European Sustainable Agriculture Through Genome Editing

European Food Forum Event:
“New Genomic Techniques EU Proposal:
legal framework and enforcement challenges”

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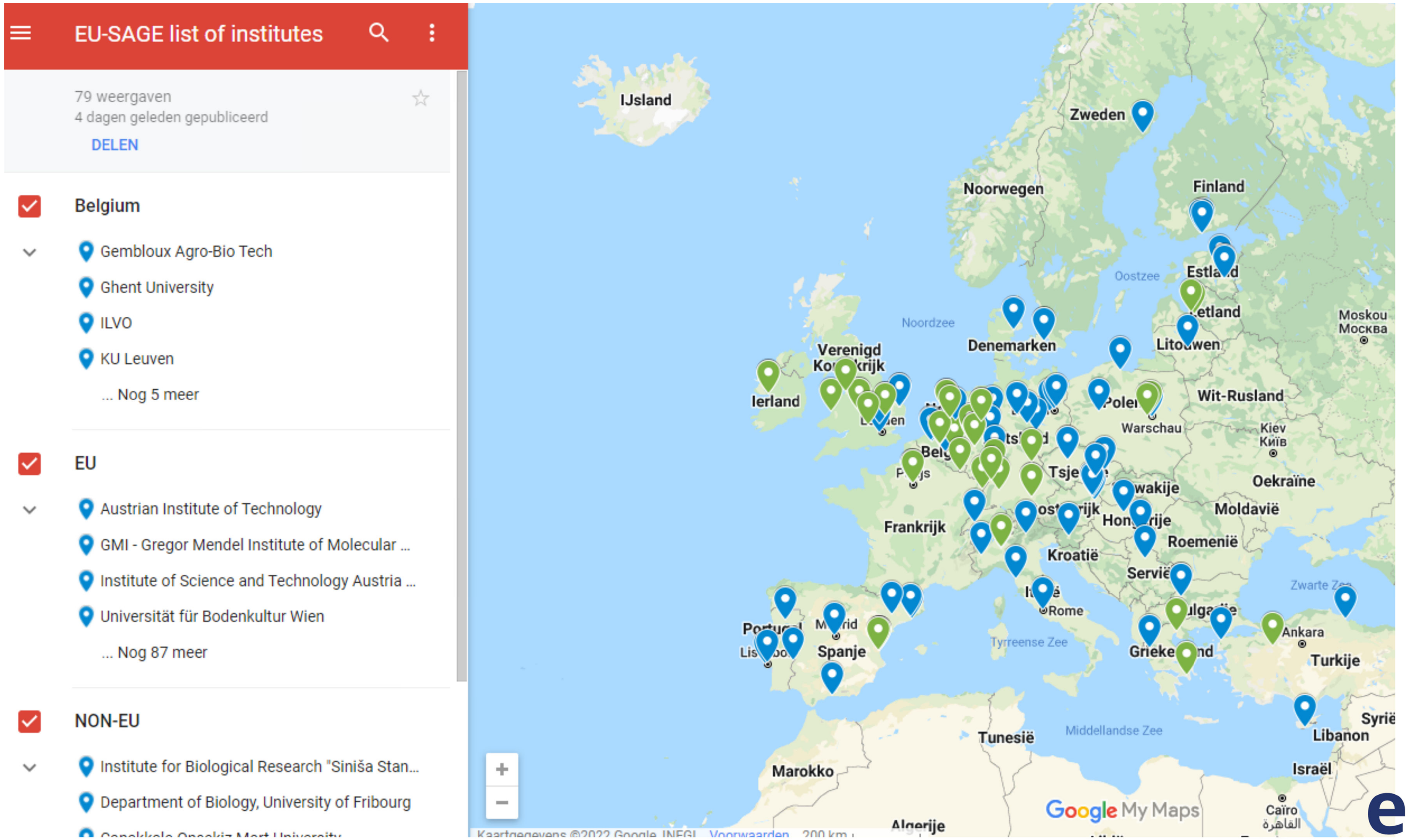
EU-SAGE has over 150 members from 31 countries



