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Dopady a determinanty využitia NGT

Impacts and Determinants of the Use of NGT

Policy Brief
Správa dostupná online

Deliverable 4 within the project:

NextGeneBEcon_SK
Nové genomické technológie v poľnohospodárstve: spoločenská akceptovateľnosť, ekonomické dopady a rozhodovacie procesy

Nitra, Jún 2026

Funded by the EU NextGenerationEU through the Recovery and Resilience Plan for Slovakia under the **Project No. 09I01-03-V04-00049**

Impacts and Determinants of the Use of NGT

Introduction

In 2023, the European Commission proposed revised legislation that distinguishes some NGTs from GM techniques, aligning EU policy more closely with major trade partners (EC, 2023). The proposed legislation allows for the use of specific NGTs (e.g., targeted mutagenesis and cisgenesis) but continues to regulate transgenic organisms under existing GMO laws. The reforms aim to establish a science-based framework that facilitates the development and commercialization of NGT crops in the EU and enabling farmers and other food supply chain actors to reap benefits of new technology. The European Parliament passed the EU's NGT legislation proposed by the Commission in 2024 and the Council approved it later in year 2025. Currently there are discussions in member states and at the EU level how to implement NGTs. This policy brief aims to contribute to these discussions.

Definition

In the EU, NGTs are defined as techniques capable to change the genetic material of an organism and that have emerged or have been developed since 2001 (EC, 2021). New Genomic Techniques differ from old genetic modification methods resulting in Genetically Modified Organisms (GMO).

While GMO typically involve the insertion of foreign DNA from unrelated species, NGTs allow targeted and precise changes within an organism's own without transferring genes between species that cannot multiply in nature. NGTs enable the development of plant varieties that could also arise through natural mutations or conventional breeding but with greater speed and accuracy.

Methods

We have conducted a representative survey among farmers in Slovakia. The survey gathered data on farm characteristics, familiarity of farmers with NGTs, attitudes toward NGTs and conventional breeding, and demographic characteristics of respondents. Attitudes toward NGTs and conventional breeding were measured using a three-point scale (negative, neutral, positive). The survey was conducted online from January to March 2025. The sample of 202 respondents is representative with respect to types of farms, size of farms, gender, age, and education of the primary decision-maker on the farm, and with respect to the geographical location of farms.

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To assess consumer acceptance of New Genomic Techniques (NGTs), a survey was conducted in Germany (DE), Denmark (DK), France (FR), Slovakia (SK), and the United Kingdom (UK). The consumer survey was implemented using a Computer-Assisted Web Interviewing (CAWI) approach, administered in the respective national languages. Data were collected from a total sample of 5,000 participants (1,000 respondents per country) between January and February 2024. A stratified sampling method was applied to ensure that each national sample was representative of the respective country's population in terms of age, gender, region, and education.

Discrete choice experiment was used to compute willingness to sell and willingness to buy parameters based on survey data.

Impacts

New Genomic Techniques are important tool to enhance food security in the EU and globally while improving the impact of agriculture and food supply chains on climate, biodiversity, and protection of natural resources. In the long-run, NGT crops have a potential to increase productivity and competitiveness (EC, 2023a).

NGTs can reduce pesticide dependency in European agriculture and costs of farmers on pesticides. By applying NGTs to edit specific genes researchers have developed varieties with longer shelf lives, which reduces post-harvest losses and food. NGTs provide higher quality products and enhance the efficiency of the food supply system (Dal Bello et al., 2024).

NGTs can be instrumental in enhancing the nutritional content of crops and reduce the presence of harmful substances in food products, such as allergens and toxins, thus improving food safety (Alam and Rustgi, 2025).

In the long-run, NGT crops have a potential to increase productivity and competitiveness of agriculture provided international trade with NGT crops does not face tariff or non-tariff barriers. According to the European Commission's impact assessment, the deregulation of certain NGT crops is essential to ensure the global competitiveness of EU farms (EC, 2023a).

