soon.

The biotech industry's health promises are based on technological fixes that change the composition of the oil in a plant, for example. But a healthy diet needs to be diverse, and can be best delivered with locally and seasonally produced food, with agroecology offering the best approach.

Agroecology is the best response to making agriculture more resilient

Shorter food supply chains, greater crop diversity and a more diverse approach to breeding offer a more sustainable approach to reducing emissions and adapting to extreme weather conditions[31] such as when fields are flooded, then exposed to extreme drought followed by another intense rainy season at harvest time.

Agroecology can also provide solutions to problems such as nitrogen-pollution using crops such as horse beans and lupin, for example, drawing on local and traditional knowledge.

Agroecology can foster biodiversity

Evidence shows that agroecology is an efficient and successful way to foster biodiversity and agrobiodiversity in and around the farms. Diverse arable systems that use multiple crops with adapted local varieties create a more diverse and resilient agrobiodiversity.[32] This is in sharp contrast to the reduced agrobiodiversity that results from GM approaches.

Opportunities exist for radically different new approaches, such as growing polycultures, with up to a hundred different crops on one field.

Real innovation

Innovation requires far more than new technologies. Real innovation means reorganising the food distribution system, supporting participative breeding with locally adapted varieties, involving communities, and connecting traditional, native crop varieties with modern knowledge about ecosystems. In this way farmers will be able to stabilise yields, harvest nutrient-rich plants and protect biodiversity, while mixed farms will be able to adapt to changing weather and other challenges.

One model that secures livelihoods for farmers and increases trust between farmers and consumers by supporting responsible production practices such as extensive, pasture-based animal husbandry is an approach known as "community-supported agriculture". This involves a group of people guaranteeing to purchase all of a farmer's seasonally available produce, paying in advance and so sharing the production risks.

Footnotes:

31 Altieri, M.A., Nicholls, C.I., Henao, A. *et al.* Agroecology and the design of climate change-resilient farming systems. Agron. Sustain. Dev.35, 869–890 (2015). https://doi.org/10.1007/s13593-015-0285-2, https://link.springer.com/article/10.1007/s13593-015-0285-2

32 European Economicand Social Committee, European agriculture should develop towards agroecology, July 2019. https://www.eesc.europa.eu/en/news-media/news/european-agriculture-should-develop-towards-agroecology-0 , FAO, Diversity: diversification is key to agroecological transitions to ensure food security and nutrition while conserving, protecting and enhancing natural resources, http://www.fao.org/agroecology/knowledge/10-elements/diversity/en/ , Reid, V., Agriculture, agroecology and biodiversity, Biodiversity, 2014, Vol15, No 4, 239-240, 24 Nov 2014, https://doi.org/10.1080/14888386.2014.980441, https://www.tandfonline.com/doi/abs/10.1080/14888386.2014.980441?journalCode=tbid20; Wanger, T.C., DeClerck, F., Garibaldi, L.A. *et al.* Integrating agroecological production in a robust post-2020 Global Biodiversity Framework. Nat Ecol Evol4, 1150–1152 (2020). https://doi.org/10.1038/s41559-020-1262-y

- **States need to follow EU law** and the ruling of European Court of Justice and ensure the new generation of GMOs are properly regulated. This is in line with EU environment and food rules and ensures transparency for breeders, farmers, food processors and consumers. In case any environmental problems are identified, transparency and traceability are crucial.
    - **Biotech companies are legally obliged to deliver a testing method for any GMO that has been authorised in the EU.** In addition, European laboratories need to update their testing protocols for unapproved GMOs so that they can be identified in imports.
    - **The different tools and support systems in the farming sector should be assessed and priority should be given to those which could lead to a radical transformation towards agroecology.** Diverse, climate-resilient and low input production and distribution models must be promoted, which prioritise the protection and restoration of ecosystems, soils and the climate, as well as providing fair incomes and working conditions for producers and labourers across the supply chain.
- **EU and national level research programmes level should prioritise more sustainable farming and breeding methods.** These research bodies should include funding opportunities for participatory processes like farmer-led innovation platforms and farmer-to-farmer knowledge exchange at the local and regional level.

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