

# The future of plant breeding is under threat in Europe

Current interpretation of patent law is insufficient to stop patents on conventional breeding

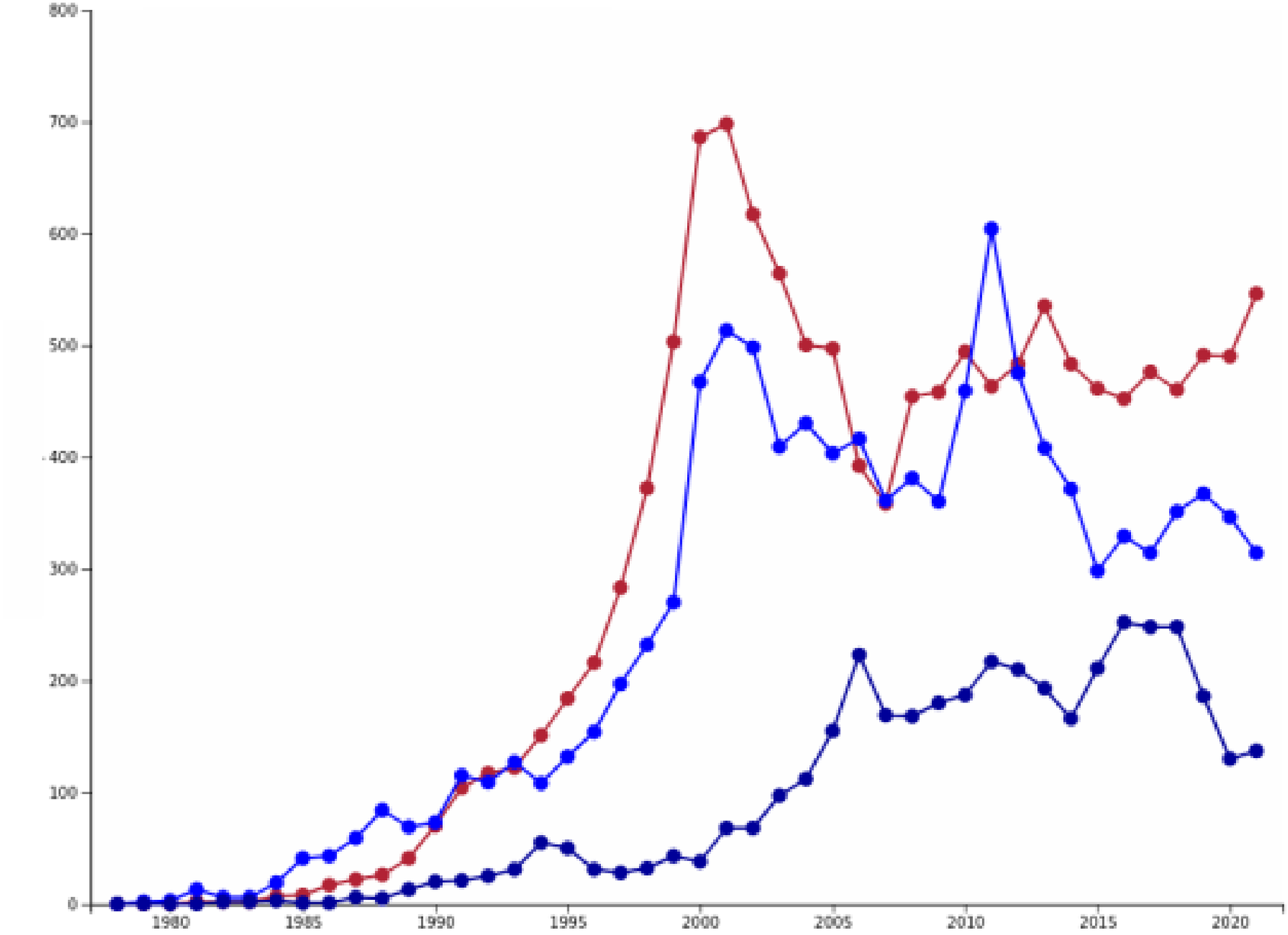



**Figure 1: Patents on plants – the number of all patent applications filed for plants under the PCT/WIPO (upper /red line) and at the EPO (middle / lighter blue line), including patents on plants granted by the EPO (lower / darker blue line) per year. Research according to official classifications (IPC A01H or C12N15/82). Source: www.kein-patent-auf-leben.de/patentdatenbank/**