Determinants of the use of NGTs

Farmers

Studies show that economic, social, and environmental factors are the main drivers of farmers' willingness to grow GM crops (Breustedt et al., 2008; Dill et al., 2008; Finger et al., 2011; Marra et al., 2002; Qaim, 2009; Qaim and Traxler, 2005). However, ethical concerns, low consumer acceptance, fear of new technologies, and legislative uncertainties are significant obstacles to be overcome (Agnoli et al. (2025). According to Ferrari (2022) familiarity with NGT technology and stronger perceptions of agronomic benefits increase farmers' willingness to adopt NGTs, while uncertainty and perceived risks act as barriers. Chatzopoulou and Chatzopoulos (2024) demonstrate that farmers' perceptions towards potential risks using GE methods and GMOs differ among types of producers within a country and between the countries.

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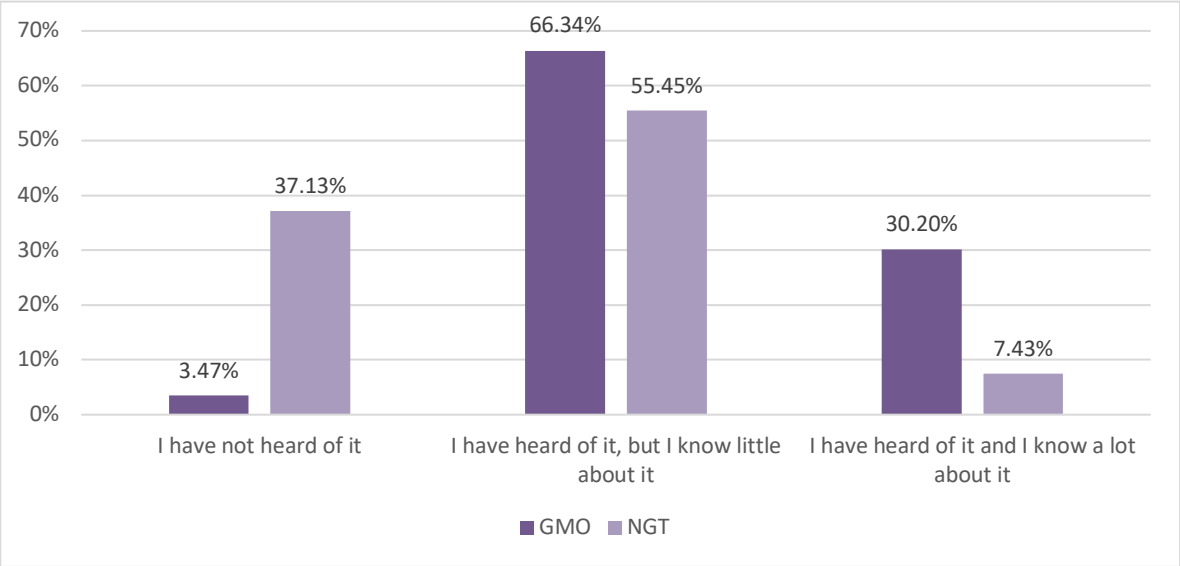
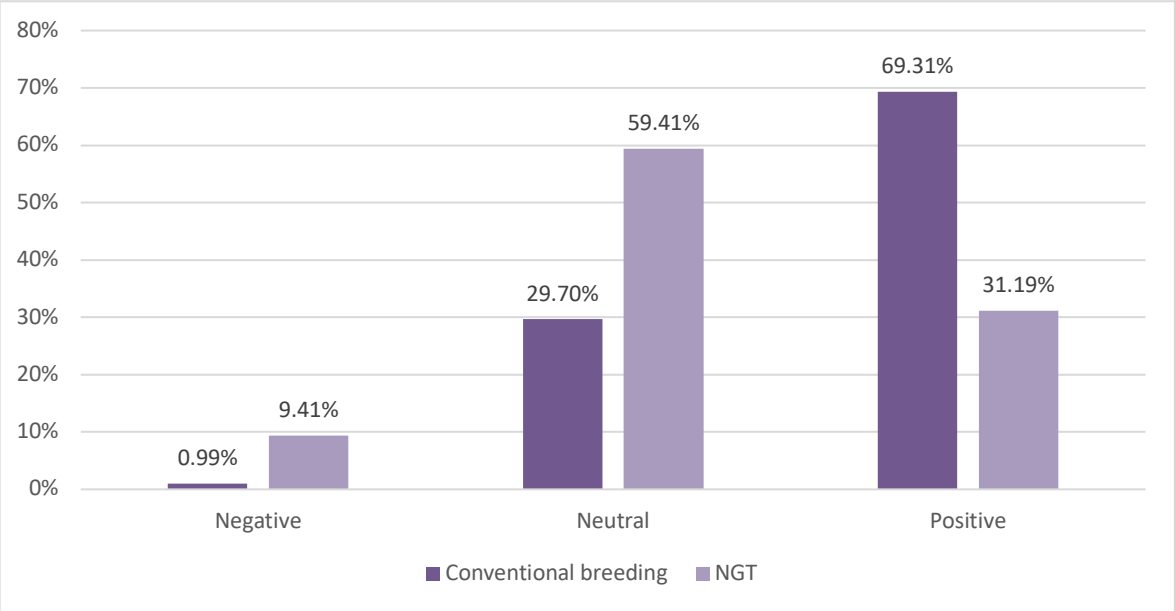
Figure 1. Awareness about GMO and NGT by farmers in Slovakia