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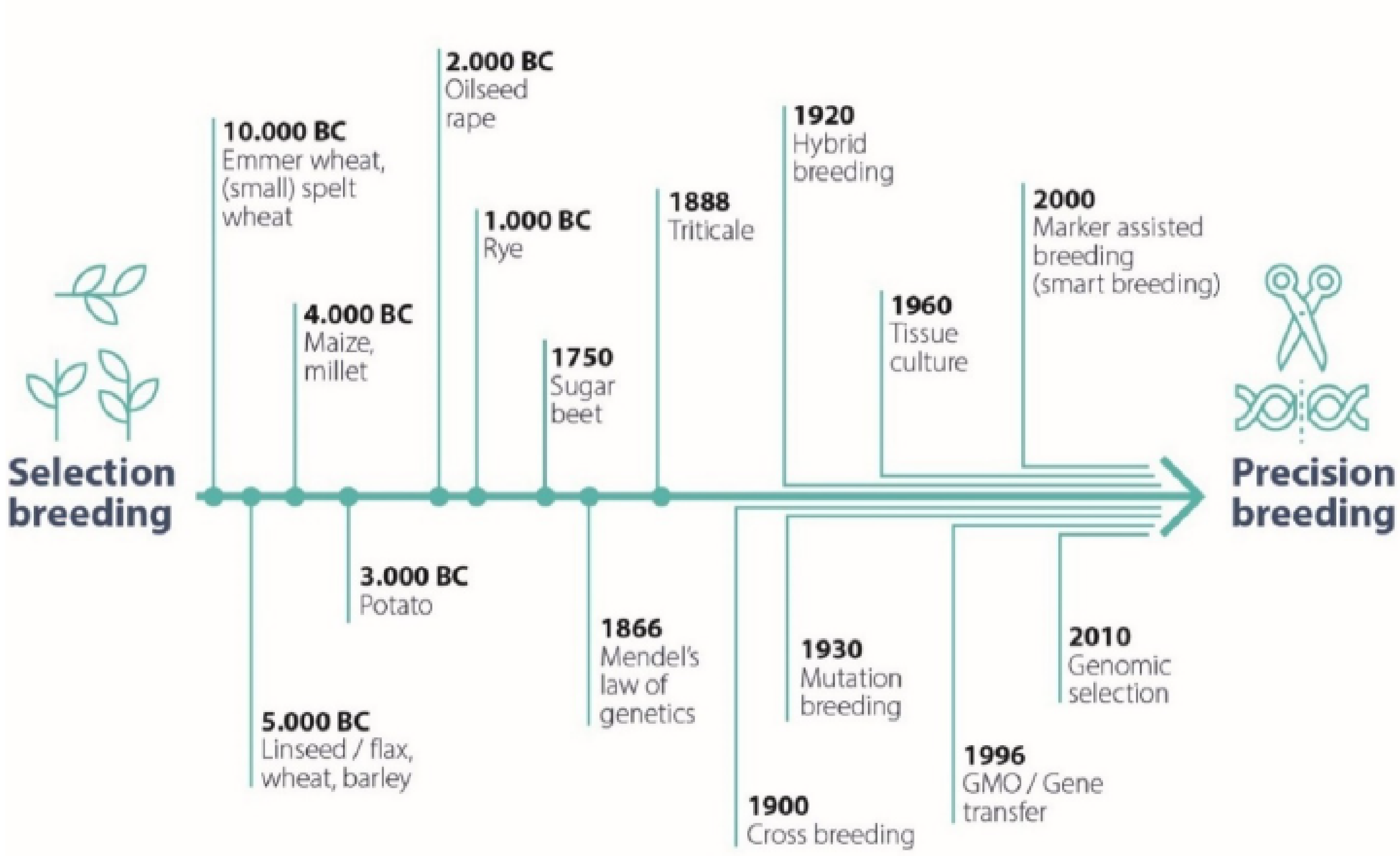
Millenia of plant breeding resulted in the food products we consume today