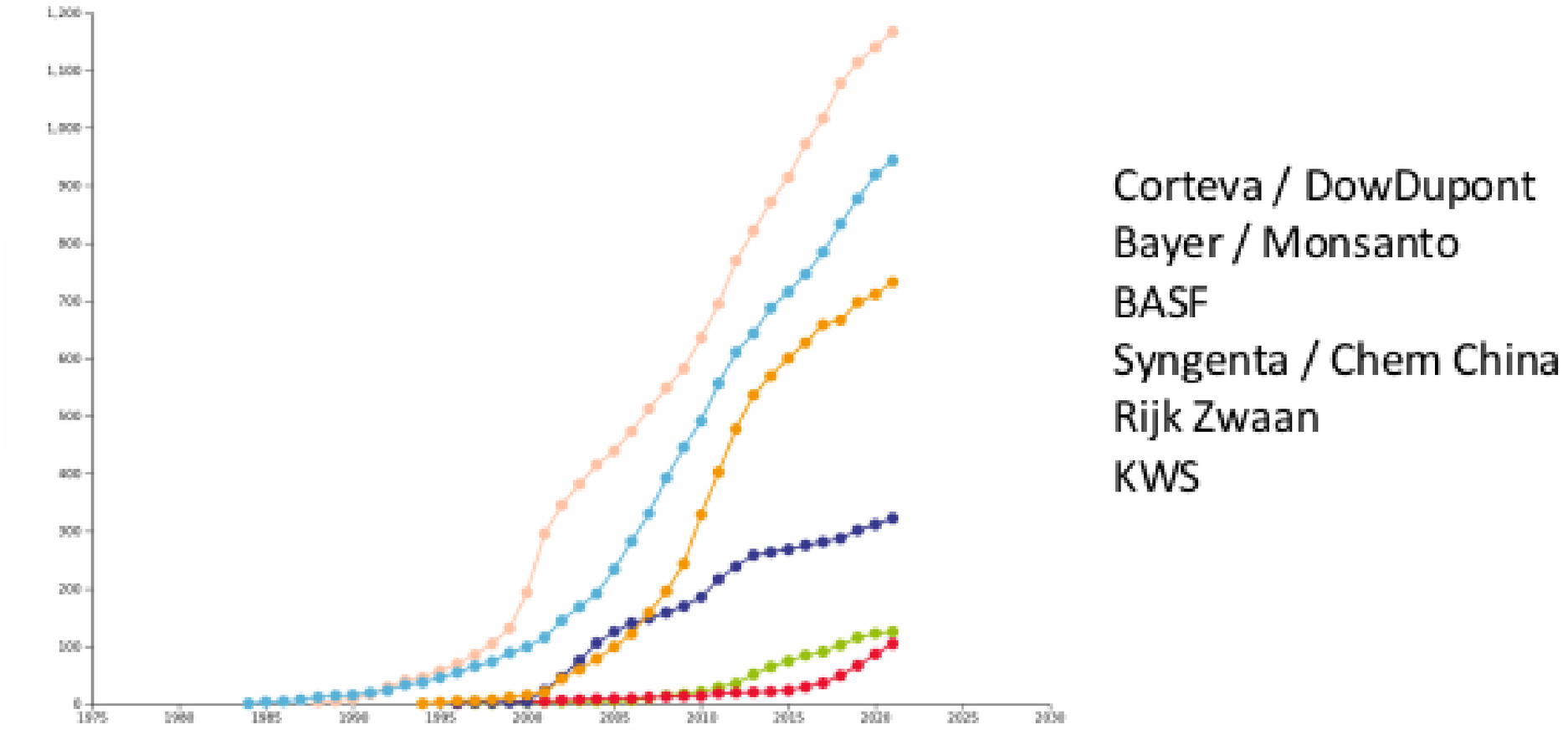



**Figure 2: Patents on plants - number of all patent applications filed for plants under the PCT/WIPO, categorized by individual companies and accumulated since 1990. Research according to official classifications (IPC A01H or C12N15/82). Source: www.kein-patent-auf-leben.de/patentdatenbank/**

