

CONSUMPTION RESEARCH NORWAY (SIFO)

GMO foods or not

Have there been changes in consumers' views on genetically modified foods from 2017 to 2020?

Annechen Bahr Bugge

OSLO METROPOLITAN UNIVERSITY
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Tittel GMO-mat eller ikke: Har det vært endringer i forbrukernes syn på genmodifisert mat fra 2017 til 2020?	Number of pages 42	Date 14 April 2020
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Client The GMO-Network		
Summary GMO-teknologien har i en årrekke vært gjenstand for offentlig debatt i Norge og i mange andre land. Diskusjonen omhandler muligheter, bruk, fordeler, risikoer, trygghet og begrensninger. I denne studien har vi sett nærmere på hva forbrukerne mener om bruk av denne teknologien i matproduksjon: Hvordan er deres kunnskaper om GMO-teknologien? Hva oppfatter de som fordelaktig ved bruk av slik teknologi? Og hva oppfatter de som bekymringsfullt? Vil de spise eller ikke spise GMO-produkter? Hva er begrunnelsene? Og hvordan stiller de seg til utvikling og bruk av gendrivere? Svarene er blitt sammenlignet med resultatene fra en forbrukerundersøkelse som ble gjennomført av SIFO i 2017. Har forbrukerne blitt mer eller mindre positive til GMO-teknologi i matproduksjon i løpet av disse tre årene? Mange hadde hørt begrepet «genmodifisert organisme (GMO)» tidligere, men relativt få mente de hadde god kjennskap til teknologien. En endring fra 2017 til 2020 var at det var noen færre som ga uttrykk for at de hadde meget eller dårlig kjennskap til GMO. I likhet med resultatene fra 2017, var det også i 2020 relativt mange som svarte «vet ikke» på spørsmålene som omhandlet temaet fordeler, ulemper og risikoer ved bruk av GMO-teknologi i matproduksjon. Det var nokså delte meninger om GMO-teknologien ville være nødvendig for å produsere nok mat i verden. Om lag halvparten mente det var sannsynlig at GMO ville ha negative effekter på natur og økosystemer. Fra 2017 til 2020 var det en økende andel som mente GMO vil kunne utgjøre en helseisiko for mennesker og dyr. Det var ingen endring i synet på hvorvidt GMO ville bidra til økt industriandbruk. Seks av ti mente denne teknologien ville bidra til dette. Videre var det en større andel som mente GMO ville føre til mindre bruk av sprøytemidler. Fire av ti mente GMO ikke var nødvendig for å skape et mer bærekraftig samfunn. Om lag halvparten mente GMO kolliderte med deres syn på en etisk forsvarlig matproduksjon. Hvis utvalgte GMO-produkter som var tillatt på det amerikanske markedet hadde vært tilgjengelige i norske butikker, ville flest spist potet og færrest laks eller mais. Tre av ti ville ha spist kjøtt fra genredigert svin (motstandsdyktig) og laks (steril) hvis slike produkter ble en realitet i fremtiden. Åtte av ti begrunnet sin bekymring for å spise GMO-produkter med mulige negative følger for natur og økosystemer. Syv av ti var bekymret for negative følger for egen helse. Om lag halvparten var bekymret for velferden for husdyr og oppdrettsfisk. Det var små endringer å spore fra 2017 til 2020. I den samme tidsperioden økte andelen som var svært eller ganske positive til salg av GMO-produkter i norske dagligvarebutikker fra 15 prosent til 24 prosent. Større andel som mente merking av GMO-produkter, fra 47 prosent til 53 prosent. Det er fortsatt stor forbrukerskepsis til GMO i matproduksjon. Videre er det altså et klart ønske om at slike produkter blir merket hvis GMO blir tillatt.		
Summary For years, GMO technology has been the subject of ongoing scientific, political and social discussion in Norway and many other countries. The discussion deals with opportunities, uses, benefits, risks, security and limitations. In this study, we have taken a closer look at what consumers think about using this technology in food production: How is their knowledge of GMO technology? What do they consider to be beneficial in using such technology? And what do they consider as worrying? Will they eat or not eat GMO products? What are the reasons? And how do they look at the development and use of gene drivers in food production? The answers have been compared to the results of a study		

conducted by the same author in 2017. The question is whether the consumers have become more or less positive about GMO technology in food production during these years?

Many had heard of the term "genetically modified organism (GMO)", but relatively few considered their knowledge of the technology to be good. However, more people considered their knowledge as good in 2020 than in 2017. In both years, the proportion who answered "do not know" to the various questions about the benefits and risks of the technology was relatively large. There were shared opinions about whether GMO technology would be needed to produce enough food in the world or not. Half believed GMOs were likely to have negative effects on nature and ecosystems. An increasing proportion believed GMOs could pose a health risk to humans and animals from 2017 to 2020. There was no change in the view on whether GMOs would contribute to increased industrial agriculture. Six out of ten believed this could be a consequence. Furthermore, a larger proportion thought GMO would lead to less use of pesticides. Four out of ten believed GMO was not necessary to create a more sustainable society. Half believed GMOs collided with their view of ethically food production. Of GMOs approved in the US market, there were potatoes and salmon Norwegian consumers were most likely to eat. Eight out of ten justified their concern about eating GMO products with possible negative effects on nature and ecosystems. Seven out of ten were concerned about negative consequences for their own health. About half were concerned about the welfare of livestock and farmed fish. There were insignificant changes from 2017 to 2020. However, the proportion that was positive for such products sold in Norwegian stores had increased from 15 to 24 percent. There was also an increasing proportion who considered it important to label the GMOs, from 47 percent to 53 percent. Overall, the study showed that there had been very small changes in the view of this technology from 2017 to 2020. There are still many consumers who are sceptical about GMO in food production. Furthermore, there is a clear desire that such products are labelled if GMO is allowed.

Stikkord

Blomster, CRISPR, dyrevelferd, epler, etikk, forbruk, gendrivere, GMO, helse, kjøtt, laks, mais, matproduksjon, matsikkerhet, merking, miljø, oppdrettsfisk, natur, poteter, sprøytemidler, teknologi.

Keywords

Animal welfare, apples, consumption, corn, CRISPR, environment, ethics, farm fish, flowers, food production, food security, gen drives, GMO, health, labeling, meat, nature, pesticides, potatoes, salmon, technology

Preface

This report was commissioned by the GMO-Network. The project manager was Annechen Bahr Bugge. The report is a follow-up of the study *Fremtidens matproduksjon Forbrukernes syn på genmodifisert mat: GMO-mat eller ikke? (Future food production. The consumers' view on GMO food: Positive and negative aspects of GMO products?)* This report was published in SIFO's report series in 2017. Our client and experts in the field with whom they collaborate have reviewed the survey carefully. GMO technology is a demanding and complex scientific and political field, and it was therefore of utmost importance that the questions were phrased in a simple, concrete and easily understood manner. Furthermore, it was important that the respondents were not asked leading questions. Developments in the field during the period 2017–2020 have necessitated some changes to the survey. The data collection for both surveys was carried out in late January and early February of 2017 and 2020, respectively.

Head of Research Anita Borch has quality-assured the report.

Oslo, 17 April 2020

Consumption Research Norway (SIFO)

OsloMet – Oslo Metropolitan University

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1. Introduction

For years, GMO technology has been the subject of ongoing scientific, political and social discussion in Norway and many other countries. The discussion deals with opportunities, uses, benefits, risks, security and limitations. In this study, we have taken a closer look at what consumers think about using this technology in food production: How is their knowledge of GMO technology? What do they consider to be beneficial in using such technology? And what do they consider as worrying? Will they eat or not eat GMO products?. What are the reasons? And how do they look at the development and use of gene drivers in food production? The answers have been compared to the results of a study conducted by the same author in 2017. The question is whether the consumers have become more or less positive about GMO technology in food production during these years.

1.1 Some key terms:

1.1.1 Genetically modified organisms (GMO)

The Norwegian Gene Technology Act defines a genetically modified organism as ‘a microorganism, plant or animal in which the genetic material has been altered by means of gene or cell technology.’¹

1.1.2 Genetically modified plants

Genetically modified plants are plants whose genetic material has been modified by means of gene technology methods for the purpose of giving them new, useful characteristics.²

1.1.3 Genetically modified animals

Genetically modified animals are used in research, medicine, industry etc. New forms of genetic modification, known as gene editing, have made it possible to change the genetic material of different organisms, including animals.

1.1.4 GMO methods

There are different ways of creating GMOs. The old genetic modification methods were based on inserting whole genes into the organism's genetic material. In recent years, new methods have been developed for making more targeted modifications to genes. This is known as gene editing. The method CRISPR, which is based on special patterns in the DNA sequence, makes it possible to alter genes by removing, replacing or adding DNA.³

¹ <https://lovdata.no/dokument/NL/lov/1993-04-02-38> (26 March 2020)

² <https://www.bioteknologiradet.no/temaer/genmodifiserte-planter-og-mat/> (1 April 2020)

³ <https://www.regjeringen.no/no/tema/klima-og-miljo/naturmangfold/innsiktsartikler-naturmangfold/genteknologi/id2339898/> (1 April 2020)

1.2 Some examples of GMO in political processes and public debate.

2 June 2017 – The government says no to genetically modified plants

*The government decided in a cabinet meeting today to refuse permission to import four genetically modified plants to Norway; three rapeseed plants and a maize plant. The three rapeseed plants were not allowed because they could harm Norwegian nature. The government turns down the maize plant due to ethical objections. 'This is an important decision. By turning down the import of three genetically modified rapeseed plants and one maize plant, we are demonstrating that Norway's GMO policy will be a restrictive one,' says Minister of Climate and Environment Vidar Helgesen. He explains that the ban on maize 1507 is the first time a prohibition has been introduced pursuant to the Gene Technology Act that has not been based on environmental or health risk concerns, but ethical considerations alone.*⁴

5 December 2017 – The Norwegian Biotechnology Advisory Board proposes softening up the GMO regulations

In a statement published today, a majority of 18 out of the 20 members of the Norwegian Biotechnology Advisory Board proposes softening up the regulatory framework for genetically modified organisms. The majority of the board recommends incorporating a hierarchy of levels into the Gene Technology Act, so that certain types of GMOs will be subject to a duty of notification instead of a complete approval process. The majority wants to keep the requirement for all types of GMOs to be labelled, but proposes that the labelling should also be differentiated into different levels to reflect relevant differences.

*In recent years, new genetic modification methods have given rise to debate about the regulation of GMOs. This applies in particular to the much discussed CRISPR method, which makes it possible to make genetic modifications to plants, animals and microorganisms without inserting 'foreign' genetic material from other species. Several Norwegian research communities have used the CRISPR method to develop, for instance, food plants that are more resistant to disease and sterile farmed fish that cannot breed with wild fish should they escape.*⁵

12 December 2017 – NRK Viten writes 'Prepare yourself for genetically edited food'

*By genetically editing food, it will be possible to make wheat without gluten, cooking oil with less saturated fat and plants that are better equipped to face climate changes, as they will have better drought tolerance. 'Gene editing provides great opportunities for developing nutritious plants adapted to the climate. We can now improve taste, shelf life, nutritional values and resistance to disease in all types of plants in a short period of time,' says Tage Thorstensen, who is a researcher at NIBIO – the Norwegian Institute of Bioeconomy Research. He has used gene editing in his research to make strawberries resistant to the fungus that causes grey mould, which destroyed much of the crops in Norway last year.*⁶

9 May 2018 Forskning.no: 'Can GMO save the world? Gene editing can make plants more resistant so that they need less fertilizer and pesticides.'

⁴ <https://www.regjeringen.no/no/aktuelt/regjeringen-sier-nei-til-genmodifiserte-planter/id2555387/> (10 March 2020)

⁵ <https://www.bioteknologiradet.no/2017/12/foreslar-a-myke-opp-gmo-regelverket/> (10 March 2020)

⁶ <https://www.nrk.no/viten/gjor-deg-klar-for-genredigert-mat-1.13813299> (10 March 2020)

Jansson is critical of environmental organisation that oppose all forms of gene editing and of the EU's extremely strict GMO legislation, which makes it virtually impossible to grow genetically modified plants for human consumption within the EU. 'There are no examples of uncontrolled spread of GMOs in nature. There are no examples of GMO crops being unhealthy to eat,' he says. 'If we consider food security and a more sustainable food production, gene editing can play an important role in saving the world. We can create plants that require less fertilizer and pesticides,' he says. Professor Michael Palmgren of the Department of Plant and Environmental Sciences at the University of Copenhagen agrees. 'GMOs are simply tools. All tools can be used in either a suitable or an unsuitable manner. It is the results we should judge,' he says.⁷

15 August 2018 GMO debate during the Arendalsuka event under the auspices of the Norwegian Biotechnology Advisory Board and others. Ørjan Brinkman is president of the Swedish Consumers' Association and the European Consumer Organisation BEUC.

During the debate, Brinkman referred to the fact that the vast majority of consumers in the Nordic countries and Europe are sceptical of GMOs in food. He emphasised the precautionary principle and said that the consumer organisations believe that not enough is known about the long-term consequences and that more independent research is needed. When asked about the new gene editing methods, he said that 'cutting out something from the genes would be like taking out a single stone from the foundations of a house. We are not worried about the immediate effects, but we are concerned about the potential long-term consequences.'⁸

12 September 2018 Faktisk.no: 'No indications that eating GMO food could be harmful.'

Many people are sceptical of genetically modified food. In 2016, when the grocery chains Rema 1000, Coop and Norgesgruppen publicly warned against allowing genetically modified maize, researchers referred to it as baseless scaremongering and commercial calculation. One of the sceptics was Berit Nordstrand, a doctor, public speaker, blogger and cookbook author, who sells a range of products such as granola and crispbread that bear her name. Faktisk.no has recently received several tips about the article 'GMO-mat er ikke mat' ('GMO food is not food'), in which Nordstrand writes that GMO food could provide less nutritious and more toxic food, that genetically manipulated plants contain built-in insect repellent and can withstand immense amounts of pesticides. She has 95,000 followers on Facebook.⁹

27 September 2018 Daily newspaper Nationen, opinion piece by Director Anne I. Myhr and researcher Odd-Gunnar Wikmark at GenØk – The Center for Biosafety: 'Gene editing is being regulated as GMO'

The court's ruling is very clear and mainly states that gene edited organisms are GMO and must be regulated as such. This means that before they can be approved, they must undergo a risk assessment in accordance with the EU's GMO directive. Many people, including here in Norway, have claimed that certain gene edited organisms are identical to those found in nature and therefore safe, but this claim is not supported by the European Court of Justice.

⁷ <https://forskning.no/planteverden-genmodifisert-mat-genteknologi/kan-gmo-redde-verden/269960> (11 March 2020)

⁸ <http://www.bioteknologiradet.no/2018/08/vi-stroymer-fra-gmo-mote-i-arendal-kl-12-30/> (11 March 2020)

⁹ <https://forskning.no/mat-og-helse-dna-genetikk/faktiskno-ingenting-tyder-pa-at-det-er-farlig-a-spise-gmo-mat/1238182> (11.03.20)

*The ruling clearly states that we currently do not have experience of safe use of gene editing techniques. Any exemptions from the regulation of gene editing and products made using these new techniques will be in breach of the very purpose of the directive itself, which is to protect health and the environment. It will also constitute a clear breach of the precautionary principle.*¹⁰

28 February 2019 Aftenposten Viten asks: 'Will the "breakthrough of the century" not be allowed in Norway?'

*An EU court recently ruled that a gene editing method called CRISPR is to be regarded as GMO. We consider this very unfortunate. CRISPR does not involve inserting foreign DNA into the organism, but rather edit the organism's own. [...]. The biggest difference is time. What has previously taken us several generations to change can now be changed quickly and in a much more precise manner. However, it is difficult to convince the general public and politicians. We believe the EU ruling has come about due to a lack of knowledge.*¹¹

4 March 2019 Researcher Dorothy Dankel of the Department of Biological Sciences at the University of Bergen writes: 'Who is right? The enthusiastic CRISPR professor or the sceptical average Norwegian? How should the issue be debated?'