Source: own processing, 2025

Figure 2. Attitude toward conventional breeding and NGT by farmers in Slovakia



Source: own processing, 2025

Table 1. Willingness to sell – Main effects model

Attribute	Coefficient	Std. Error	z-value	p-value	95% Confidence Interval
Yield: 5.03 t/ha	-39.162	10.450	-3.750	0.000	[-59.644, -18.680]
Yield: 5.57 t/ha	-86.338	16.316	-5.290	0.000	[-118.317, -54.359]
Yield: 6.10 t/ha	-143.762	25.267	-5.690	0.000	[-193.284, -94.240]
Stress tolerance	-78.423	13.034	-6.020	0.000	[-103.969, -52.876]
NGT	65.741	12.857	5.110	0.000	[40.541, 90.941]

Note: Reference group for yield: 4.50 t/ha; stress tolerance = high stress tolerance relative to low; NGT = production process employing NGTs (relative to conventional production process without NGTs). Source: own processing, 2025

Farmers in Slovakia are willing to accept 39.16 Euros per ton less for varieties with a yield of 5.03 t/ha compared to the reference level (4.50 t/ha), and this discount increases progressively with higher yield levels.

Similarly, farmers are willing to accept a 78.42 Euros per ton lower price for varieties with enhanced stress tolerance, indicating the importance of resilience in production.

In contrast, the only positive WTS value was observed for the NGT attribute, with a coefficient of 65.74 Euros per tonne, meaning that farmers would need to receive a higher price per tonne to choose an NGT variety over a conventional one.

Consumers

Existing studies also suggest that acceptance of NGT-derived crops varies across EU countries (Rousselière and Rousselière, 2017) and by demographic characteristics such as education and age (Beghin and Gustafsson, 2021). In general, EU consumers tend to prefer food from traditional breeding over NGT-derived food, and NGT-derived food over GM food (Beghin and Gustafsson, 2021; Strobbe et al., 2023; Busch et al., 2021; Bearth et al., 2022; Nguyen et al., 2022).

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Table 2. Awareness of NGTs by consumers

	DE	DK	FR	SR	UK
Heard of NGTs (all)	59.9%	49.6%	47.1%	45.7%	50.1%
- Males	60.6%	54.2%	51.4%	49.5%	54.5%
- Females	59.2%	45.0%	43.0%	42.2%	45.8%
P-value: chi2 for gender – awareness of NGTs	0.652	0.004	0.007	0.020	0.007
- Age 18-34	63.5%	55.5%	47.6%	41.8%	62.2%
- Age 35-49	59.9%	45.2%	47.2%	42.5%	55.3%
- Age 50-64	58.3%	50.4%	47.8%	45.7%	42.8%
- Age 65+	57.9%	47.2%	45.6%	55.4%	34.3%
P-value: chi2 for age – awareness of NGTs	0.574	0.092	0.965	0.018	0.000
- Primary education	54.1%	43.4%	44.8%	38.2%	54.6%
- Secondary education	58.8%	51.3%	44.1%	45.7%	37.1%
- University education	65.7%	52.4%	53.7%	49.0%	60.4%
P-value: chi2 for educ. – awareness of NGTs	0.037	0.066	0.024	0.164	0.000