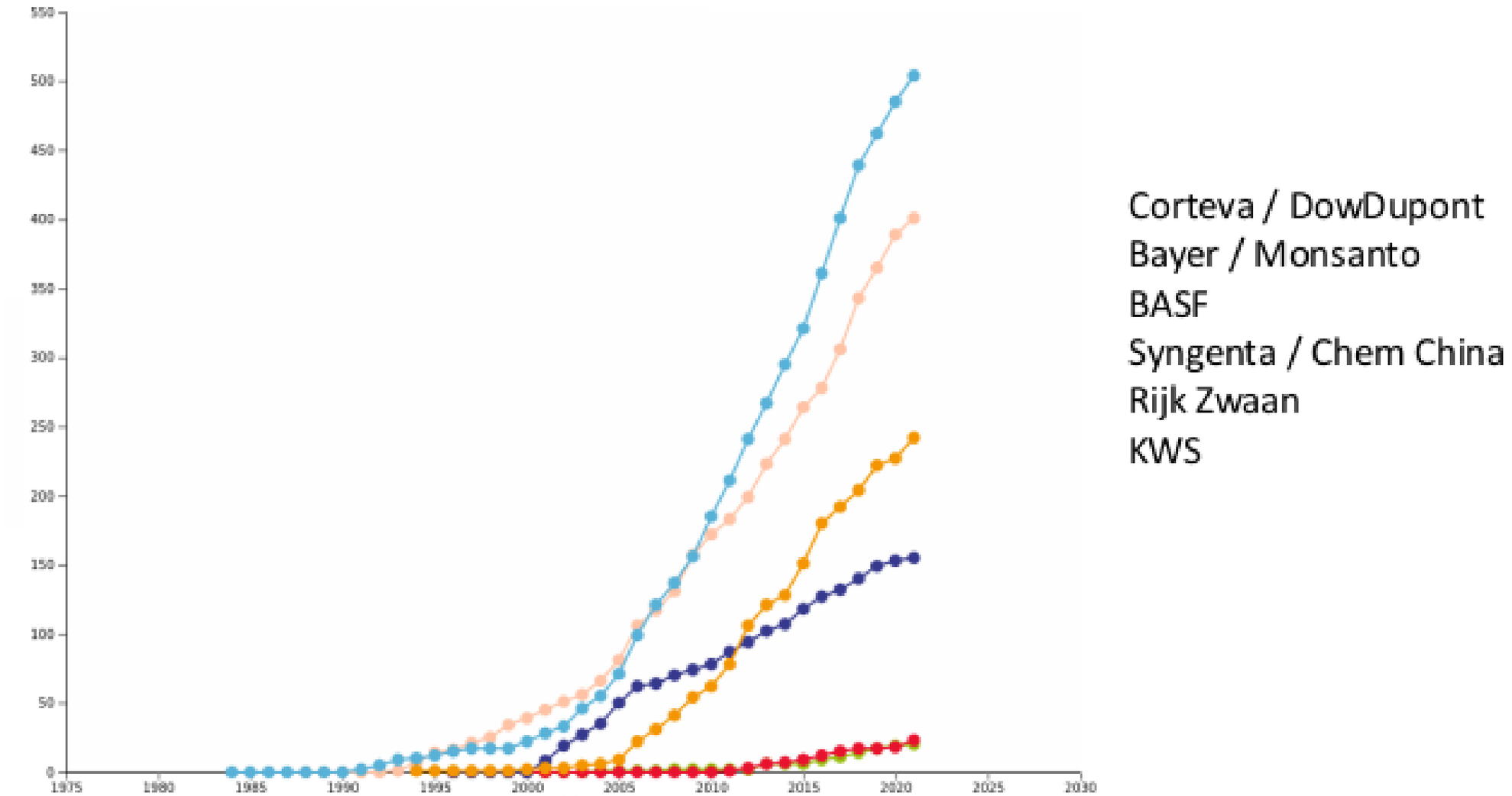



**Figure 3: All EPO patents granted on plants, categorized by individual companies and accumulated since 1990. Research according to official classifications (IPC A01H or C12N15/82).**
**Source: www.kein-patent-auf-leben.de/patentdatenbank/**