*Should we conduct research on the use of CRISPR if the consumers do not want it? From a purely democratic point of view, the short answer is: 'no'. The majority decides. But to add nuance to the debate, the question remains: why do they not want CRISPR, and why do researchers want to use CRISPR? Do researchers want to use CRISPR to acquire more basic knowledge or to patent new products? Do people not want CRISPR because they distrust research or because they feel strongly about a natural ecosystem? Value is not only measured in numbers or money. There are also moral values to consider. In public debate, emotional arguments can carry the same weight as logical arguments.*¹²

10 October 2019 Executive Director Åslaug Haga of Global Crop Diversity Trust in a talk in Kulturhuset in Oslo: 'We don't need to go use GMO'

*We at Crop Trust believe that we don't need to resort to GMO to resolve the challenge of global food security. Natural diversity provides us with fantastic opportunities, and it contains all the properties we need in the future. With the help of new technology, conventional plant breeding has become much more efficient than it used to be. We also need to have a much more varied diet than we currently do. This is a golden opportunity to talk about more diversity among our food plants.*¹³

16 January 2020 Nationen: 'Genetically modified carnation will be allowed in Norway'

The Ministry of Environment and Climate announces that the carnations called 'Moonacqua' and 'Moonvista' can be imported to Norway as cut flowers.¹⁴

26 January 2020 The Norwegian Forum for Development and Environment (ForUM), a network consisting of over 50 civil society organisations, writes the following in its statement to the Norwegian Ministry of Environment and Climate

¹⁰ <https://www.nationen.no/kronikk/genredigering-reguleres-som-gmo/>

¹¹ <https://www.aftenposten.no/viten/i/3jnqXd/skal-ikke-aarhundrets-gjennombrudd-bli-tillatt-i-norge> (11 March 2020)

¹² <https://www.tekna.no/fag-og-nettverk/miljo-og-biovitenskap/tekna-havbruk/tekna-havaker/crispr-teknologi-i-avbruksbransjen/er-vi-klare-for-crispr-tid-for-en-stor-offentlig-debatt/> (11 March 2020)

¹³ <https://www.gmofrimat.no/vi-trenger-ikke-ga-veien-om-gmo/> (10 March 2020)

¹⁴ <https://www.nationen.no/nyhet/genmodifisert-nellik-blir-tillaten-i-noreg/> (11 March 2020)

*Gene drive technology can change genetic elements (gene drives) in entire populations of insects, plants, animals and other organisms in a short amount of time. This can potentially lead to the extinction of wild species, and is also a threat against sustainable food and agriculture. Even if it is done with the best of intentions, for instance to eradicate mosquitoes that carry dangerous diseases, it could lead to big, irreversible encroachments on the ecosystems that can have unintended consequences for natural diversity. There is a lot of potential when it comes to gene drives, but we currently do not know enough about the potential consequences. Furthermore, we want to point out that there are already tried-and-tested documented methods that can address several of the challenges that gene drives can solve, with less risk. ForUM is asking Norway to work for a moratorium on the release of gene drives, but welcomes further research in the field within safe frameworks.*¹⁵

1.3 Dilemmas

Taking into consideration that consumers are believed to exert great influence on the development and use of GMO technology in food production, it is important to map their attitudes. The purpose of this study, like the one carried out in 2017, is precisely to gain insight into the consumers' views. What do the consumers know about the technology? Which aspects of the technology are perceived as beneficial? What worries people? Will they buy and eat GMO food? How important do the consumers think it is that such product are labelled? And what about gene drives? Is this a method that consumers are familiar with? What are their views on research on this technology? And what about a possible international ban on releasing them in nature?

1.4 Materials and method

A web survey was developed for a representative sample of the Norwegian population in 2017 (N = 1014) and 2020 (N = 1066). Both surveys were completed in late January/early February. The following topics were covered in the survey:

- Knowledge of GMO and gene drives
- Views on the development and use of GMO and gene drives in food production
- Views on possible positive and negative effects of GMO technology on health, nature, ecosystems, the environment, animals, fish and workers
- Willingness to eat GMO food
- The importance of labelling GMO food
- Views on research and legislation

This was seen in light of background variables such as gender, age, education and place of residence. Statistical analyses were carried out using the computer programme SPSS. Pearson's chi-squared test was used to compare the response rate of different groups. We have chosen $p < 0.05$ as our significance level. The data collection was carried out by Norstat in January/February in 2017 and 2020. The quantitative data are presented in simple figures or explained in running text.

¹⁵ <http://www.forumfor.no/assets/docs/Innspill-fra-ForUM-til-KLD-om-ny-naturavtale-26.01.2020.pdf> (11 March 2020)

2. Results from the consumer survey

In this chapter, we will present results from the survey on consumers' view on the use and development of GMO technology in food production. The results will be seen in light of the survey SIFO carried out on the same topic in 2017. The latter was published in SIFO's report series (Bugge and Rosenberg 2017). The material in both surveys was based on a representative sample. A selection criterion for participation in the survey was that you had to be the person responsible for most of the household's grocery shopping. GMO is a complex topic, and great effort went into formulating simple, concrete and neutral questions. Some of the questions were prefaced by short explanations of terms. The following explanation of the term GMO was provided at the beginning of the survey:

'In this survey, you will be asked about your views on the use of genetically modified organisms in food production. A GMO is an organism, for instance a plant, animal, fungus or bacteria, in which the genetic material has been altered by means of gene technology. In recent years, new methods for genetic modification have made it possible to make more targeted changes to the genetic material than before. The new methods are known as gene editing, for instance CRISPR. The questions we ask you are related to your view on some selected GMO products, your view on GMO labelling of food and your attitudes to the use of GMO in food production.'

2.1 What do you know about GMO?

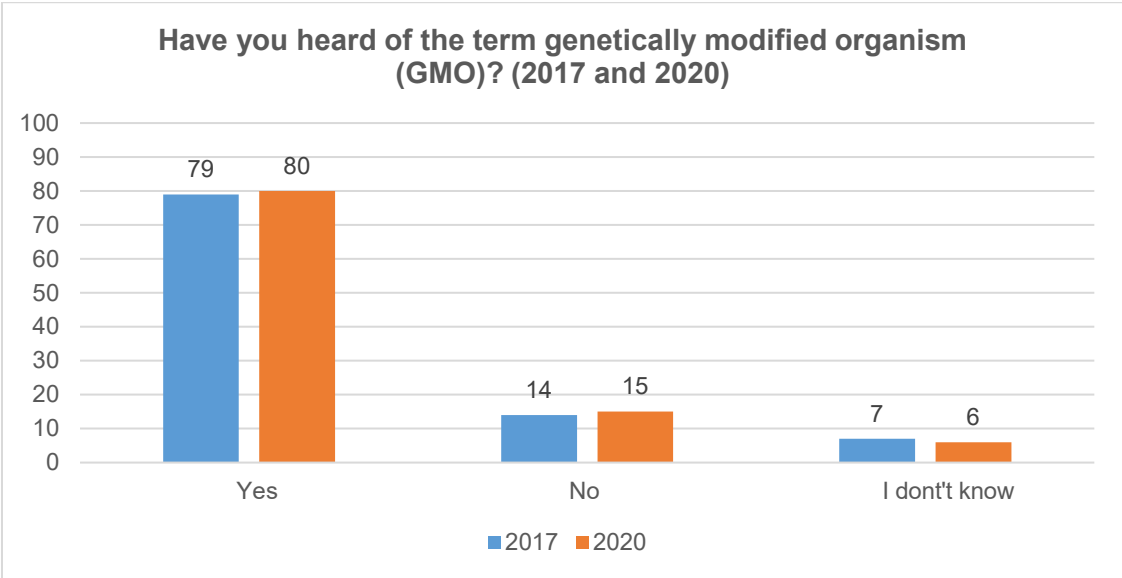


Figure 2-1 Have you heard of the term genetically modified organism (GMO)? Percentage. N = 1014 (2017) and 1066 (2020). Norstat 2017 and 2020

Eight out of ten had heard of the term genetically modified organism (GMO) in 2017, and the same was the case in 2020. One of the changes found to have taken place over the course of these years was that women reported better knowledge of GMO in 2020 than in 2017. In 2017, more men (82 per cent) than women (75 per cent) believed they had heard the term before. This was not the case in 2020. This was not the case in terms of age. While the differences between the different age groups' knowledge of the term genetically modified organism (GMO) were negligible in 2017, in 2020 more people belonging to the older age

group (55 years or older) (84 per cent) believed they had knowledge of the term compared with the younger age groups. Both in 2017 and 2020, a higher percentage of people with a high level of education than with lower levels of education were familiar with the term. In 2020, 89 per cent of people with a university/university college degree (more than 4 years) had heard of the term, compared with 76 per cent of those who had completed a secondary education.

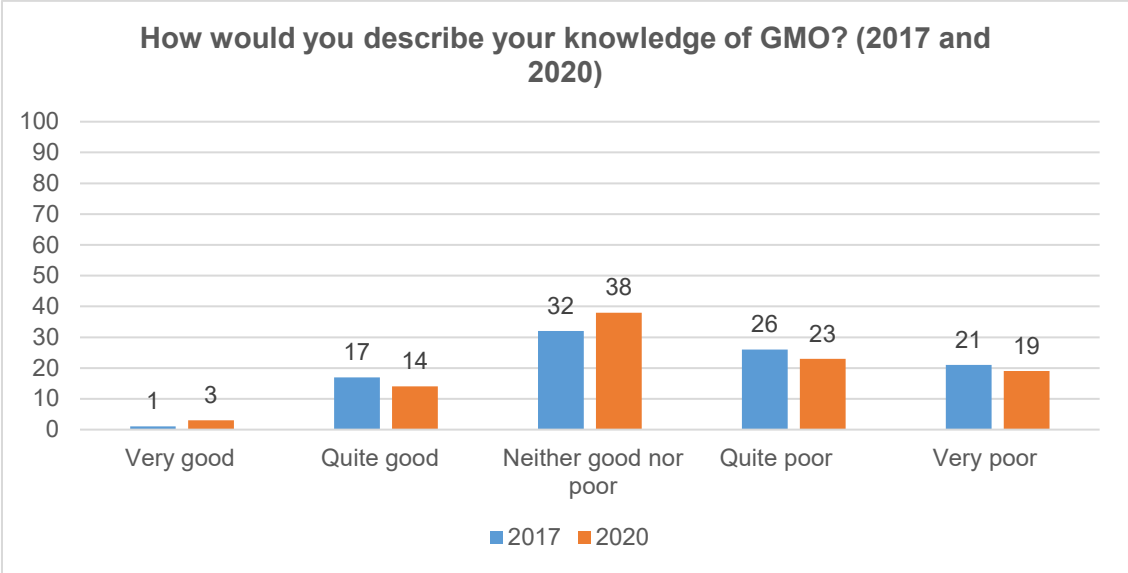


Figure 2-2 How would you describe your knowledge of GMO? Percentage. N = 1014 (2017) and 1066 (2020). Norstat 2017 and 2020

This means that most people had heard of the term GMO, but far fewer people (18 per cent) believed their knowledge of the technology to be very or quite good. This was also the case in 2017. One change that had occurred in the course of these three years is that fewer people believed that their knowledge was very or quite poor. In 2017, 47 per cent believed they lacked knowledge, compared with 42 per cent in 2020.

More women (46 per cent) than men (37 per cent) stated that they had poor knowledge of GMO. Twenty per cent of the men and 15 per cent of the women believed they had good knowledge of the topic. Education also had an effect. More people with higher education (32 per cent) than with a lower level of education (22 per cent) believed they had good knowledge of GMO. This is the same pattern as in 2017.

2.2 Benefits, disadvantages and possible risks associated with the use of different GMOs

In order to gain knowledge of how the respondents assessed the development and use of genetic modification in future food production, they were asked to consider several statements about benefits, disadvantages and risks. In 2017, the question was worded as follows: *‘There is disagreement about the benefits and disadvantages and possible dangers of GMO. Which of the following statements best express your own view of this technology in relation to...?’* We changed the wording of the question slightly in the survey prepared in 2020: *‘There are many different GMOs. They may have different benefits, disadvantages and possible risks associated with their use. With this in mind, we will present some general*

statements on the use of genetically modified organisms. Which of the following statements best express your own view of this technology?’

As in 2017, a relatively high proportion of respondents answered ‘I don’t know’ to the questions concerning benefits, disadvantages and risks. This supports the respondents’ own assessment that their knowledge of this technology is fairly limited. The proportion of respondents who answered ‘I don’t know’ to the different questions about advantages and disadvantages varied from 30 to 45 per cent.

2.2.1 Is GMO necessary to produce enough food in the world – or not?

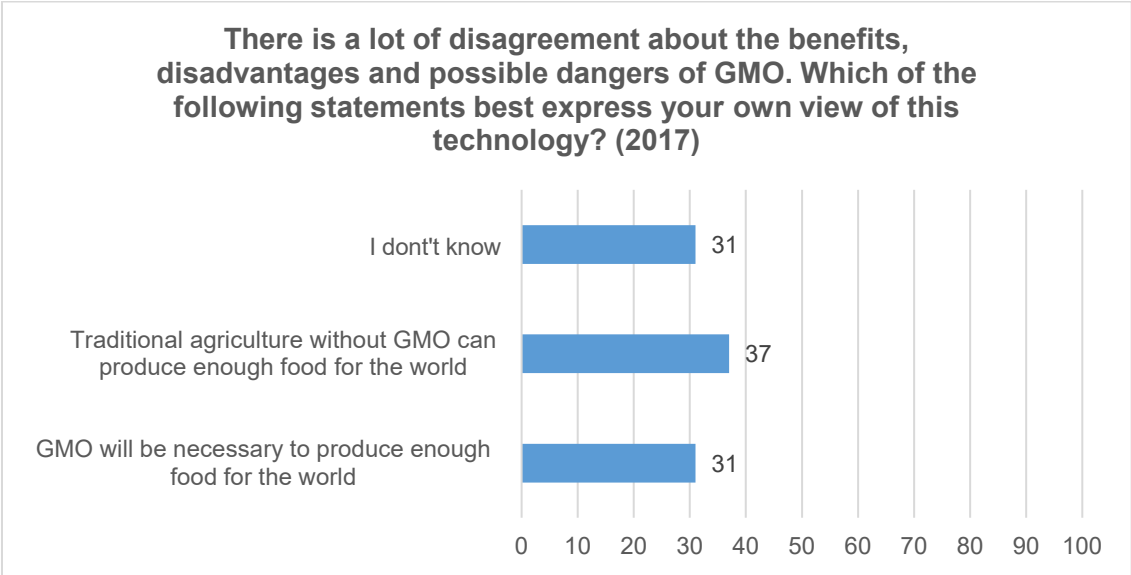


Figure 2-3 There is a lot of disagreement about the benefits, disadvantages and possible dangers of GMO. Which of the following statements best express your own view of this technology? Percentage. N = 1014. Norstat 2017

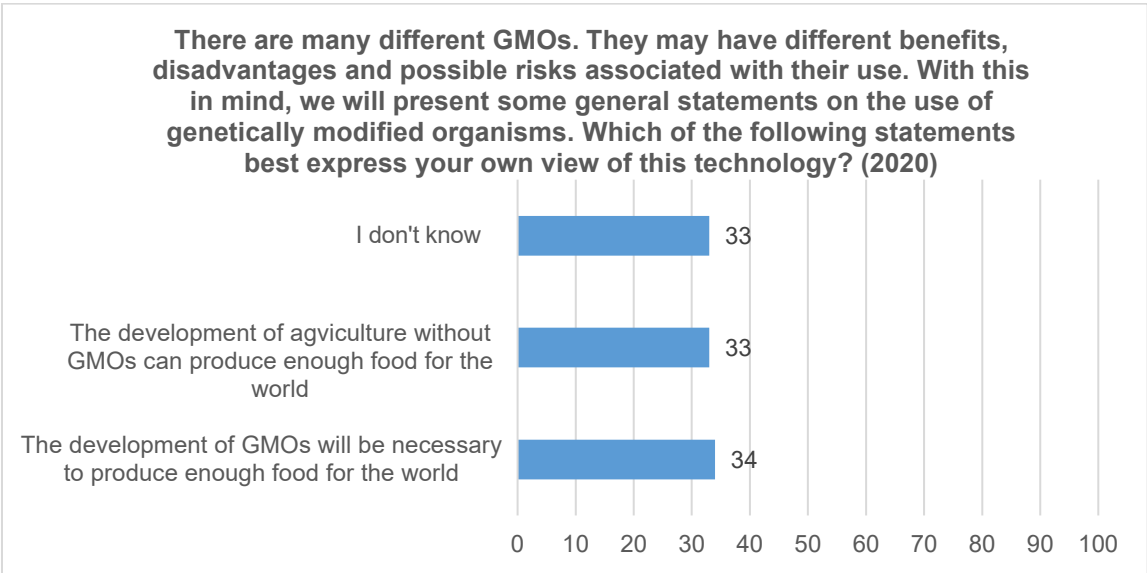


Figure 2-4 There are many different GMOs. They may have different benefits, disadvantages and possible risks associated with their use. With this in mind, we will present some general statements on the use of genetically modified organisms. Which of the following statements best express your own view of this technology? Percentage. N = 1066. Norstat 2020

Although the wording of the questions about whether or not developing GMOs would be necessary in order to produce enough food in the world was somewhat different, only small differences were found from 2017 to 2020. In addition, both surveys showed that the respondents were divided in their view on whether this would be necessary or not. In 2017, 31 per cent believed GMOs would be necessary to produce enough food. Three years later, 34 per cent of the respondents believed the same thing. The number of respondents who believed that agricultural development without GMOs would be sufficient to produce enough food in the world was somewhat lower in 2020 (33 per cent) than in 2017. In 2017, 37 per cent believed traditional agriculture would be sufficient.