Note: P-values for each country compared to alpha = 0.05.
Source: own processing

Table 3. Willingness to pay by consumers

	DE	DK	FR	SR	UK
	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
nutri_b	-0.283***	-0.129***	-0.244***	-0.210***	-0.244***
nutri_c	-0.671***	-0.277***	-0.639***	-0.514***	-0.588***
eco_y	0.132***	0.060***	0.119***	0.026	0.135***
ngt_y	-0.121***	-0.061***	-0.137***	-0.180***	-0.066***

Note1: nutri_b and nutri_c = nutritional score B and nutritional score C (relative to nutritional score A), eco_y = ecologically friendly production process (relative to standard production process), ngt_y = production process employing NGTs (relative to conventional production process without NGTs)
Note2: *** significant at 1% level, ** significant at 5% level, * significant at 10% level
Source: own processing

Our results show that consumers require a price discount to buy a yoghurt with a worse nutritional score or produced by NGTs. Out of the five studied countries, the largest price discount for an NGT yoghurt is required by Slovak consumers (a discount of 18% for an NGT yoghurt relative to a no-NGT yoghurt) while the lowest price discount is required by consumers in Denmark and the United Kingdom (a discount of 6.1% and 6.6%, respectively). On the other hand, consumers are willing to pay a higher price for yoghurts that are friendly to the environment in their production methods and use of ingredients. The only exception is Slovakia, where the coefficient for the “eco” icon is not significant.

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Summary

This policy brief examines the impacts and determinants of the adoption of New Genomic Techniques (NGTs) in agriculture, with a particular focus on farmers and consumers in Europe. In response to recent EU legislative developments that distinguish certain NGTs from traditional genetically modified (GM) techniques, this policy brief contributes to ongoing policy discussions on their implementation and potential role in sustainable agriculture.

Compared to conventional breeding, NGTs allow faster and more accurate development of crop varieties with desirable traits. These technologies have significant potential to enhance agricultural productivity, improve food quality, reduce pesticide use, and strengthen resilience to climate change, while supporting broader environmental and sustainability goals.

The empirical analysis is based on two complementary surveys. The first is a representative survey of 202 Slovak farmers conducted between January and March 2025, capturing farm characteristics, awareness of NGTs, and attitudes toward both NGTs and conventional breeding. The second is a cross-country consumer survey conducted in Germany, Denmark, France, Slovakia, and the United Kingdom (n = 5,000), using a Computer-Assisted Web Interviewing approach. In addition, a discrete choice experiment was applied to estimate willingness to sell (WTS) and willingness to pay (WTP).

The results show that farmers' willingness to adopt NGTs is driven primarily by economic, agronomic, and informational factors. While farmers recognize the benefits of higher yields and improved stress tolerance, they require a price premium to adopt NGT-based production, indicating concerns related to market acceptance and regulatory uncertainty. Familiarity with the technology and perceived benefits positively influence adoption, whereas perceived risks and ethical concerns act as barriers.

On the consumer side, awareness of NGTs varies across countries and demographic groups, with higher awareness generally observed among younger and more educated respondents. Consumers tend to prefer conventionally bred products over NGT-derived ones, though NGT products are still more acceptable than GM products. The results indicate that consumers require price discounts for NGT-based food products, with the highest discount observed in Slovakia. At the same time, environmentally friendly production attributes significantly increase willingness to pay, suggesting potential synergies between sustainability and technological innovation.

Economic incentives, consumer acceptance, and regulatory clarity are key determinants of NGT adoption. Enhancing public awareness, strengthening communication strategies, and aligning policies with market expectations will be essential to support the successful integration of NGTs into European and Slovak agriculture.

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Zhrnutie

Tento policy brief skúma dopady a determinanty využívania nových genomických techník (NGTs) v poľnohospodárstve, so zameraním najmä na farmárov a spotrebiteľov v Európe. V reakcii na nedávny legislatívny vývoj v EÚ, ktorý odlišuje niektoré NGT od tradičných geneticky modifikovaných (GM) techník, policy brief prispieva k prebiehajúcim diskusiám o ich implementácii a potenciálnej úlohe v udržateľnom poľnohospodárstve.