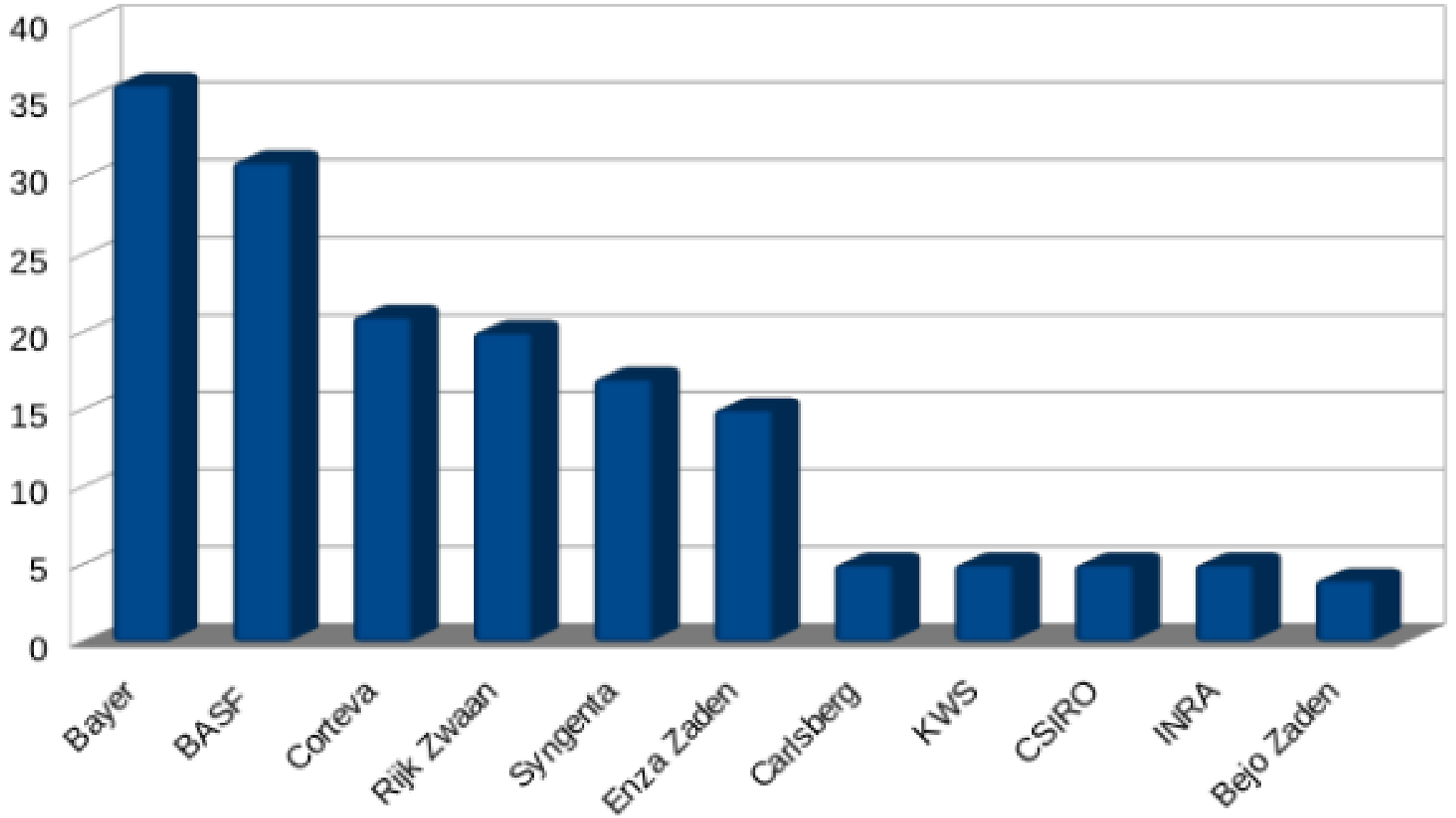



**Figure 6: EPO patents granted for conventional plant breeding (international classifications IPC A01H or C12N15/82), between 2012 and 2022, categorized by companies. Source: database of *No Patents on Seeds!***