In 2017, a much higher proportion of men (38 per cent) than women (25 per cent) believed that GMOs would be necessary to produce enough food. A similar pattern emerged in 2020. This time, 39 per cent of the men, compared with 29 per cent of the women, believed that GMOs would be necessary. More women (39 per cent) than men (26 per cent) responded 'I don't know'.

Young people had a much more positive attitude to this statement than the older age groups. In 2017, 42 per cent of the oldest respondents (55 years +), compared with 30 per cent of the youngest age group (18–34 years), believed that traditional agriculture without GMO would be sufficient. This was also the case in 2020. In 2017, 39 per cent of the oldest respondents, compared with 26 per cent of the youngest ones, believed that developing GMO would be unnecessary. Forty-five per cent of the youngest respondents and 28 per cent of the oldest believed it would be necessary.

Of the people who believed that developing GMO would be necessary to produce enough food in the world, more lived in Oslo or another city (38 per cent) than in the countryside (20 per cent).

2.2.2 Is it likely that GMOs will have a negative effect on nature and ecosystems – or not?

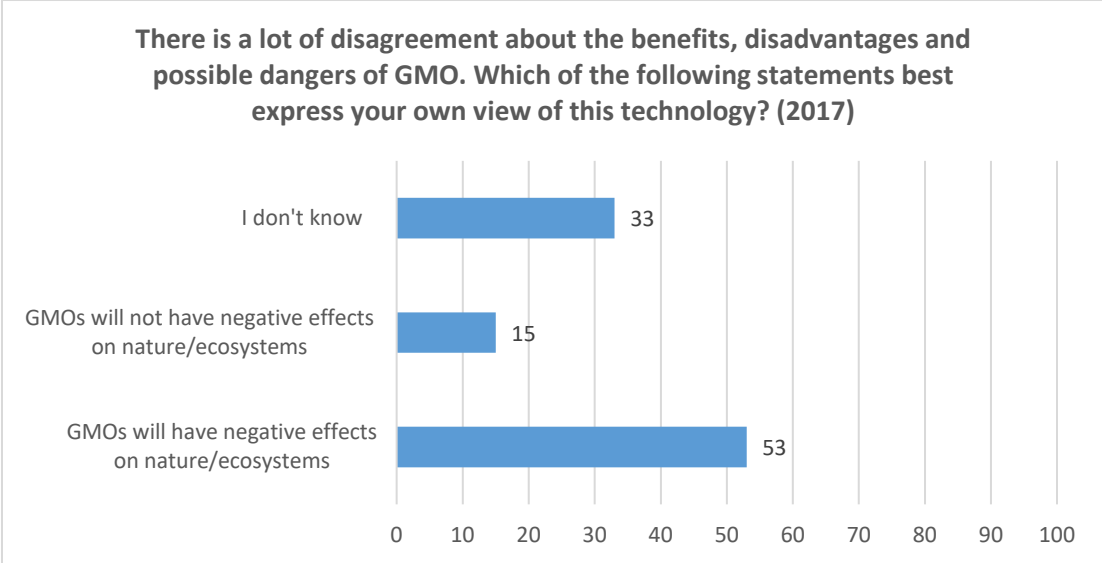


Figure 2-5 There is a lot of disagreement about the benefits, disadvantages and possible dangers of GMO. Which of the following statements best express your own view of this technology? Percentage. N = 1014. Norstat 2017

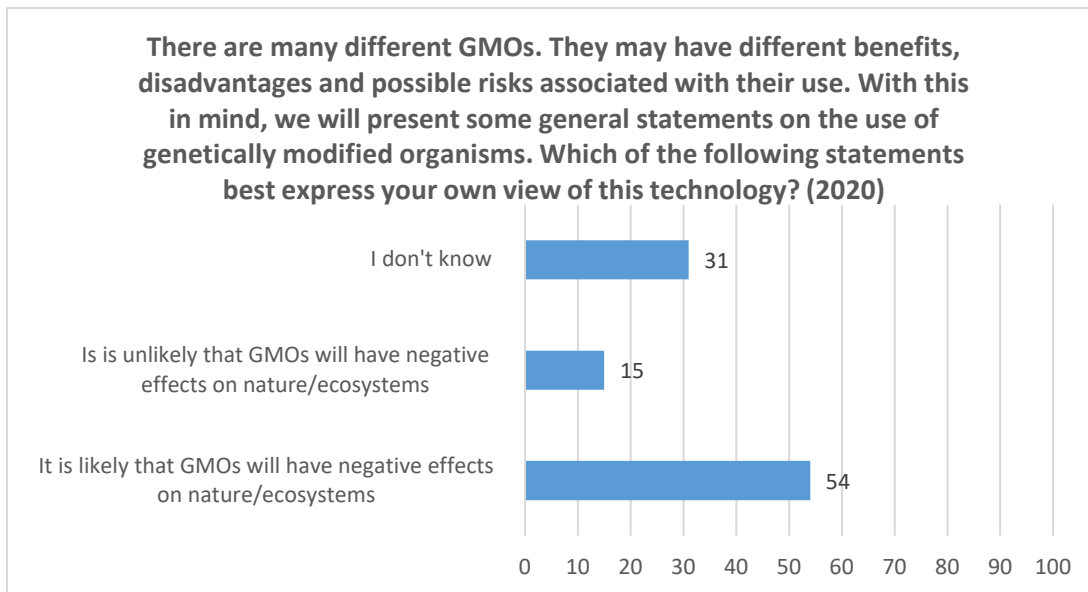


Figure 2-6 There are many different GMOs. They may have different benefits, disadvantages and possible risks associated with their use. With this in mind, we will present some general statements on the use of genetically modified organisms. Which of the following statements best express your own view of this technology? Percentage. N = 1066. Norstat 2020

The respondents' view on GMOs' possible effects on nature and ecosystems remained unchanged from 2017 to 2020. Over half (53–54 per cent) believed that it was probable that such technology could have negative effects. Far fewer (15 per cent) believed it to be unlikely. Three out of ten answered 'I don't know'.

More women than men believed that it was probable that GMOs would have negative effects on nature and ecosystems. In 2017, 56 per cent of the women, compared with 49 per cent of the men, believed this. The same pattern emerged in 2020. However, the proportion of men who believed this had now increased to 52 per cent. The proportion remained unchanged for women (56 per cent). More women (34 per cent) than men (28 per cent) responded 'I don't know'.

There were minor differences between the different age groups in their views regarding GMOs' possible effects on nature and ecosystems in 2020. In 2017, however, a slightly higher proportion of respondents in the youngest age group (18–34 years) (38 per cent) than in the older age groups (35 years+) (30–31 per cent) answered 'I don't know'. Furthermore, the respondents in the age group 35–54 years were the least concerned about negative effects.

A higher number of respondents with a low level of education (44 per cent) than with a high level of education (21 per cent) responded that they were unable to take a stand to the statement about GMOs' possible effects on nature and ecosystems. More people with the highest level of education (66 per cent) than at lower levels (49 per cent) believed it could have negative effects. The same pattern also emerged in the 2017 survey.

More people in the countryside (62 per cent) than people living in Oslo or another city (49–51 per cent) believed that it was probable that GMOs would have negative effects on nature and ecosystems.

2.2.3 Is it likely that GMOs will constitute a risk to human or animal health – or not?

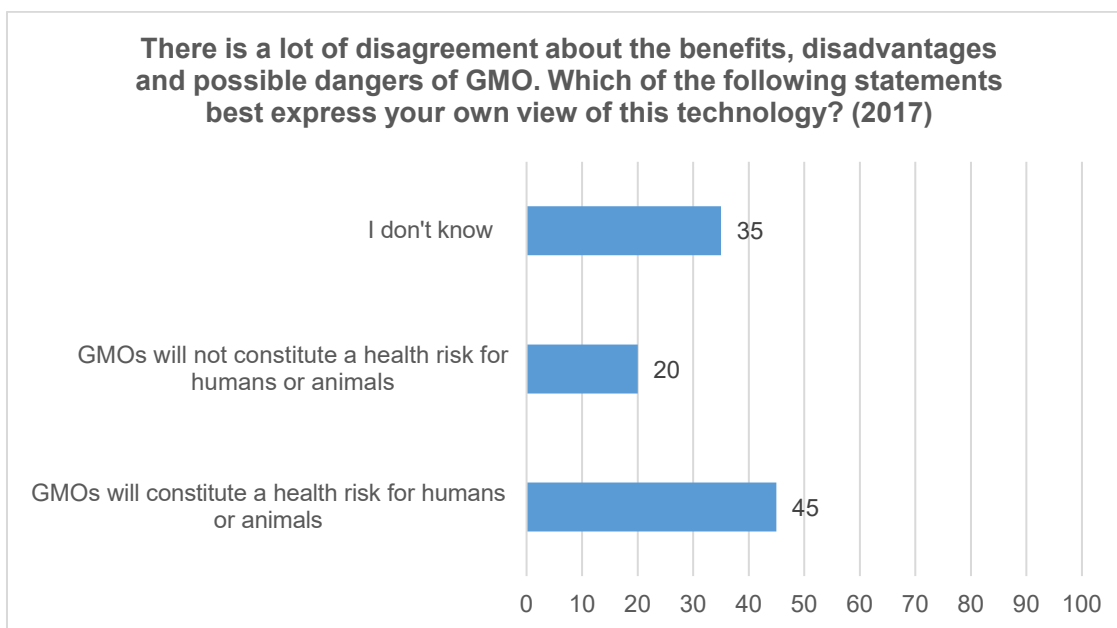


Figure 2-7 There is a lot of disagreement about the benefits, disadvantages and possible dangers of GMO. Which of the following statements best express your own view of this technology? Percentage. N = 1014. Norstat 2017

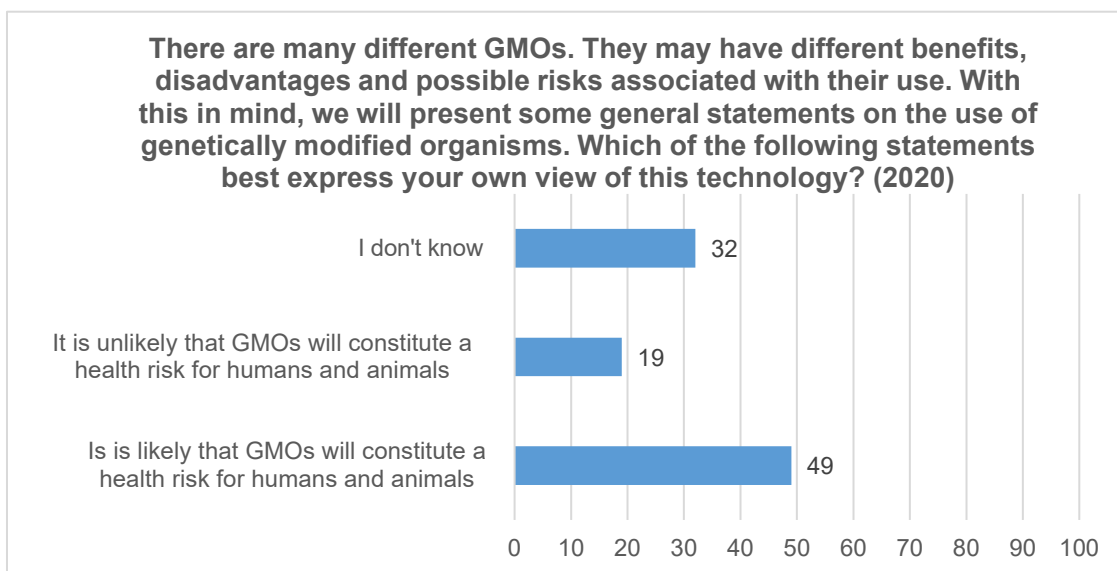


Figure 2-8 There are many different GMOs. They may have different benefits, disadvantages and possible risks associated with their use. With this in mind, we will present some general statements on the use of genetically modified organisms. Which of the following statements best express your own view of this technology? Percentage. N = 1066. Norstat 2020

From 2017 to 2020, the proportion of people who believed it probable that GMOs would constitute a health risk for people or animals rose from 45 per cent to 49 per cent. There was no change in the proportion who believed that it was improbable (19–20 per cent). More women than men believed GMOs could constitute a health risk. This was the case in both 2017 and 2020. In the latter survey, 53 per cent of the women, compared with 44 per cent of the men, believed this.

In 2017, a much lower number of respondents in the youngest age group (18–34 years) (35 per cent) than in the older age groups (35 years+) (47–51 per cent) believed that GMO would probably constitute a health risk. In 2020, age had no effect.