V porovnaní s konvenčným šľachtením umožňujú NGT rýchlejší a presnejší vývoj odrôd plodín s požadovanými vlastnosťami. Tieto technológie majú významný potenciál zvýšiť poľnohospodársku produktivitu, zlepšiť kvalitu potravín, znížiť používanie pesticídov a posilniť odolnosť voči zmene klímy, pričom zároveň podporujú širšie environmentálne a ciele v oblasti udržateľnosti.

Empirická analýza vychádza z dvoch dopĺňajúcich sa prieskumov. Prvým je reprezentatívny prieskum medzi 202 slovenskými farmármi realizovaný v roku 2025, ktorý zachytáva charakteristiky fariem, informovanosť o NGT a postoje k NGT a konvenčnému šľachteniu. Druhým je medzinárodný spotrebiteľský prieskum realizovaný v Nemecku, Dánsku, Francúzsku, na Slovensku a v Spojenom kráľovstve (n = 5 000) prostredníctvom metódy CAWI. Okrem toho bol použitý diskrétny výberový experiment na odhad ochoty predávať (WTS) a ochoty platiť (WTP).

Výsledky ukazujú, že ochota farmárov využívať NGT je ovplyvnená najmä ekonomickými, agronomickými a informačnými faktormi. Hoci farmári vnímajú prínosy vyšších výnosov a lepšej odolnosti voči stresu, na prijatie produkcie založenej na NGT požadujú cenovú prémiu, čo poukazuje na obavy súvisiace s akceptáciou trhu a regulačnou neistotou. Znalosť technológie a vnímané prínosy podporujú jej prijatie, zatiaľ čo vnímané riziká a etické obavy predstavujú bariéry.

Na strane spotrebiteľov sa informovanosť o NGT líši medzi krajinami a demografickými skupinami, pričom vyššia je spravidla u mladších a vzdelanejších respondentov. Spotrebitelia vo všeobecnosti uprednostňujú produkty z konvenčného šľachtenia pred produktmi z NGT, pričom NGT produkty sú však prijateľnejšie ako GM produkty. Výsledky naznačujú, že spotrebitelia požadujú cenové zľavy pri produktoch z NGT, pričom najvyššia zľava bola zistená na Slovensku. Zároveň environmentálne šetrné vlastnosti produkcie významne zvyšujú ochotu platiť, čo poukazuje na možné synergie medzi udržateľnosťou a technologickými inováciami.

Ekonomické stimuly, akceptácia spotrebiteľov a regulačná jasnosť predstavujú kľúčové determinanty využívania NGT. Zvyšovanie informovanosti verejnosti, posilnenie komunikačných stratégií a zosúladenie politík s očakávaniami trhu budú nevyhnutné pre úspešnú integráciu NGT do európskeho a slovenského poľnohospodárstva.

Funded by the EU NextGenerationEU through the Recovery and Resilience Plan for Slovakia under the **Project No. 09I01-03-V04-00049**

References

Abdoulaye, T., Abass, A., Maziya-Dixon, B., Tarawali, G., Okechukwu, R., Rusike, J., ... & Ayedun, B. (2014). Awareness and adoption of improved cassava varieties and processing technologies in Nigeria. Journal of Development and Agricultural Economics, 6(2), 67-75.

Agnoli, L., Vasileiou, E. & Demaria, F. (2025). Barriers and Drivers in the Adoption of New Genomic Techniques for Grapevines. Wine Economics and Policy 14(2): 25-39.

Baker, L. M., Tully, K. M., Sumners, D. R., Jones, E. F., León-Reyes, A. E., Boyer, C., & Peterson, H. H. (2020). Is it for generation me? A qualitative study exploring marketing and selling plants online to millennial-aged consumers. Journal of Applied Communications, 104(2), 2.

Bearth, A.; Kaptan, G.; Kessler, S.H. (2022). Genome-edited versus genetically-modified tomatoes: an experiment on people's perceptions and acceptance of food biotechnology in the UK and Switzerland. Agriculture and Human Values 39, 1117–1131, 2022. https://doi.org/10.1007/s10460-022-10311-8.