Development of breeding technologies over time



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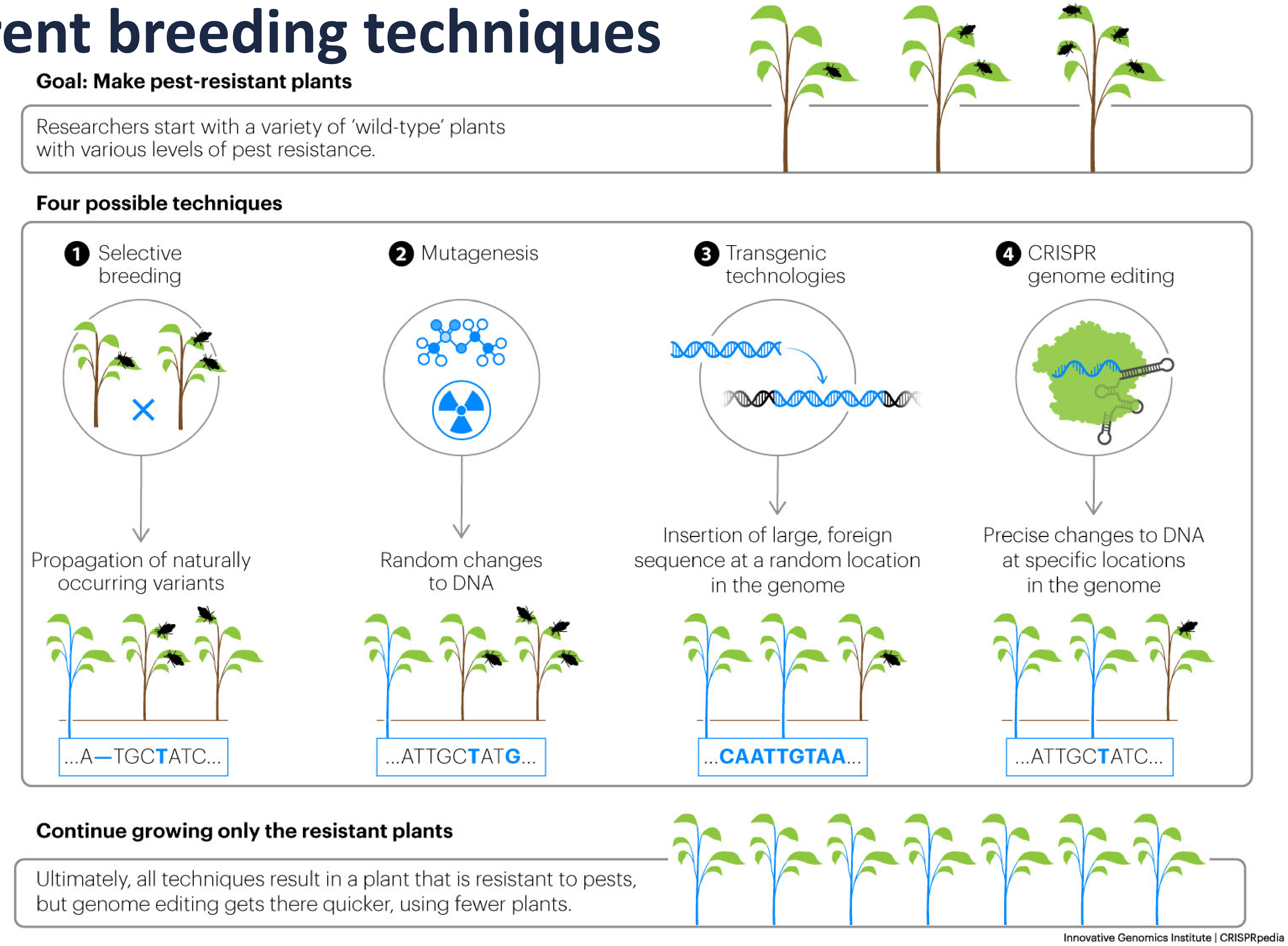
Different breeding techniques



Genome editing enables precision breeding

SPECIFIC	from random to targeted DNA changes
PRECISE	off target changes are negligible
EFFICIENT	feasible in one/two life cycles of a plant