2.2.4 Will GMOs contribute to increased industrial agriculture – or not?

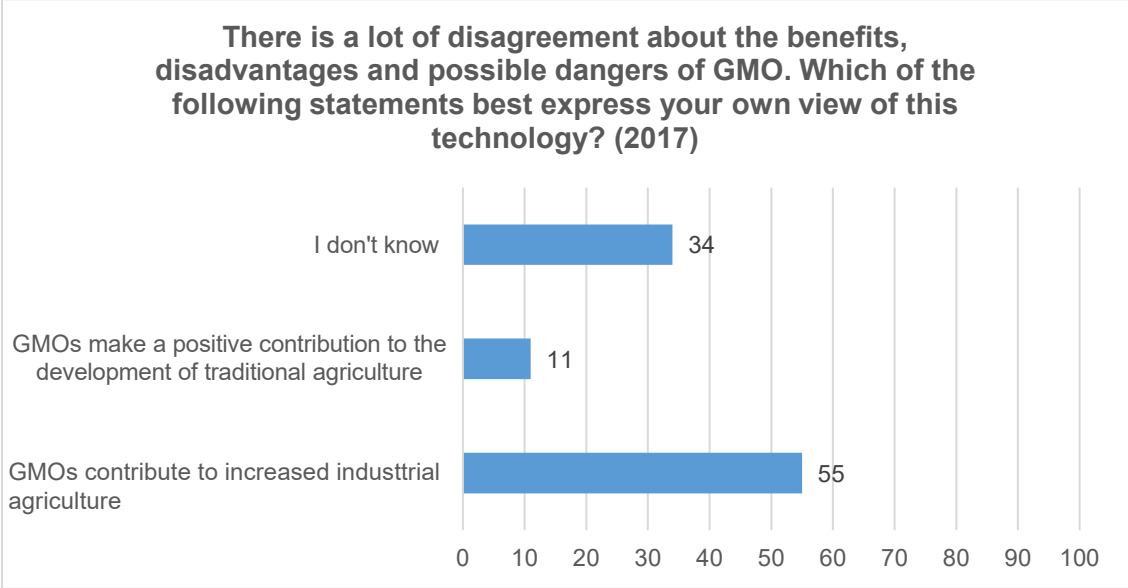


Figure 2-9 There is a lot of disagreement about the benefits, disadvantages and possible dangers of GMO. Which of the following statements best express your own view of this technology? Percentage. N = 1014. Norstat 2017

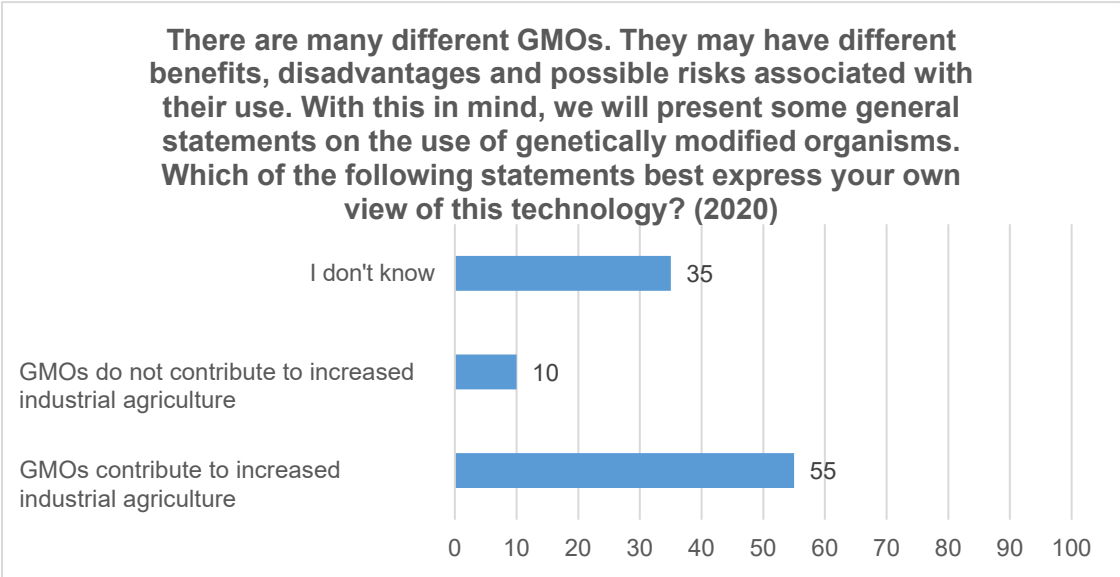


Figure 2-10 There are many different GMOs. They may have different benefits, disadvantages and possible risks associated with their use. With this in mind, we will present some general statements on the use of genetically modified organisms. Which of the following statements best express your own view of this technology? Percentage. N = 1066. Norstat 2020

From 2017 to 2020, there were no changes in the view about whether GMOs will contribute to increased industrial agriculture. Approximately half of the respondents (55 per cent) believed it probable that GMOs would contribute to increased industrial agriculture. One of ten believed this not to be the case.

More men than women believed that GMOs would contribute to increased industrial agriculture. In 2020, 66 per cent of the women, compared with 47 per cent of the men, believed this. The older respondents were also more likely to believe that GMO would contribute to more industrial agriculture. Sixty-five per cent of the oldest respondents (55 years +), compared with 48–51 per cent of the youngest respondents (18–54 years), believed this. Furthermore, more people with a high level of education (61 per cent) than with a low level of education (49 per cent) believed that increased industrialisation could be a consequence of GMOs. The same pattern emerged in 2017.

2.2.5 Will GMOs lead to decrease the use of pesticides – or not?

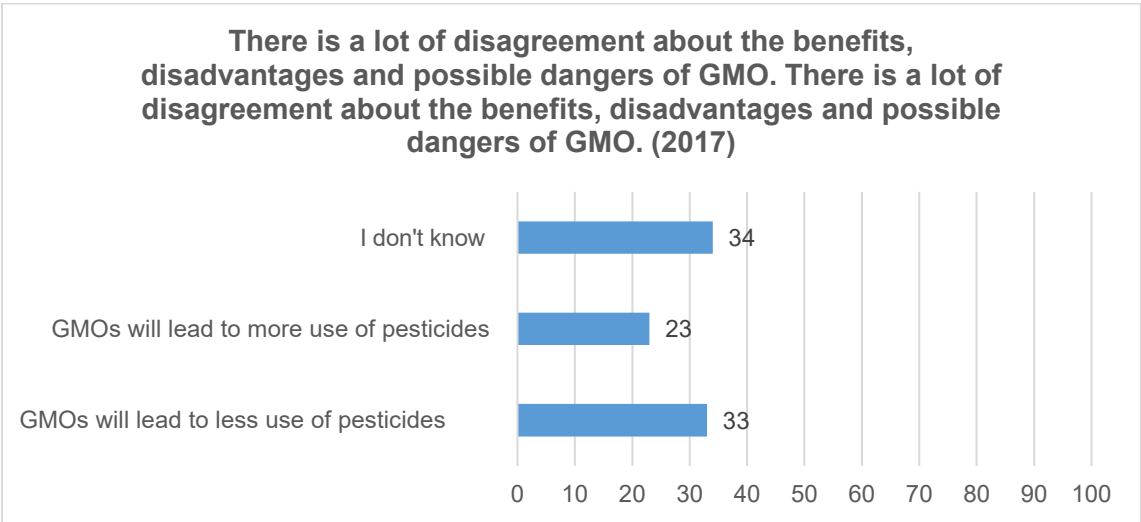


Figure 2-11 There is a lot of disagreement about the benefits, disadvantages and possible dangers of GMO. There is a lot of disagreement about the benefits, disadvantages and possible dangers of GMO. Percentage. N = 1014. Norstat 2017

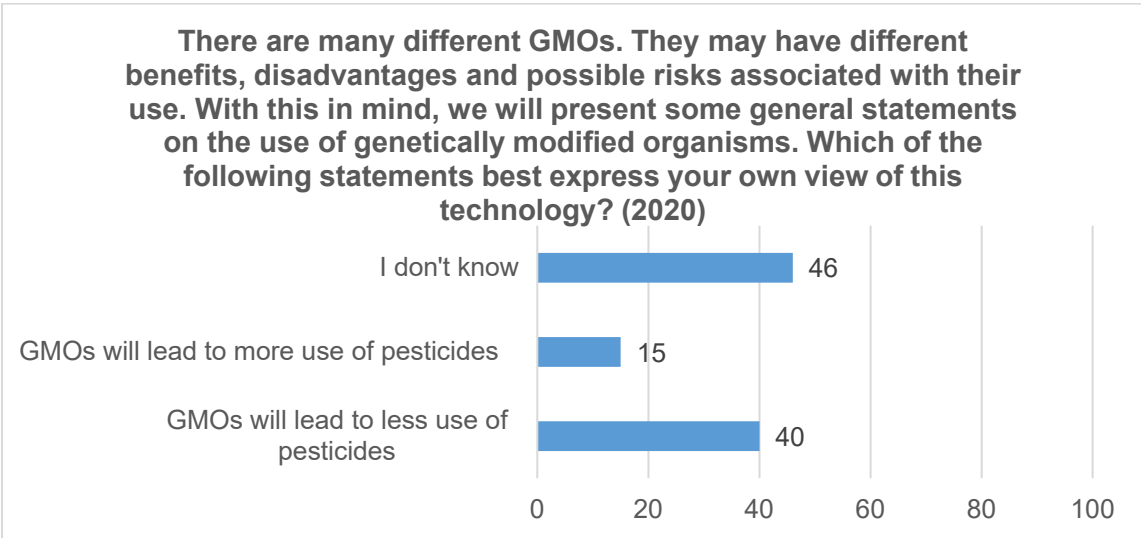


Figure 2-12 There are many different GMOs. They may have different benefits, disadvantages and possible risks associated with their use. With this in mind, we will present some general statements on the use of genetically modified organisms. Which of the following statements best express your own view of this technology? Percentage. N = 1066. Norstat 2020

The proportion of respondents who believed that GMO would reduce the use of pesticides increased from 33 per cent in 2017 to 40 per cent in 2020. It is also worth mentioning that the proportion of respondents who answered 'I don't know' increased considerably between the two surveys – from 33 per cent to 40 per cent.

More men (47 per cent) than women (33 per cent) believed that GMOs could lead to a reduction in the use of pesticides. Furthermore, 52 per cent of those with a high level of education, compared with 31 per cent of those with a low level of education, believed this. It must be mentioned, however, that about half of those with a low level of education answered 'I don't know' to this question. Three out of ten with higher education answered 'I don't know'. The same pattern emerged from the results in 2017.

2.2.6 Is the development of GMOs necessary to create a more sustainable agriculture – or not?

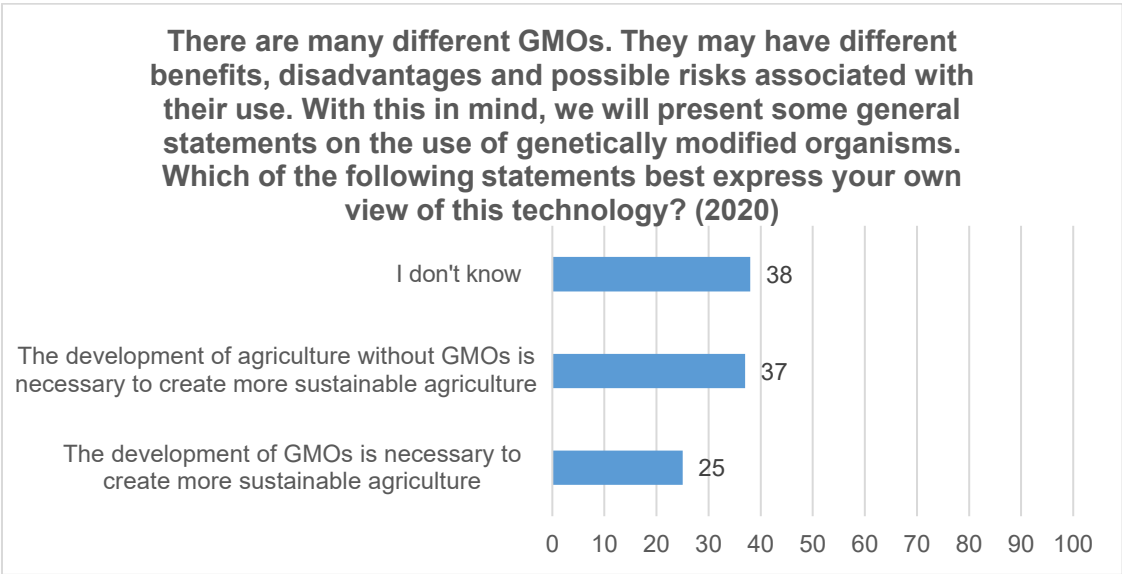


Figure 2-13 There are many different GMOs. They may have different benefits, disadvantages and possible risks associated with their use. With this in mind, we will present some general statements on the use of genetically modified organisms. Which of the following statements best express your own view of this technology? Percentage. N = 1066. Norstat 2020

Thirty-seven per cent believed that developing agriculture without GMOs was necessary to create a more sustainable agriculture. Twenty-five per cent believed that GMOs would be necessary.

Far more women (45 per cent) than men (29 per cent) answered 'I don't know' to the question about whether GMO was necessary to create sustainable agriculture. There were also fewer older than younger respondents who answered 'I don't know' to this question. In addition, the older respondents (46 per cent) to a much greater extent than the youngest (25 per cent) believed that the best way of achieving sustainable agriculture would be without GMOs.

People with a high level of education (33 per cent) were more likely than people with a low level of education (21 per cent) to believe that GMOs are necessary to create sustainable agriculture. The same was true of people living in Oslo or another city (28 per cent). In the countryside, 18 per cent of the respondents believed GMOs would be necessary.

2.2.7 Is the use of GMOs in food production ethically justifiable – or not?

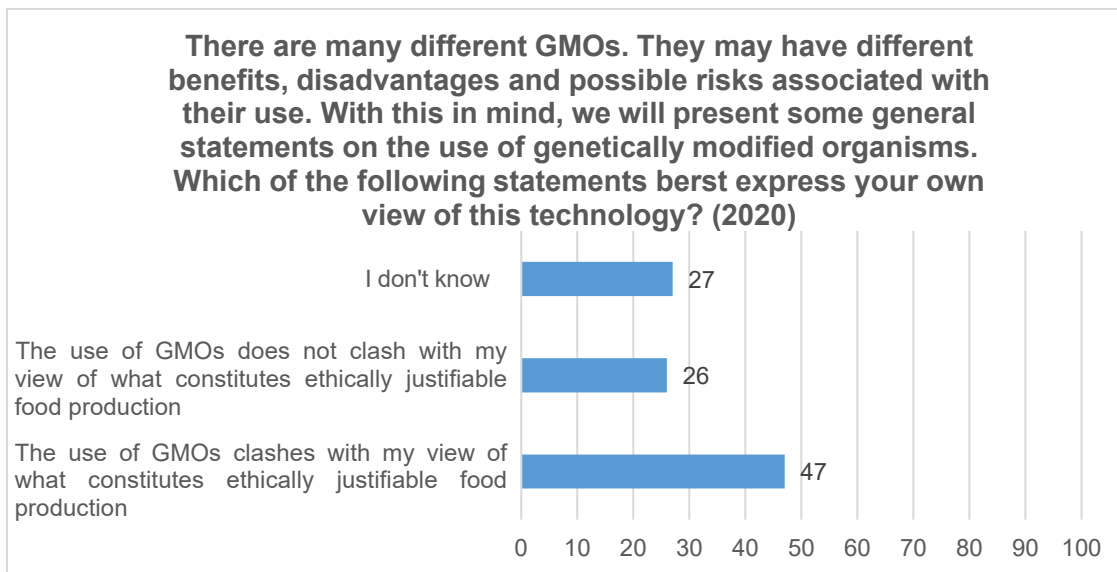


Figure 2-14 There are many different GMOs. They may have different benefits, disadvantages and possible risks associated with their use. With this in mind, we will present some general statements on the use of genetically modified organisms. Which of the following statements best express your own view of this technology? Percentage. N = 1066. Norstat 2020

Approximately half of the respondents (47 per cent) stated that the use of GMO clashed with their view of what was ethically justifiable in food production. Three out of ten (26 per cent) was of the opposite view. Far more men (34 per cent) than women (19 per cent) believed that GMOs did not clash with their view of what constitutes ethically justifiable food production. A larger proportion of the oldest group (55 years+) (57 per cent) than the youngest (18-34 years) (32 per cent) believed GMOs to be ethically problematic. In the age group 35–54 years, 48 per cent believed this. People with a high level of education (36 per cent) were also more likely than people with a low level of education (21 per cent) to consider GMOs unproblematic. Of people living in the countryside, 63 per cent found GMOs to clash with their view of what constituted ethically justifiable food production, compared with 40–44 per cent of the people living in Oslo or another city.

2.3 Which GMO products would you have eaten/not have eaten?

2.3.1 GMO products approved for the US market

Currently, the following GMO products have been approved for the US market:

- *Meat* from animals (cows, pigs, chickens etc.) that have eaten genetically modified feed
- *Salmon* that has been given genetically modified to make it grow faster
- *Apples* that have been genetically modified so that they do not turn brown and therefore have a longer shelf life if they are cut or damaged
- *Corn* that has been genetically modified to make it resistant to special pesticides, such as glyphosate.
- *Potatoes* that have been genetically modified to increase its resistance to potato blight.

To what extent would the respondents eat or not eat such products if they were available in Norwegian grocery shops in 2020?