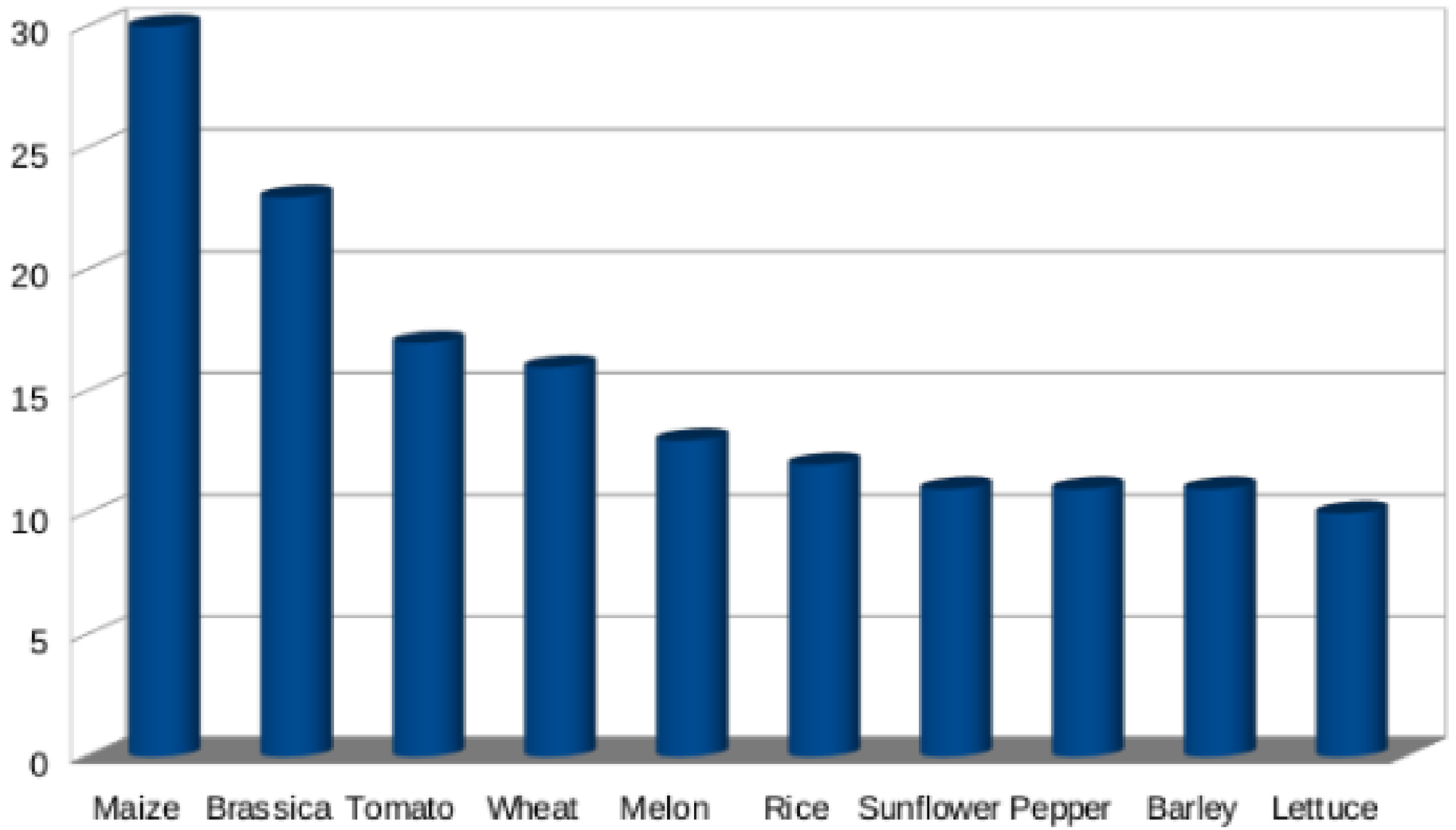



**Figure 7: EPO patents granted on conventional plant breeding (international classifications IPC A01H or C12N15/82) between 2012 and 2022, categorized by species. Source: database of *No Patents on Seeds!***

## Leading Companies by Seeds & Trait Sales, 2020

| Ranking | Company /Headquarters | Seeds & Trait Sales $US millions | % Global Market Share |
|---|---|---|---|
| 1. | Bayer[13] (Germany) | 10,286 | 23 |
| 2. | Corteva Agriscience[14] (USA) | 7,756 | 17 |
| 3. | ChemChina/ Syngenta[15] (China) | 3,193 | 7 |
| 4. | BASF[16] (Germany) | 1,705 | 4 |
| 5. | Groupe Limagrain/ Vilmorin & Cie[17] (France) | 1,684 | 4 |
| 6. | KWS[18] (Germany) | 1,494 | 3 |
| | **TOTAL TOP 6** | **26,118** | **58** |
| 7. | DLF Seeds[19] (Denmark) | 1,153 | 3 |
| 8. | Sakata Seeds[20] (Japan) | 648 | 1.0 |
| 9. | Kaneko Seeds[21] (Japan) | 570 | 1.0 |
| | **Total World Market** | **45,000** | **100** |

Source: ETC Group

# Patent applications on conventional breeding of plants

### a) Syngenta / ChemChina patent application for soy plants with resistance to Asian soybean rust, WO2022173659

The patent description shows how the gene variants were detected in populations of wild relatives of soybeans (*glycine tomentella*), i. e. by screening for their natural resistance. It is shown that crossing and selection is sufficient to generate new varieties with improved resistance to Asian soy rust.