EU-SAGE DEVELOPED AN INTERACTIVE, REGULARLY UPDATED, PUBLICLY ACCESSIBLE ONLINE DATABASE OF GENOME-EDITED CROPS

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Genome editing applications in crops bring benefits for producers and/or consumers

Trait category		Trait category explanation
Improved food/feed quality	**22,4%**	Modified composition of components such as vitamins, toxic substances, starch, oil, proteins, fibres, allergens, etc. to improve nutritional value.
Plant yield and growth	**22,2%**	Increased yield related to photosynthetic efficiency, to fruit size or weight or to increased number of flowers, seeds and fruits. Improved plant architecture, for example plant height and shape, growth pattern and fruit shapes.
Biotic stress tolerance	**18,2%**	Resistance to plant diseases caused by bacteria, viruses, fungi, pests, pathogens, or nematodes.
Industrial utilisation	14,0%	Applications of industrial interest such as breeding tools, bio-fuel production, nitrogen use efficiency etc.
Herbicide tolerance	7,4%	Tolerance of plants to various types of herbicides.
Abiotic stress tolerance	8,1%	Resistance to abiotic stress factors such as drought, heat, cold, salt, water excess and UV radiation.
Product flavour/colour	5,6%	Modified flavour or colour.
Storage performance	2,2%	Improvement of storage characteristics such as increased shelf-life, altered storage requirements, non-browning properties and reduced black spots.

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Genome editing applications in crops: examples

GRAPEVINE HIGHLY RESISTANT TO FUNGUS

This specific genome-edited grapevine variety is highly resistant to fungus. Farmers that plant this grapevine need to use **less fungicides.**

MULTIPURPOSE PENNYGRASS

With genome editing, this penny grass was developed into a cover crop that can be used outside of cropping seasons. It is used to **protect soil and control carbon loss**.

MORE TOLERANT RICE

Using CRISPR, researchers developed a semidwarf type of rice.

This variety shows **better tolerance of low-nutrient conditions** and **higher resistance to pathogens and insects.**

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Examples of genome edited-crops and their potential benefits in the context of EU agricultural challenges

CROP	INTRODUCED PROPERTY	POTENTIAL BENEFICIAL EFFECT IN THE CONTEXT OF EU AGRICULTURAL CHALLENGES
Grapevine	Increased resistance to fungus *(Erysiphe necator)*, causing powdery mildew	Reduced dependency on the use of chemical or organic fungicides
Wheat	Resistance against fungus powdery mildew	Avoidance of the use of chemical or organic fungicides to combat powdery mildew
Potato	Resistance to potato virus X	Reduction of yield loss following potato virus X infection
Citrus fruit	Resistance against bacteria *(Xanthomonas citri)* causing citrus canker	Reduction of yield loss
Wheat	Drought tolerance	Reduction of yield loss under dry conditions
Tomato	Enhanced tolerance to heat stress	Better performance under heat stress
Maize	Drought tolerance	Reduction of yield loss under dry conditions

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Examples of genome edited-crops and their potential benefits in the context of EU agricultural challenges

CROP	INTRODUCED PROPERTY	POTENTIAL BENEFICIAL EFFECT IN THE CONTEXT OF EU AGRICULTURAL CHALLENGES
Rice	Enhanced salinity tolerance	Enhanced yield under salinity stress conditions
Oilseed rape	Improved pod shattering resistance	Reduced seed loss during harvest, thereby increasing yields and reducing volunteer plants
Maize	Increased total kernel number or kernel weight	Higher yield per unit of land
Lettuce	Enhanced photosynthesis and decreased leaf angles for improved plant architecture and high yields	Higher yield per unit of land
Tomato	More fruits and bigger fruits	Higher yield per unit of land
Barley	Increase in plant height, tiller number, grain protein content and yield	Higher yield per unit of land and increased quality

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Genome-edited plants released on the market

ic soy bean in the US

stable frying oil

ns fatty acids: healthier fried food

nriched tomato in Japan

lowers blood pressure: health benefit

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trient-rich mustard leaf in the US

alth benefit

y corn in Japan

reased amylopectin in the corn: beneficial for
e and paper industries

Non-browning banana in the Philippines

ing food waste

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