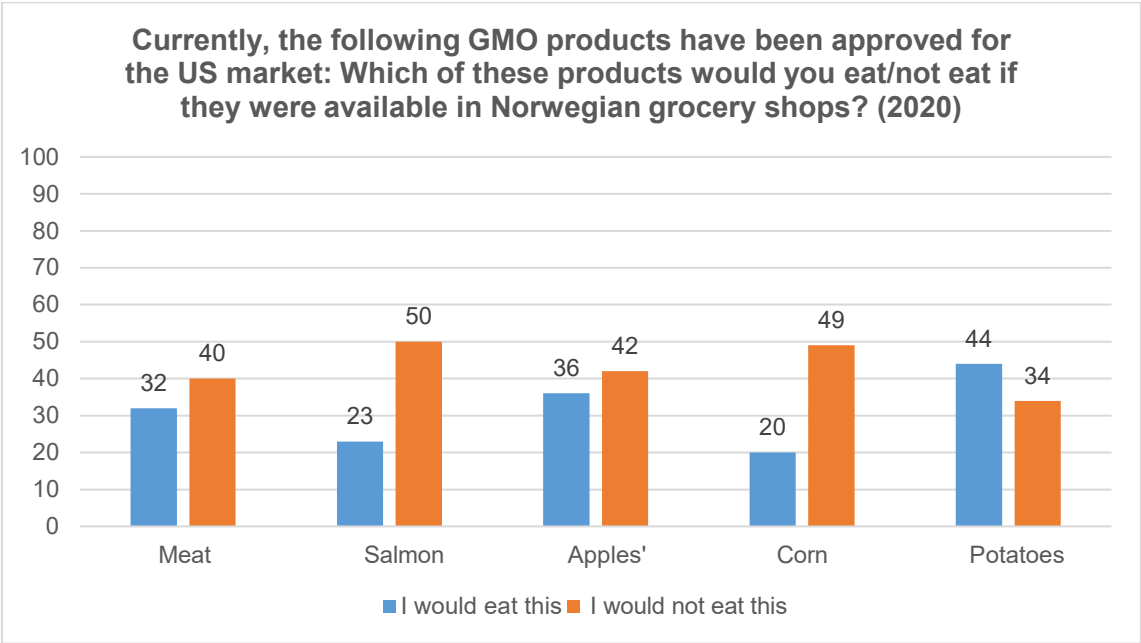


Figure 2-15 Currently, the following GMO products have been approved for the US market: Which of these products would you eat/not eat if they were available in Norwegian grocery shops? Percentage. N = 1066. Norstat 2020

The product that the most respondents would eat was genetically modified potatoes (44 per cent), followed by genetically modified apples (36 per cent), meat (32 per cent), salmon (23 per cent) and maize (20 per cent). Around half would not eat genetically modified salmon or maize. Four out of ten said the same thing about genetically modified apples and meat. Three out of ten respondents would not eat genetically modified potatoes.

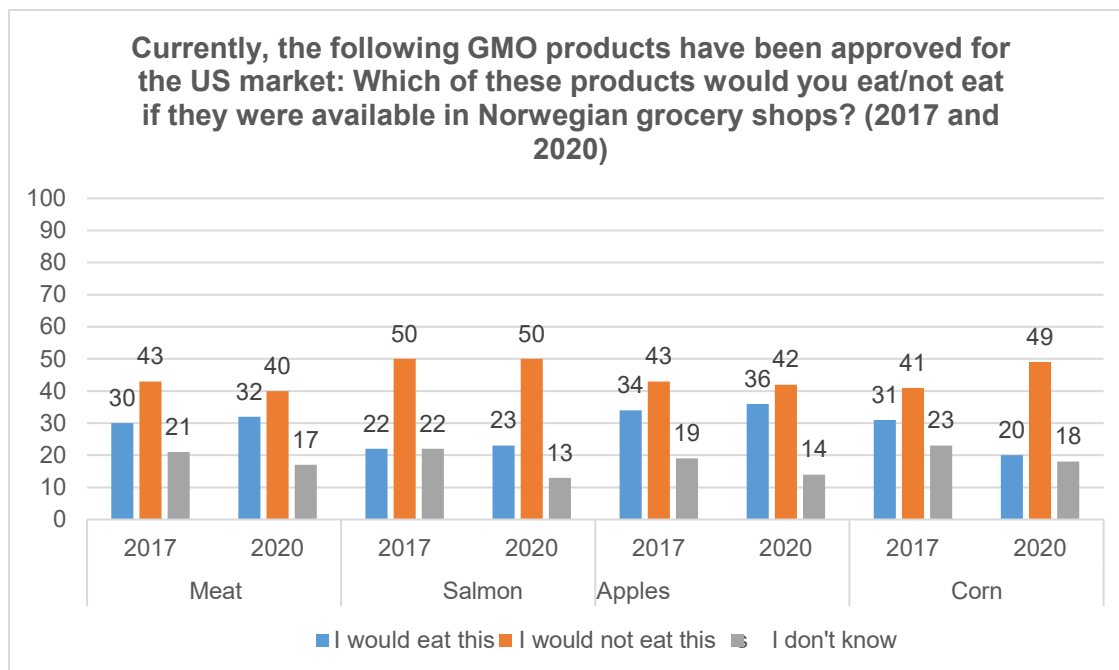


Figure 2-16 Currently, the following GMO products have been approved for the US market: Which of these products would you eat/not eat if they were available in Norwegian grocery shops? 2017–2020. Percentage. N = 1014 (2017) and 1066 (2020). Norstat 2017 and 2020

There was little change from 2017 to 2020 in terms of the willingness to eat genetically modified products. One exception was genetically modified maize. Fewer people answered that this was a product they would eat in 2020 (20 per cent) than in 2017 (31 per cent). The proportion of respondents who answered 'I don't know' was also a little lower. This applied to all the products.

Men had a more positive attitude than women to eating genetically modified products. The figures from 2020 showed that 43 per cent of the men, compared with 24 per cent of the women, were open to eating genetically modified meat. More men (42 per cent) than women (32 per cent) would eat genetically modified apples. Thirty-three per cent of the men, compared with 15 per cent of the women, were open to eating genetically modified salmon. Furthermore, 24 per cent of the men, compared with 17 per cent of the women, were open to eating genetically modified corn.

The older age groups had a more negative attitude to eating genetically modified products than younger people. In the older age group (55+ years), 44–47 per cent would not have eaten genetically modified meat or apples, compared with 30–33 per cent of the younger group (18–34 years). The proportion who would not eat genetically modified maize was much higher among older respondents (55 per cent) than among the younger ones (12 per cent). There was also a much higher percentage of older people (54 per cent) than younger respondents (42 per cent) who would not eat genetically modified salmon.

Education also had an effect on the willingness to eat genetically modified products. More respondents with a high level of education (41 per cent) than with a low level of education (30 per cent) reported that they would eat genetically modified meat. Thirty-six per cent of respondents with a high level of education, compared with 19 per cent of those with a low level of education, said the same thing about genetically modified salmon. The differences between the educational levels were negligible in relation to apples and maize.

When it came to potatoes that have been genetically modified to make them more resistant to potato blight, respondents were only asked if they would be willing to eat this product in 2020. There was no difference between the genders. However, a far higher proportion of the youngest group (60 per cent) was willing to eat such potatoes compared with the oldest group (36 per cent).

2.3.2 Possible future genetically modified products

In the survey that was carried out in 2020, questions were also asked about the willingness to eat a selection of genetically modified products that may become available in the future. The question was worded as follows: ‘Today, research is being conducted in more and more areas with a view to producing genetically modified products:

- Meat from pigs that have been gene-edited to be more resistant to certain pig diseases.
- Salmon that has been gene-edited to become sterile and in order to avoid it breeding wild salmon.

Which of these products would you eat/not eat if they became available in Norwegian grocery shops in the future?

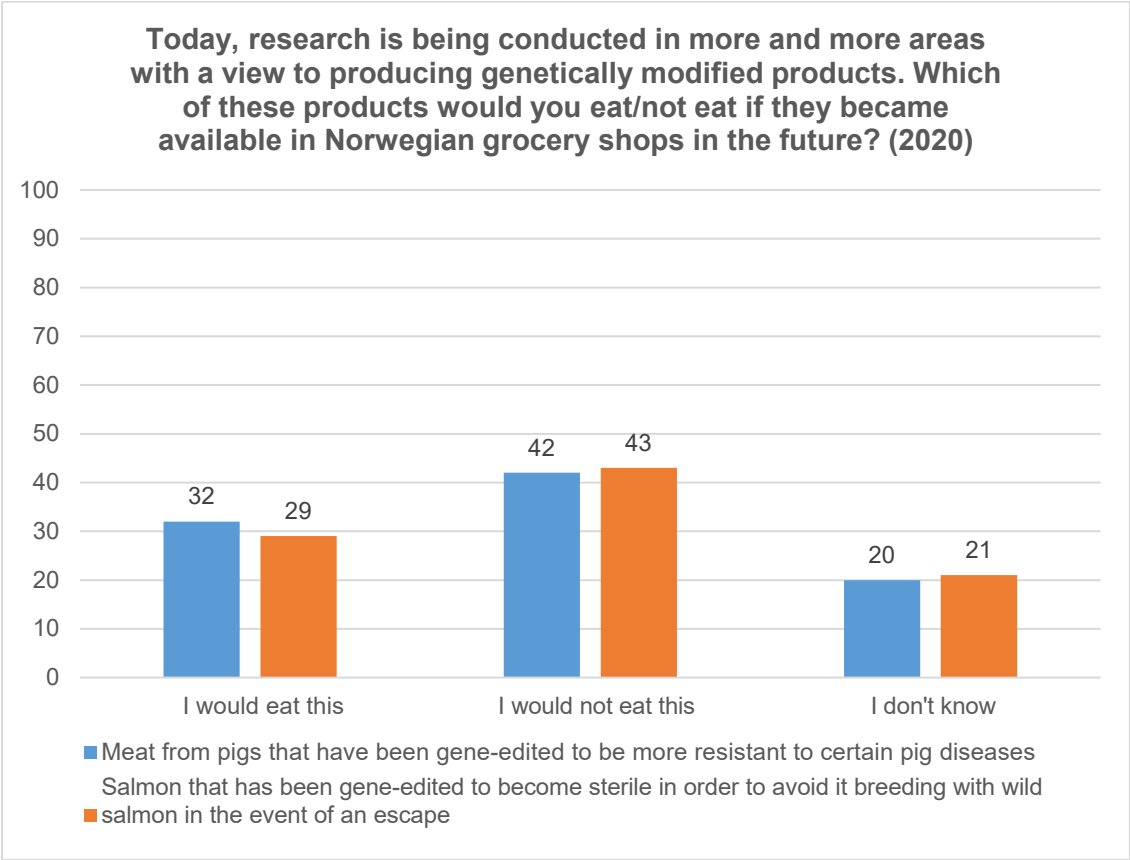


Figure 2-17 Today, research is being conducted in more and more areas with a view to producing genetically modified products. Which of these products would you eat/not eat if they became available in Norwegian grocery shops in the future? Percentage. N = 1066. Norstat 2020

When asked whether they would eat the selected possible genetically modified products, three out of ten answered that they would eat meat from gene-edited (resistant) pigs and (sterile) salmon if it became available in Norwegian stores in the future. Four out of ten would not eat such products.

Far more men (38–42 per cent) than women (21–24 per cent) were willing to eat meat from gene-edited salmon and pig.

Younger respondents had a more positive attitude to eating meat from genetically modified pigs than the older ones. This was not the case for salmon, however. Among the youngest (18–34 year), 42 per cent would have eaten such pork, compared with 26–29 per cent of respondents in the older age groups (35 years +). Education made no difference. When it came to place of residence, more people (33–38 per cent) living in Oslo or another city than in the countryside (24 per cent) would eat meat from gene-edited modified pigs.

2.4 What is the reason that you would not eat genetically modified food products?

The proportion of people who reported that they would not eat one or more of the products mentioned were asked what their concerns were. There were several possible alternatives.

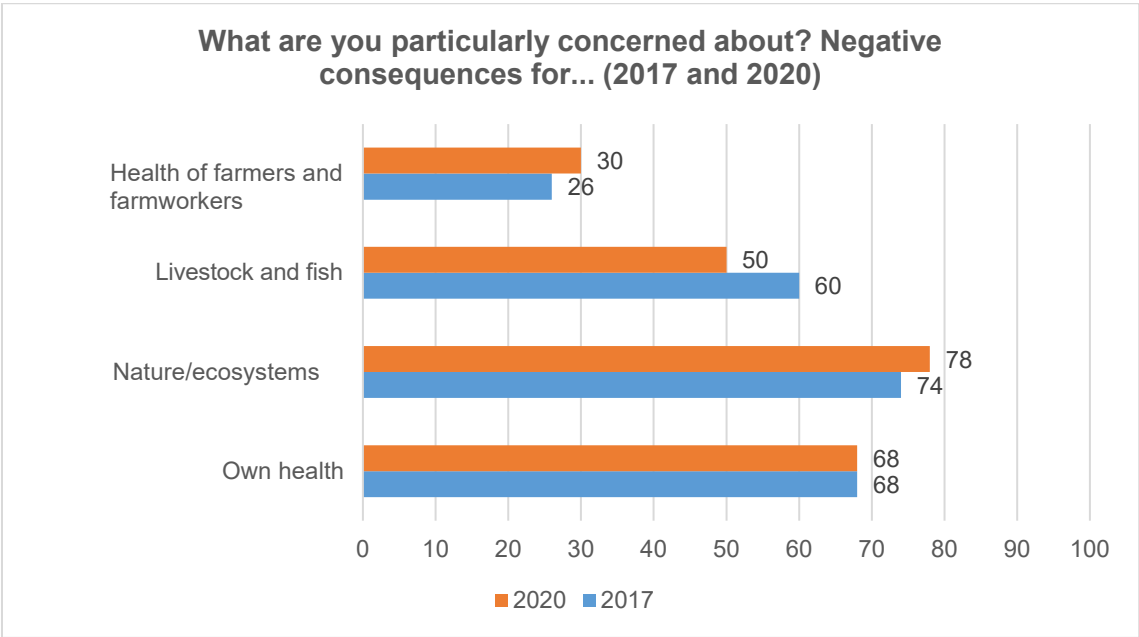


Figure 2-18 What are you particularly concerned about (several possible answers)? N = 609 (2017) and 548 (2020). Percentage. Norstat 2017 and 2020

What worried most people was negative consequences for nature and ecosystems (78 per cent), followed by own health (68 per cent), the welfare of livestock and farmed fish (50 per cent) and the health of farmers and farm workers (30 per cent). As shown by the figure, there were relatively few changes from 2017 to 2020. The exception was concerns for possible negative consequences for animal and fish welfare. There could be several reasons for this. It must be mentioned, however, that the wording of the question was somewhat changed from 2017 to 2020. In 2017, the following question was asked: ‘What are you concerned

about? Negative consequences for animal and fish health?’ This was changed to ‘What are you particularly concerned about? Negative consequences for the welfare of livestock and farmed fish?’

Gender, age and education had an effect on what concerned people. Women (58 per cent) were more concerned about the negative consequences for livestock and farmed fish than men (41 per cent). A higher proportion of women (36 per cent) than men (21 per cent) were concerned about negative consequences for the health of farmers and farm workers. The younger groups (18–54 years) (74–76 per cent) were more concerned about negative consequences for their own health than the oldest (55 years +) (59 per cent). Fifty-seven per cent of the younger age groups, compared with 42 per cent of the oldest group, were concerned about the negative consequences for livestock and farm fish’s health. Negative consequences for farmers and farm workers also concerned a higher number of the youngest respondents (42 per cent) than the oldest (19 per cent). People with higher education (87 per cent) were more likely than people with a low level of education (72 per cent) to express concern about negative consequences for nature and ecosystems.