Beghin, J.C.; Gustafson, C.R. (2021). Consumer Valuation of and Attitudes towards Novel Foods Produced with New Plant Engineering Techniques: A Review. Sustainability, 13(20), 11348, 2021. https://doi.org/10.3390/su132011348.

Busch, G.; Ryan, E.; von Keyserlingk, M.A.G.; Weary, D.M. (2021). Citizen views on genome editing: effects of species and purpose. Agriculture and Human Values 39, 151- 164, 2022. https://doi.org/10.1007/s10460-021-10235-9.

Chatzopoulou, S,. and S. Chatzopoulos (2024). Livestock farmers' perceptions towards genetically engineered methods and genetically modified organisms in Denmark and Sweden, Journal of Rural Studies, Volume 111

EC. 2021. Study on the Status of New Genomic Techniques under Union Law and in Light of the Court of Justice Ruling in Case C-528/16. European Commission, Brussels, 29.4.2021, SWD(2021) 92.

Eckerstorfer, M.F., Heissenberger, A., Reichenbecher, W., Steinbrecher, R.A. and F. Waßmann. 2019. An EU perspective on biosafety considerations for plants developed by genome editing and other new genetic modification techniques (NGMTs). Frontiers in Bioengineering and Biotechnology, 7. https://doi.org/10.3389/fbioe.2019.00031

Ferrari, L. (2022). Farmers' attitude toward CRISPR/Cas9: The case of blast resistant rice. Agribusiness, 38(1), 175-194.

Gifford, R., & Nilsson, A. (2014). Personal and social factors that influence pro-environmental concern and behaviour: A review. International journal of psychology, 49(3), 141-157.

Greiner, R., & Gregg, D. (2011). Farmers' intrinsic motivations, barriers to the adoption of conservation practices and effectiveness of policy instruments: Empirical evidence from northern Australia. Land use policy, 28(1), 257-265.

Nguyen, T.H.; Ben Taieb, S.; Moritaka, M.; Fukuda, S. (2022). Implicit and Explicit Attitudes toward Foods Derived from Genome Editing and Genetic Modification Technologies under Different Information Treatments. Journal of Food Products Marketing, 28(1), 1-30, 2022. https://doi.org/10.1080/10454446.2022.2037487.

Nyairo, N. M., Pfeiffer, L., Spaulding, A., & Russel, M. (2022). Farmers' attitudes and perceptions of adoption of agricultural innovations in Kenya: a mixed methods analysis. Journal of Agriculture and Rural Development in the Tropics and Subtropics (JARTS), 123(1), 147-160.

Parisi, C., & Rodriguez, C. E. (2021). Current and future market applications of new genomic techniques.

Pignatti, E., Carli, G., & Canavari, M. (2015). What really matters? A qualitative analysis on the adoption of innovations in agriculture. Journal of Agricultural Informatics, 6(4).

Pokrivcak, J., Rajcaniova, M. & Lazorcakova, E. (2024). Report on consumer and stakeholder acceptance of NGTs. Deliverable 1.2, 8/2024. https://genebecon.eu/wp-content/uploads/2024/10/GeneBEcon_Deliverable1.2.pdf

Qaim, M. (2020). Role of New Plant Breeding Technologies for Food Security and Sustainable Agricultural Development. Applied Economic Perspectives and Policy, 42(2), 129-150, 2020. https://doi.org/10.1002/aepp.13044.

Rousseliere, D.; Rousseliere, S. (2017). Is biotechnology (more) acceptable when it enables a reduction in phytosanitary treatments? A European comparison of the acceptability of transgenesis and cisgenesis. PLoS ONE, 12(9), e0183213, 2017. https://doi.org/10.1371/journal.pone.0183213.

Strobbe, S.; Wesana, J.; Van Der Straeten, D.; De Steur, H. (2023). Public acceptance and stakeholder views of gene edited foods: a global overview. Trends in Biotechnology, 41(6), 736-740, 2023. https://doi.org/10.1016/j.tibtech.2022.12.011.

Funded by the EU NextGenerationEU through the Recovery and Resilience Plan for Slovakia under the **Project No. 09I01-03-V04-00049**