Those who answered that they were concerned for ‘other’ reasons than the alternatives given were given the possibility to elaborate. The following opinions and concerns were noted:

- *We do not know what negative consequences introducing GMOs may bring.*
- *Am against GMO as a matter of principle.*
- *It would probably make reusing own crops for seed impossible*
- *What would come next? Where do we draw the line?*
- *Interfering with nature will have consequences in the long run*
- *Less diversity of species and the fact that Bayer/Monsanto own and control the seed and food market¹⁶*
- *Negative consequences for future food production*
- *Unethical treatment of animals*
- *It is unethical to interfere with nature and animals*
- *Unnatural. Insane.*
- *Destroying genetic material, accumulation of negative substances.*

¹⁶ <https://www.monsantoglobal.com/global/uk/Pages/default.aspx> og <https://www.bayer.com/> (13 March 2020)

2.5 What are consumers' views on genetically modified foods being sold in the future?

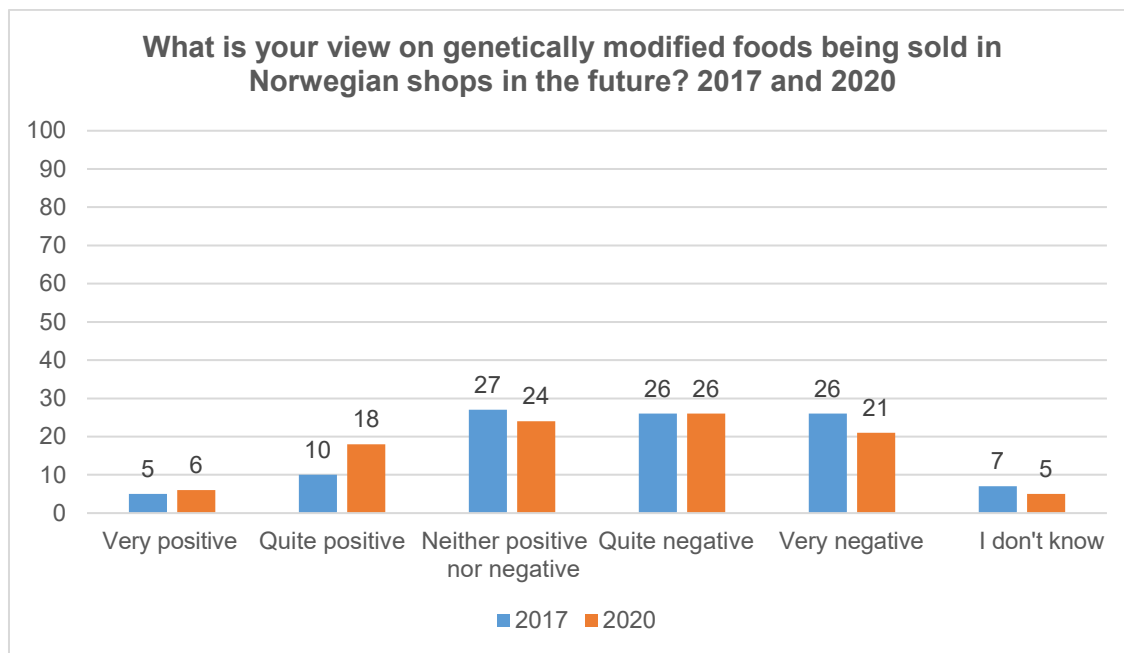


Figure 2-19 What is your view on genetically modified foods being sold in Norwegian shops in the future? Percentage. N = 1014 (2017) and 1066 (2020). Norstat 2017 and 2020

From 2017 to 2020, the proportion of respondents who had a very or quite positive attitude to the sale of genetically modified foods in Norwegian shops increased from 15 to 24 per cent. The proportion of respondents who had a very or quite negative attitude decreased from 52 to 47 per cent.

More men (20 per cent) than women (8 per cent) took a positive view of the sale of such products. Fifty-three per cent of the women, compared with 47 per cent of the men, were very or quite negative. This was also the pattern in the survey from 2017.

A far lower proportion of the youngest respondents (18–34 years) (34 per cent) had a very or quite negative attitude to the sale of genetically modified foods compared with the older respondents (35 years+) (55–59 per cent). Twenty-six per cent of the youngest, compared with 15 per cent of the older, were of very or quite positive view. The same pattern was seen in the survey from 2017.

A higher number of respondents living in Oslo (21 per cent) or another city (24 per cent) took a very or quite positive view of the sale of genetically modified foods than people in the countryside (13 per cent). Sixty-one per cent of respondents living in the countryside took a very or quite negative view, compared with 44–45 of the respondents living in Oslo or another city.

2.6 What are consumers' views on genetically modified flowers being sold in the future?

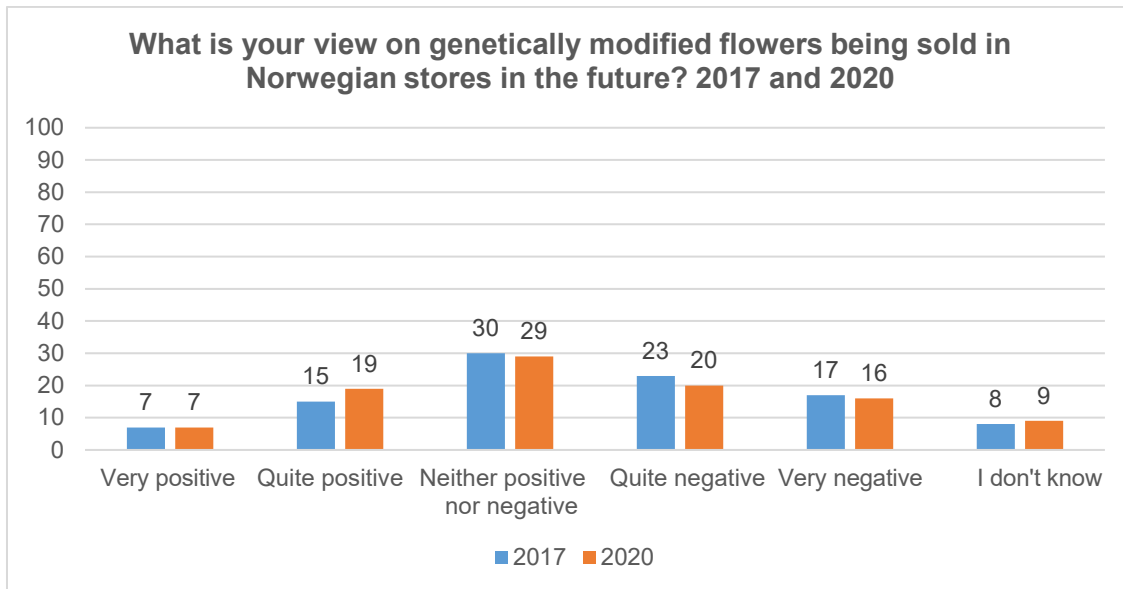


Figure 2-20 What is your view on genetically modified flowers being sold in Norwegian stores in the future? Percentage. N = 1014 (2017) and 1066 (2020). Norstat 2017 and 2020

The views on genetically modified flowers and plants being sold in Norwegian shops in the future did not change much from 2017 to 2020. In the latter survey, 26 per cent took a very or quite positive view of such products being sold. Thirty-six per cent took a very or quite negative view. Furthermore, 29 per cent had neither a positive nor a negative attitude.

More men (30 per cent) than women (23 per cent) took a very or quite positive view. There were also more respondents in the youngest age group (18–34 years) (37 per cent) than in the older age group (35 years+) (20–21 per cent) who had a positive attitude to the sale of genetically modified flowers. The same pattern was seen in the survey from 2017.

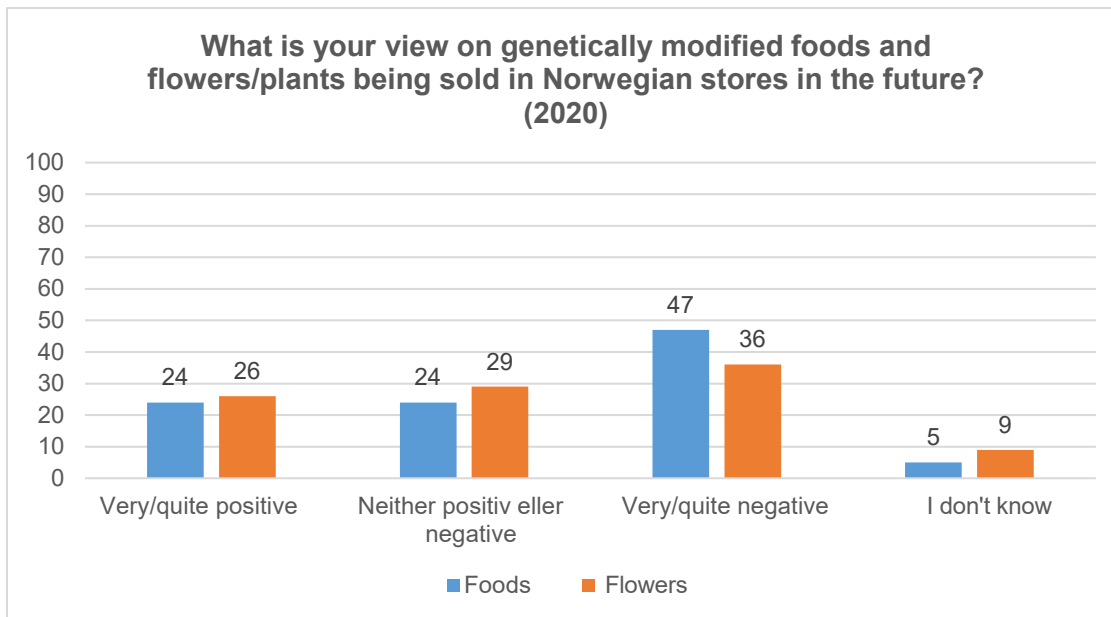


Figure 2-21 What do you think about genetically modified foods and flowers/plants being sold in Norwegian shops in the future? Percentage. N = 1066. Norstat 2020

Both in 2017 and 2020, the respondents' attitudes were more negative to the sale of genetically modified foods than flowers and plants. Forty-seven per cent of the respondents stated that they took a very or quite negative view of the sale of such foods. Thirty-six per cent said the same thing about flowers and plants.

2.7 How important is it that GMO products are labelled?

The results from 2017 showed that approximately half of the respondents (47 per cent) reported that they used the different labelling schemes that exist for food, for example the Keyhole label, Debio, Fairtrade, Brødskala'n, to a large or quite large extent when they choose which products to buy. This question was not repeated in 2020. However, both surveys asked about the importance of labelling GMO products.

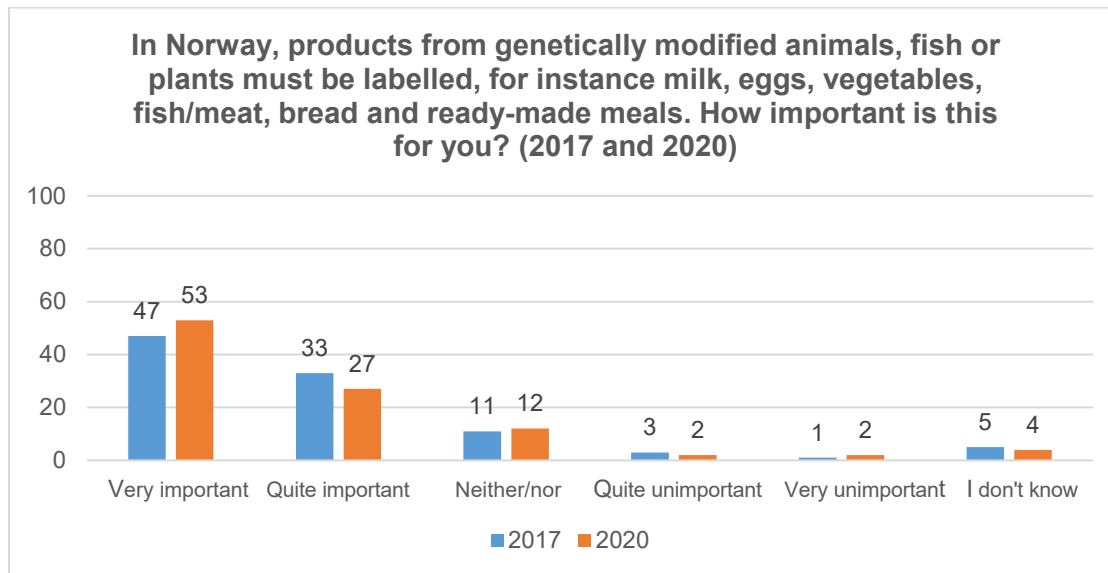


Figure 2-22 In Norway, products from genetically modified animals, fish or plants must be labelled, for instance milk, eggs, vegetables, fish/meat, bread and ready-made meals. How important is this for you? 2017 and 2020. Percentage. N = 1014 (2017) and 1066 (2020). Norstat 2017 and 2020

Eight out of ten believed that it was very or quite important that GMO products were labelled. However, the proportion of respondents who found this very important was slightly higher in 2020 (53 per cent) than in 2017 (47 per cent). Few respondents (4 per cent) believed that labelling GMO products was quite or very unimportant.

More women (57 per cent) than men (48 per cent) considered labelling to be very important. Thirty per cent of the men, and 24 per cent of the women, believed it was quite important. A similar pattern emerged in 2017.

A lower proportion of the youngest age group (18–34 years) (48 per cent) than of the older respondents (35 years+) (54–57 per cent) believed that it was very or quite important that GMO products be labelled.

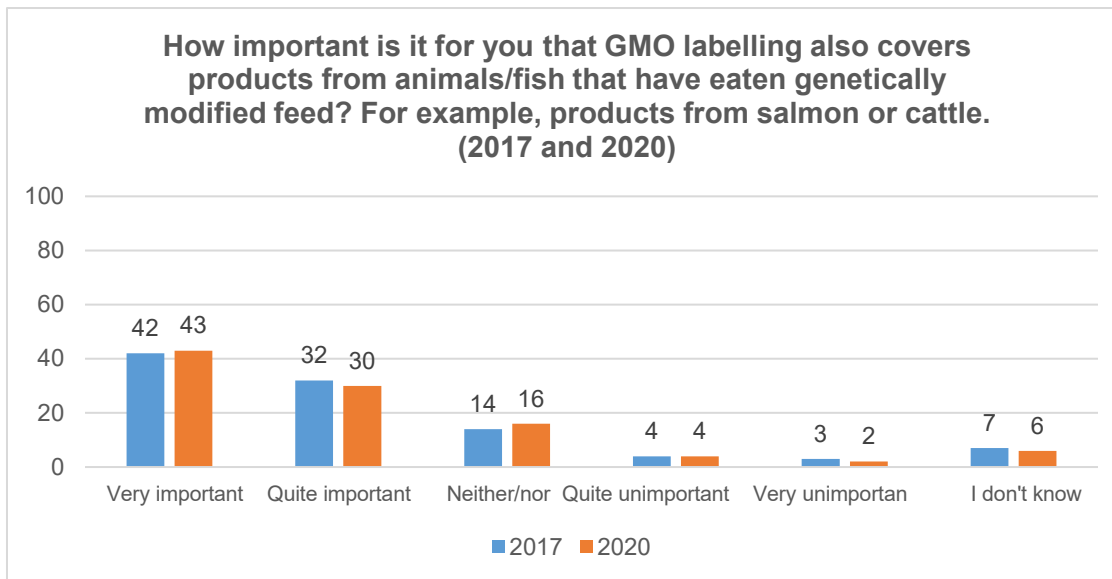


Figure 2-23 How important is it for you that GMO labelling also covers products from animals/fish that have eaten genetically modified feed? For example, products from salmon or cattle. Percentage. N = 1014 (2017) and 1066 (2020). Norstat

There was no change in the proportion of respondents who believed that it was very or quite important that GMO labelling also covers products from animals or fish that had eaten genetically modified feed. In 2020, 43 per cent believed this to be very important and 30 per cent considered it quite important. Six per cent believed it was quite or very unimportant.

More women (47 per cent) than men (39 per cent) considered it very or quite important. A lower proportion of respondents in the youngest age group (18–34 years) (36 per cent) than in the older age groups (35 years+) (45–48 per cent) believed that it was very or quite important. This is the same pattern as in 2017.

2.8 Is the term gene drives known?

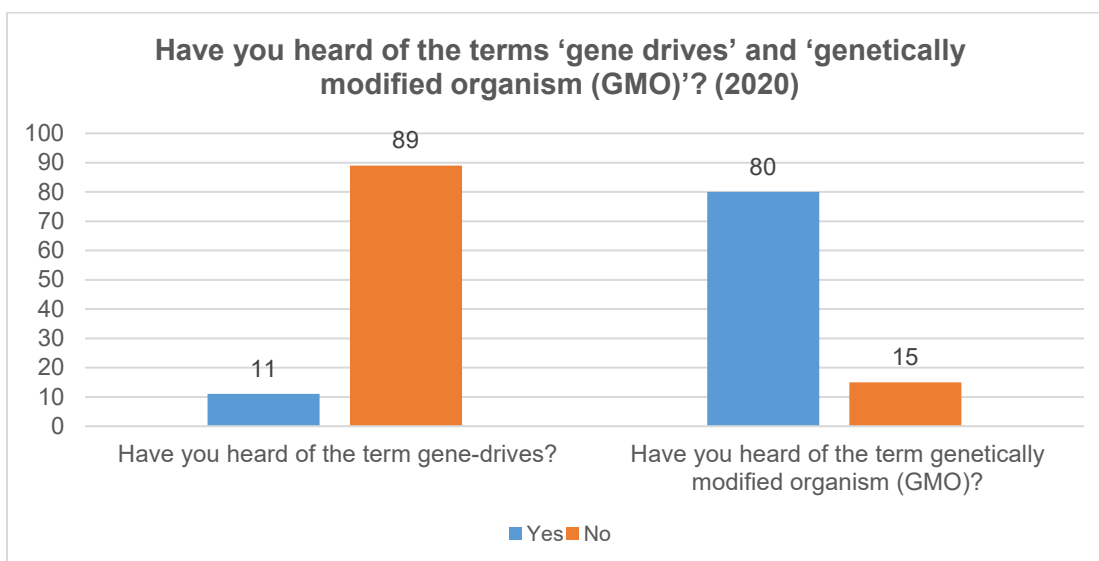


Figure 2-24 Have you heard of the terms 'gene drive' and 'genetically modified organism (GMO)'? Percentage. N = 1066. Norstat 2020

There were far fewer who had heard of the term 'gene drive' (11 per cent) than 'genetically modified organisms (GMO)' (80 per cent). Gender, age and place of residence had no effect on the knowledge of gene drives. Thirteen per cent of those with higher education, compared with 8 per cent of those with a low level of education, had heard of term.

The respondents were given the following explanation of the term 'gene drives': *'Gene drive technology makes it possible to make GMOs designed for spreading in nature. The aim is to replace whole populations of plants and animals. Some researchers envisage a future where agricultural pests such as rats and vermin can be eradicated.'* They were then asked the following question: *'What is your view on laboratory research on gene drives?'*

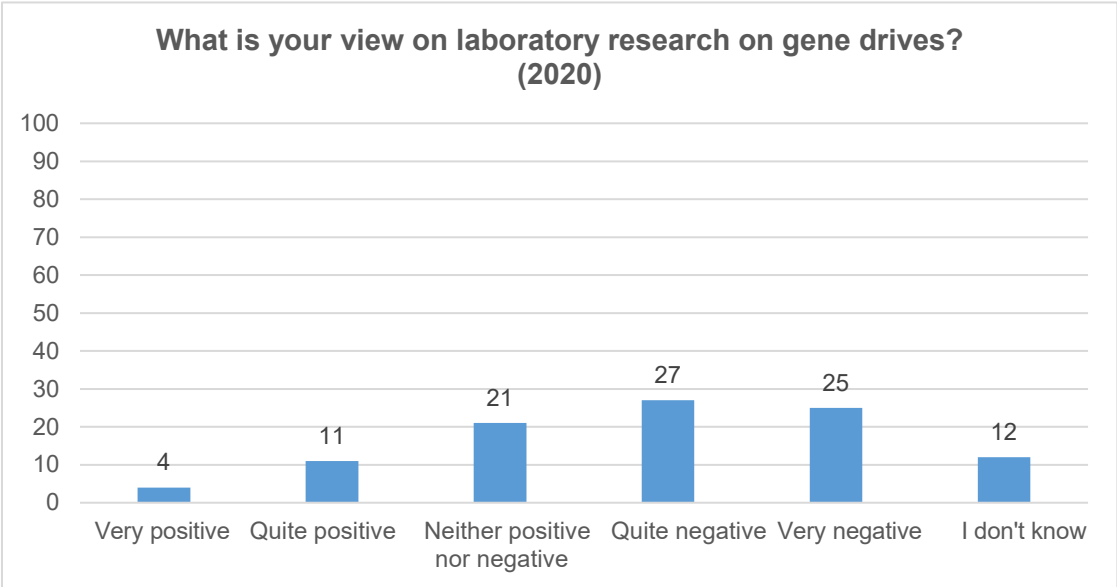


Figure 2-25 What is your view on laboratory research on gene drives? Percentage. N = 1066. Norstat 2020

Approx. half (52 per cent) took a very or quite negative view of laboratory research on gene drives. Ten out of ten (15 per cent) took a very or quite positive view.

More men (18 per cent) than women (12 per cent) had a very or quite positive attitude to this type of research. The youngest age group (18–34 years) (20 per cent) were also more positive than the older ones (35 years+) (12–14 per cent). This was also the case for people with higher education. Eighteen per cent of those with a high level of education, compared with 13 per cent of those with a low level of education, took a positive view.

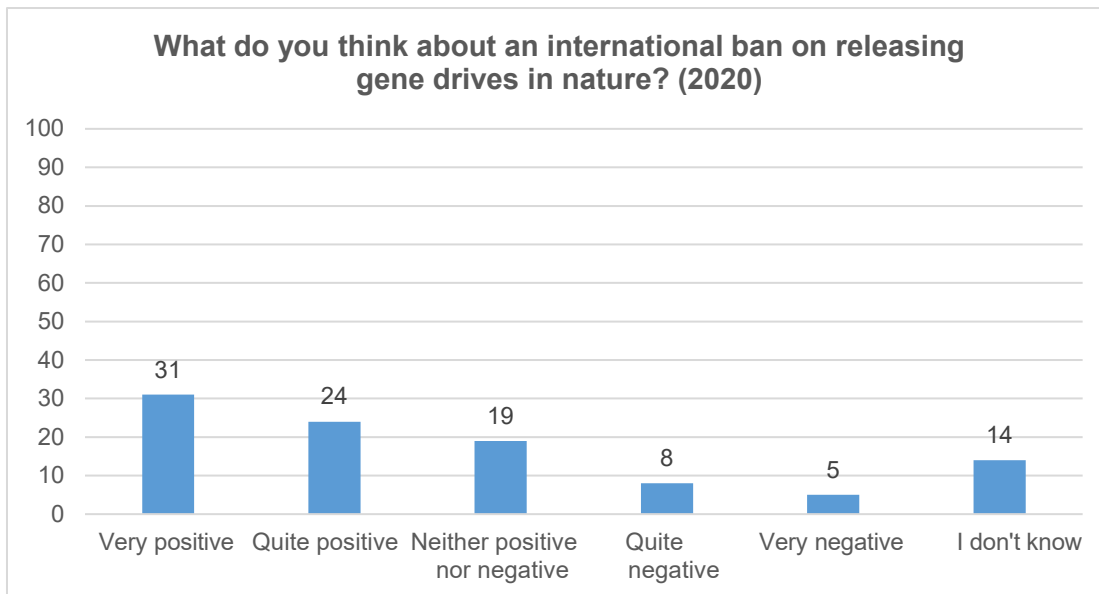


Figure 2-26 What do you think about an international ban on releasing gene drives in nature? Percentage. N = 1066. Norstat 2020

About half of the respondents (55 per cent) had a very or quite positive attitude to an international ban on releasing gene drives in nature. One in ten (13 per cent) took a negative view of this. The older respondents (35 years+) (59 per cent) had a more positive attitude to a ban than the youngest group (18–34) (46 per cent). People with higher education also had a more positive attitude. Sixty-three per cent of those with a high level of education, compared with 53 per cent of those with a low level of education, held this opinion.

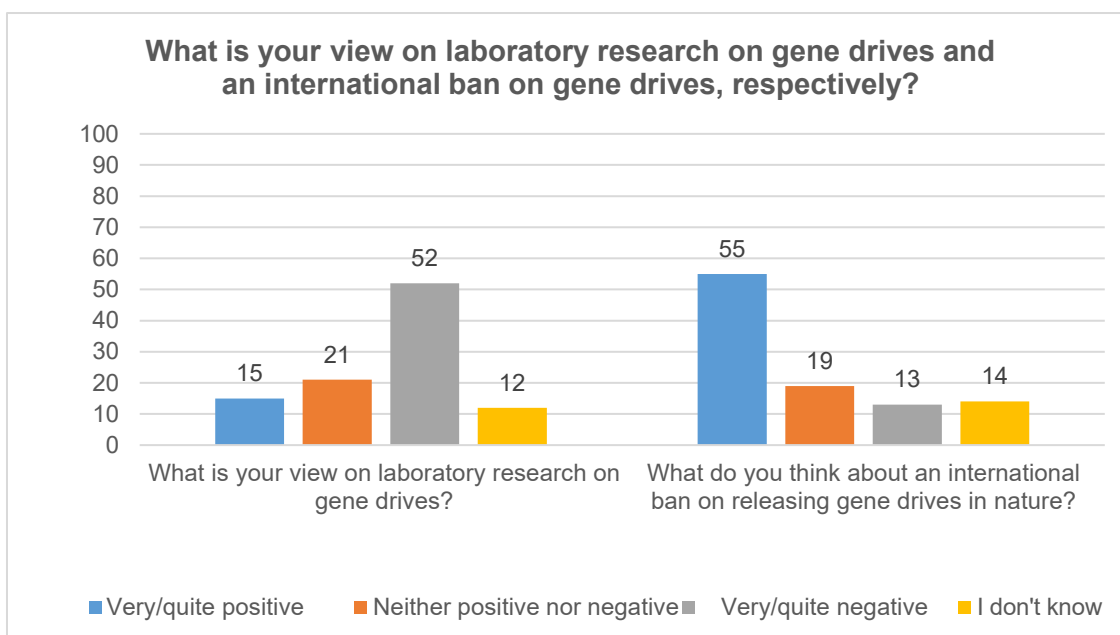


Figure 2-27 What is your view on laboratory research on gene drives and an international ban on releasing gene drives in nature? Percentage. N = 1066. Norstat 2020

The results from the consumer survey showed that about half of the respondents (52 per cent) took a negative view of laboratory research on gene drives. As many (55 per cent) took a very or quite positive view of to an international ban on placing gene drives in nature.

3. Summary and conclusion

3.1 Summary

- *Poor knowledge of the technology*

Eight out of ten respondents answered that they had heard of the term 'genetically modified organism (GMO)', but relatively few (18 per cent) believed they had good knowledge of the technology. A change from 2017 to 2020 was that fewer respondents expressed that they had a very poor or poor knowledge of it. More men than women believed their knowledge to be very or quite good. More respondents with a high level of education than a low level of education believed that they had good knowledge of GMO technology.

- *A significant proportion put down 'I don't know'*

In order to gain knowledge of the consumers' views on the use of GMOs in food production, the respondents were asked to consider a range of statements about the technology. As in 2017, a relatively high proportion of respondents (30-45 per cent) answered 'I don't know' to the questions concerning benefits, disadvantages and risks. This supports the respondents' own assessment of their knowledge of this technology.

- *Opinions were divided as regards whether GMO technology will be necessary to produce enough food*

Approximately the same proportion of respondents (31–37 per cent) believed that the development of GMOs would be and would not be necessary to produce enough food in the world. This was the case in both 2017 and 2020. Men were more likely than women to believe that it would become a necessity. There were also more young respondents compared to older ones who held this opinion. People living in the countryside were less likely to share this opinion than people living in Oslo or another city.

- *About half of the respondents believed it was probable that GMOs would have negative effects on nature and ecosystems*

The results were similar to those from 2017 in that about half of the respondents believed it probable that this technology could have negative effects on nature and ecosystems. Women were more concerned about this than men. The younger respondents were more concerned than the older ones. The same was true people with a high level of education and people living in the countryside.

- *A larger proportion of respondents believed that GMOs could pose a health risk for people and animals*

About half of the respondents in the 2020 survey believed that it was probable that GMO technology could pose a health risk. This represented a small increase from 2017. Far more women than men were worried about possible health risks. Neither age, education or place of residence had any effect.

- *Six in ten believed that GMO would contribute to increased industrial agriculture*

There were no changes from 2017 to 2020 in the views on whether GMO will contribute to increased industrial agriculture. One in ten believed this technology would not contribute to increased industrial agriculture, and six in ten believed the opposite. More women than men believed it would lead to more industrial agriculture. The older respondents were also more likely to be of this opinion, and people with higher education were more likely to believe so than people with a low level of education.

- *A larger proportion of the respondents believed that GMO would lead to less pesticide use*

The proportion of respondents who believed that GMO would lead to less use of pesticides increased from 33 per cent in 2017 to 40 per cent in 2020. Men were much more inclined to believe this than women, and people with higher education were more likely to believe so than people with a low level of education.

- *Four in ten believed that GMO was not necessary to create more sustainable agriculture*

Four in ten believed that GMO was not necessary to create more sustainable agriculture. One in four believed the opposite. Women were less inclined than men to believe that GMOs were necessary. Older respondents were more likely than younger respondents to believe that GMOs were unnecessary, and people with higher education were more likely to believe so than people with a low level of education. Furthermore, people living in Oslo or another city believed GMOs to be necessary.

- *Half of the respondents believed that GMOs clashed with their view on ethically justifiable food production.*

Forty-eight per cent believed that GMOs ran counter to what they believed constituted ethically justifiable food production. Twenty-six per cent believed it did not clash with their own views. Far more many women than men considered GMOs unethical. Again, the results showed that older respondents were more sceptical than the younger ones, and people with higher education were more likely to believe so than people with a low level of education. People living in the countryside were also more likely to believe that GMOs were unethical than people living in Oslo or another city.

- *If the selected GMO products had been available in Norwegian shops, potato would be eaten by the most respondents and salmon or maize by the fewest.*

The respondents were presented with a list of GMO products that have been approved for the US market: meat (from animals who have eaten genetically modified feed), salmon (fast-growing), apples (that do not turn brown/have a longer shelf life), maize (resistant to certain pesticides) and potatoes (resistant to potato blight). Two out of ten would eat genetically modified salmon or maize. Three out of ten said the same thing about genetically modified meat. Four out of ten would eat potatoes resistant to potato blight. The main trend was that people would not eat such products (40–50 per cent). A relatively high proportion responded 'I don't know' (17–21 per cent).

- *Three out of ten would eat meat from genetically modified pigs (resistant to disease) and salmon (sterile) if such products were to become a reality in the future.*

In other words, three out of ten reported that these were products they would eat. Four out of ten would not eat such products. More men than women would eat meat from genetically modified pigs or salmon. The older age groups had a more negative attitude to eating

genetically modified products than the young. The same applied to people living in the countryside compared to people living in Oslo or another city.

- *Eight out of ten respondents' stated that the reasons for their concerns regarding eating GMO products were possible negative consequences for nature and ecosystems*

In other words, the GMO products' possible negative consequences for nature and ecosystems were what concerned most respondents (78 per cent), followed by negative consequences for own health (68 per cent) and livestock and farmed fish welfare (50 per cent). This did not change much from 2017 to 2020. Gender, age and education had an effect. Women generally expressed greater concern for possible negative consequences than men. The younger respondents were more concerned than the older group, as were people with higher education. It should also be mentioned that the proportion of men and young people who expressed concerns for possible negative consequences for nature and ecosystems increased from 2017 to 2020.

- *A higher number of respondents took a positive view of the sale of genetically modified foods in Norwegian shops in the future.*

From 2017 to 2020, the proportion of respondents with a very or quite positive attitude to the sale of GMO products in Norwegian grocery shops increased from 15 to 24 per cent. There was also a slight decrease in the proportion who stated that they took a very or quite negative view. More women than men were negative, older people had a more negative attitude than young people. The same applied to people living in the countryside compared to people living in Oslo or another city.

- *A larger part of the respondents believed that labelling GMO products was important*

The proportion of respondents who considered it very important that GMO products were labelled, increased from 47 per cent to 53 per cent from 2017 to 2020. More women than men believed this to be important. There were also more older respondents compared to younger ones who believed this.

- *Half took a negative view of laboratory research on gene drives*

When asked about their views on laboratory research on gene drives, half were very or quite negative. Men, young people and people with a high level of education had the most positive attitudes to this type of research.

- *Half were positive to an international ban on releasing gene drives*

Over half (55 per cent) stated that they took a positive view of an international ban on releasing gene drives in nature. Old people had a more positive view on prohibiting this than young people. More of the respondents with a high level of education than of those with a low level of education took a positive view of such a prohibition.

3.2 Conclusion

By means of surveys carried out in 2017 and 2020, we have attempted to shed light on the consumers' views on the development and use of GMO technology in (Norwegian) food production. The study revealed that opinions of this technology had not changed much over

the course of these years. Overall, it emerged that most respondents stated that they possessed little knowledge of GMO technology. Many expressed concern for possible negative effects of the technology. This applied in particular to nature and ecosystems, but also to the health and welfare of animals, people and fish. Compared to 2017, a somewhat higher proportion of respondents took a positive view of the sale of GMO products in Norwegian grocery shops. However, the proportion of respondents who believed that such products should be labelled also increased. There is still significant scepticism among consumers in relation to GMOs in food production. Furthermore, it is clear that such products must be labelled if GMOs are allowed in the future.

In the survey conducted in 2020, the respondents have also been asked about gene drive technology. There were far fewer who had heard of the term 'gene drive' (11 per cent) than 'genetically modified organisms (GMO)' (80 per cent). Gender, age and place of residence had no effect on the knowledge of gene drives. About half of the respondents were critical of laboratory research and over half (55 per cent) took a positive view of an international ban on releasing gene drives in nature.

3.3 Commentary and short comparison between SIFO's and the Norwegian Biotechnology Advisory Board/GENEinnovate's studies on consumers' attitudes to GMO and gene editing.

On 2 April 2020, the Norwegian Biotechnology Advisory Board¹⁷ and GENEinnovate¹⁸ published the report *Norwegian consumers' attitudes toward gene editing in Norwegian agriculture and aquaculture*. This study had the same purpose as SIFO's study, namely to examine the Norwegian population's attitudes to the use of different forms of genetic modification in Norwegian food production. The report concludes that the majority of Norwegian consumers take a positive view of using gene editing in a way that is sustainable and beneficial for society in Norwegian farming and aquaculture. However, results showed that many consumers were concerned about risk, but there was a high level of confidence that genetically modified products approved by the Norwegian authorities did not pose a risk

¹⁷ The Norwegian Biotechnology Advisory Board is an independent, advisory body appointed by the government and under the legal authority [Act relating to the Production and Use of Genetically Modified Organisms \(Gene Technology Act\)](#) of the Act relating to the Production and Use of Genetically Modified Organisms, etc. (the Gene Technology Act) and [the Act relating to the](#)

[Application of Biotechnology in Human Medicine \(the Biotechnology Act\)](#). The Norwegian Biotechnology Advisory Board is a consultative body for the Norwegian authorities in cases concerning modern biotechnology. The Norwegian Biotechnology Advisory Board is to contribute information to the general public and the public administration, and promote debate about ethical and social consequences of using modern biotechnology. <https://www.biotechnologiradet.no/om-oss/>. 19 April 2020

¹⁸ GENEinnovate is a research project on gene editing. The initiative is led by Norsvin, and is a cooperation between Geno, Graminor, AquaGen, the Norwegian University of Life Sciences and the Norwegian Biotechnology Advisory Board. The aim is to establish a research environment with expertise on gene editing technology for use on livestock, fish and plants in Norway. <https://norsvin.no/9-millioner-kroner-forskning-pa-genredigering/> (19 March 2020)

to health or the environment. In conclusion, it was pointed out that there is a need for more knowledge about gene technology and food among the population.

It has emerged in this report that SIFO's conclusions are somewhat different. We will therefore comment on and provide a short comparison between the two studies below. The Norwegian Biotechnology Advisory Board and GENEinnovates will hereinafter be referred to as the BG study.

Both studies showed that most respondents had some knowledge of the technology. In the BG study, six out of ten answered that they had good or some knowledge of the terms genetically modified food and gene editing. Four out of ten had only heard of the terms. Three per cent had never heard of the terms. A similar pattern emerged in SIFO's survey. Eight out of ten had heard of the term GMO. Six out of ten described their knowledge of technology as 'very/quite good' or 'neither good nor poor'. Four out of ten believed their knowledge was very or quite poor.

While the SIFO study did not ask questions about actual knowledge of the technology, the respondents in the BG study were presented with several statements intended to reveal such knowledge, for example 'traditional heredity has nothing to do with genes' and 'regular tomatoes do not have genes, while genetically modified tomatoes have genes'. Both statements are untrue, and the respondents were more likely to answer correctly the more knowledge they themselves believed they had about genetically modified food.

The wording of the questions about the respondents' attitudes was also quite different, and this was reflected in the answers. In the SIFO study, the respondents were asked to consider several statements about possible benefits, disadvantages and risks of the technology. Specifically, they were asked which statements on the use of GMOs best matched their view on the technology. The results showed that half believed GMOs would have negative effects on nature and the environment. As many considered it probable that the technology could pose a risk to human and animal health. Four in ten believed that this type of technology was not necessary to create more sustainable agriculture. In BG's study, the respondents were presented with several statements that differentiated between different uses of gene editing for different purposes useful to society. The results showed that the consumers' attitudes were influenced by the purpose and product in question. The majority took a positive attitude to the use of gene editing if it could reduce the use of pesticides and crop losses. In this case, seven out of ten took a positive view. Climate adaptation of plants was also a purpose about which many respondents were positive. About half took a positive view if the purpose was to improve the nutritional value of the plants. Six out of ten took a positive view if the purpose was to improve animal and fish health. The vast majority had a negative attitude to ideas that aimed to change the appearance of the products.

BG's report, like SIFO's survey, point out that the respondents were concerned about the health and environmental consequences of using gene editing in food production. The BG study also showed that six out of ten were very or slightly concerned for health and environmental risks related to eating gene-edited food. In SIFO's study, eight out of ten answered that the reason they did not want to eat genetically modified products were concerns for possible negative consequences for nature and ecosystems. Seven out of ten were concerned for possible negative consequences for own health. Half were worried about potential negative consequences for animal or fish health and welfare.

Both surveys showed that it important to consumers that genetically modified products were labelled. In BG's study, eight out of ten answered that it was very or quite important that products that were produced using gene technology were labelled. The same proportion believed it to be important that the labelling contained information about which characteristics had been changed and why the change had been done. SIFO's results showed a similar pattern. Eight out of ten considered it very or quite important that genetically modified products were labelled. The majority (73 per cent) also believed that it was important that products from animals that had eaten genetically modified feed were labelled.

Both SIFO's and BG's study showed that consumers preferred products that had not been produced through genetic modification. In the latter survey, half of the respondents answered that they would not have chosen food that had been genetically modified. Only 5–6 per cent answered that this was something they would have chosen. SIFO's study showed that almost half of the consumers had a very or quite negative attitude to the sale of genetically modified foods in Norwegian shops in the future. Twenty-four per cent took a positive view. Half would not eat genetically modified salmon or maize if these products were available in Norwegian shops. Four out of ten said the same thing about genetically modified apples and meat.

It emerged from the BG study that the participants in the focus groups associated genetic modification with something unnatural. On this basis, the respondents were asked to consider the naturalness of selected methods. The results showed that gene editing/modification were considered more unnatural than traditional breeding. SIFO's study contained no explicit questions about the naturalness of GMOs. However, it emerged that over half of the respondents believed that GMOs would contribute to increased industrial agriculture. Only one in ten believed GMOs would contribute positively to the development of traditional agriculture. In this context, it should be mentioned that several previous SIFO studies have shown that the consumers have become increasingly aware of how the food they eat has been produced. The ideal is to have a raw materials-based diet based on fresh products that have been carefully handled, subject to limited processing and minimal use of medicines and additives. When the consumers refer to food produced in this way, they often use the term 'natural'. One interpretation of why this characteristic has such broad appeal, is that it may be perceived as an efficient solution to the many dilemmas consumers are faced with in relation to topics such as health, environment and ethics. Furthermore, it can be viewed as criticism of industrial food production. Most probably, there is also an element of nostalgia – a longing for familiar ingredients and old techniques and recipes (Bugge 2016; Bugge 2019; Vittersø, Bugge, Schjøll & Torjusen 2020). To what extent the consumers are prepared to accept and trust foods that have been produced using genetic modification, will therefore depend on whether they are perceived as natural, real and authentic food. The results from both SIFO's and BG's studies indicate that this is not the case.

It emerged from the BG study that those who believed they had the most knowledge of gene technology and genetics also had the most positive attitude to using gene editing in agriculture and aquaculture. At the same time, the survey also showed that the actual knowledge among the population was limited. On this basis, it was concluded that there was a need for developing the population's knowledge of gene technology. However, SIFO's study suggests that the consumers' views on GMOs is as much a question of values as of knowledge. Despite most respondents expressing that they had poor knowledge of the

technology itself, half of them still believed that the use of this technology clashed with their view of what constituted ethically justifiable/satisfactory food production. We remain humble and open to the fact that more research is needed in this complex field, but based on the results that have been emerged from SIFO's studies in the field, our conclusion is that, at present, Norwegian consumers are quite sceptical about food products that have been subject to genetic modification. A minority (24 per cent) had a very or quite positive attitude to the sale of genetically modified foods in Norwegian shops in the future.

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Appendices

The questionnaire

[age] How old are you?

[gender] Are you male or female?

Row:

[r1] Male

[r2] Female

[zipcode] What is your postal code?

[Q1] Who usually buys food for your household?

Row:

[r1] I do

[r2] Another person in the household

[r3] We share the work more or less equally

Terminate: Terminated: Q1 = 2

Condition: **(Q1.r2)**

In this survey, you will be asked about your views on the use of gene modification in food production.

[Q2] Have you heard of the term genetically modified organism (GMO)?

Row:

[r1] Yes

[r2] No

[r3] I don't know

[Q3] How would you describe your knowledge of GMO?

Row:

[r1] Very good

[r2] Quite good

[r3] Neither good nor poor

[r4] Quite poor

[r5] Very poor

[r6] I don't know

A GMO is an organism (for instance a plant, animal, fungus or bacteria) in which the genetic material has been altered by means of gene technology.

In recent years, new methods for genetic modification have made it possible to make more targeted changes to the genetic material than before. The new methods are called gene editing. The best known method is called CRISPR.

The questions we ask you are related to your view on some selected GMO products, your view on GMO labelling of food and your attitudes to the use of GMO in food production.

[Q4aNew] There are many different GMOs. They may have different benefits, disadvantages and possible risks associated with their use. With this in mind, we will present some general statements on the use of genetically modified organisms.

Which of the following statements best express your own view of this technology?

Food production

Row:

[r1] The development of GMOs will be necessary to produce enough food for the world

[r2] The development of agriculture without GMOs can produce enough food for the world

[r3] I don't know

Effects on nature/ecosystems

Row:

[r1] It is probable that GMOs will have negative effects on nature/ecosystems

[r2] It is probable that GMOs will have negative effects on nature/ecosystems

[r3] I don't know

Health risk for humans and animals

Row:

[r1] It is likely that GMOs will constitute a health risk for humans or animals

[r2] It is unlikely that GMOs will constitute a health risk for humans or animals

[r3] I don't know

Agriculture

Row:

[r1] GMO contributes to increased industrial agriculture

[r2] GMO does not contribute to increased industrial agriculture

[r3] I don't know

Pesticides

Row:

[r1] GMOs will lead to less use of pesticides

[r2] GMOs will lead to more use of pesticides

[r3] I don't know

Agriculture

Row:

[r1] The development of GMOs is necessary to create more sustainable agriculture

[r2] The development of GMOs is not necessary to create more sustainable agriculture

[r3] I don't know

Food production

Row:

[r1] The use of GMOs clashes with my view of what constitutes ethically justifiable food production.

[r2] The use of GMOs does not clash with my view of what constitutes ethically justifiable food production.

[r3] I don't know

[Q5] Currently, the following GMO products have been approved for the US market: Which of these products would you eat/not eat if they were available in Norwegian grocery shops?

Column:

[c1] I would eat this

[c2] I would not eat this

[c3] Not applicable, I do not eat this

[c4] I don't know

Row:

[r1] Meat (cows, pigs, chickens etc.) that have eaten genetically modified feed

[r2] Salmon that has been given genetically modified to make it grow faster

[r3] Apples that have been genetically modified so that they do not turn brown and therefore have a longer shelf life if they are cut or damaged

[r4] Corn that has been genetically modified to make it resistant to special pesticides, such as glyphosate.

[r5] Potatoes that have been genetically modified to increase its resistance to potato blight.

[Q5a] Today, research is being conducted in more and more areas with a view to producing genetically modified products.

Which of these products would you eat/not eat if they were available in Norwegian grocery shops?

Column:

[c1] I would eat this

[c2] I would not eat this

[c3] Not applicable, I do not eat meat

[c4] I don't know

Row:

[r1] Meat from pigs that have been gene-edited to be more resistant to certain pig diseases.

[Q5b]

Column:

[c1] I would eat this

[c2] I would not eat this

[c3] Not applicable, I do not eat salmon

[c4] I don't know

Row:

[r2] Salmon that has been gene-edited to become sterile and in order to avoid it breeding with wild salmon.

[Q6] What are you particularly concerned about?

Condition: **Q5a.r1.c2 Q5b.r2.c2**

Row:

[r1] Negative consequences for own health

[r2] Negative consequences for nature/ecosystems

[r3] Negative consequences for the welfare of livestock and farmed fish

[r4] Negative consequences for the health of farmers and farmworkers

[r6] Other

[r7] I don't know

[Q7] What is your view on genetically modified foods being sold in Norwegian shops in the future?

Row:

[r1] Very positive

[r2] Quite positive

[r3] Neither positive nor negative

[r4] Quite negative

[r5] Very negative

[r6] I don't know

[Q8] What is your view on genetically modified flowers/plants being sold in Norwegian shops in the future?

Row:

[r1] Very positive

[r2] Quite positive

[r3] Neither positive nor negative

[r4] Quite negative

[r5] Very negative

[r6] I don't know

[Q11] In Norway, products from animals, fish or fruit/vegetables that have been genetically modified must be labelled. This includes milk, eggs, vegetables, fish/meat, bread and ready-made meals.

How important is this for you?

Row:

[r1] Very important

[r2] Quite important

[r3] Neither important nor unimportant

[r4] Quite unimportant

[r5] Very unimportant

[r6] I don't know

[Q12] How important is it for you that GMO labelling also covers products from animals/fish that have eaten genetically modified feed? For example, products from salmon or cattle.

Row:

[r1] Very important

[r2] Quite important

[r3] Neither important nor unimportant

[r4] Quite unimportant

[r5] Very unimportant

[r6] I don't know

[Q13] Have you heard of the term gene drives?

Row:

[r1] Yes

[r2] No

[Q14] Gene drive technology makes it possible to make GMOs designed for spreading in nature. The aim is to replace whole populations of plants and animals. Some researchers envisage a future where agricultural pests such as rats and vermin can be eradicated.

What is your view on laboratory research on gene drives?

Row:

[r1] Very positive

[r2] Quite positive

[r3] Neither positive nor negative

[r4] Quite negative

[r5] Very negative

[r6] I don't know

[Q15] What do you think about an international ban on releasing gene drives in nature?

Row:

[r1] Very positive

[r2] Quite positive

[r3] Neither positive nor negative

[r4] Quite negative

[r5] Very negative

[r6] I don't know

Consumption Research Norway (SIFO) is a non-profit, transdisciplinary research institute at OsloMet – Oslo Metropolitan University. SIFOs research aims to understand the role of consumption and consumers in society and to provide the knowledge basis for public consumer policy in Norway.

SIFOs core research areas are:

- Sustainable consumption
- Digitalization of everyday life
- Market based welfare
- Clothing and food