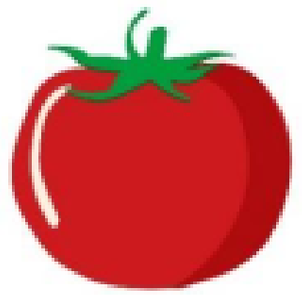
The wording in the claims references six gene variants and plants inheriting the genes, regardless of whether these are obtained from genetic engineering processes or conventional breeding. In addition, the claims cover all plants inheriting any of the genetic markers listed in two tables included on around 200 pages in the patent. The tables comprise around 45.000 gene variants (SNPs). Furthermore, the patent claims soybean plant production methods which involve selecting plants by using the marker genes. Previous research revealed similar Syngenta patent applications[7].

[7] Report from No patents on seeds! (2022): https://www.no-patents-on-seeds.org/en/report2022

### c) Rijk Zwaan patent application for tomatoes with resistance to Tomato Brown Rugose Fruit Virus (TOBRFV), WO2022013452

The patent description explains how the gene variants were detected in populations of wild relatives of domesticated tomatoes (*Solanum pimpinellifolium*), i. e. by screening for natural resistance. It is shown that crossing and selection are sufficient to generate new varieties with improved resistance to TOBRFV.

The wording of the claims describes gene variants (and markers) detected in the wild species and the domesticated tomato plants that were obtained from further breeding. In addition, it claims the marker genes and breeding method if the gene variants are used in the selection process.



The 2022 *No Patents on Seeds!* report[8] revealed several patent applications for tomatoes with resistance to TOBRFV. At that time, it was found that around a dozen international patent applications covering conventionally-bred TOBRFV resistant tomato plants had been filed. Companies that are filing these patents include, e. g. BASF (Nunhems), Bayer (Seminis), Enza Zaden, Philoseed, Rijk Zwaan and Vilmorin. Our recent research shows that five further patent applications were published, thus increasing the legal uncertainties for all interested breeders.

# International patent applications on resistance against TBRF-Virus in tomato

**‚Jordan' Virus: 10 patent applications of 5 different companies are targeting same chromosome, with overlapping claims**

Bayer/Seminis
WO2020018783

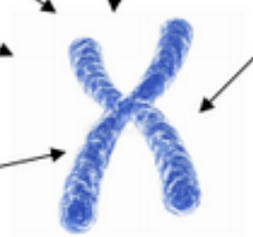
BASF/ Nunhems:
WO2021213892

Vilmorin:
WO2021245282
WO2020249996
WO2020249798

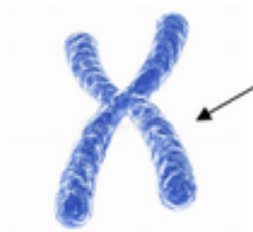
Philoseed:
WO2022018734

Rijk Zwaan:
WO2019110821
WO2019110130
WO2021170868
WO2021110855

Vilmorin:
WO2020249996
WO2020249798
WO2018219941
WO2021245282

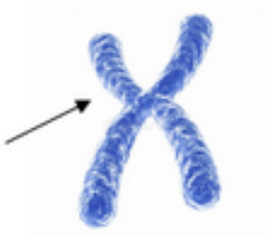


Chromosome 11



Chromosome 9

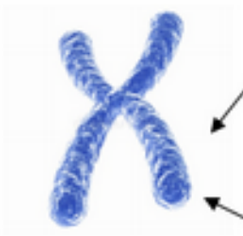
Rijk Zwaan:
WO2019110130



Chromosome 12



Enza Zaden:
WO2020148021



Chromosome 8

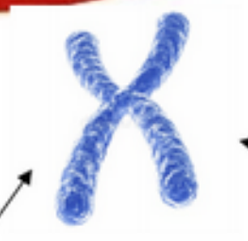
Rijk Zwaan:
WO2022013452

BASF/ Nunhems:
WO2021213892



Chromosome 2

Philoseed:
WO2022018734



Chromosome 6

Rijk Zwaan:
WO2019110130

Vilmorin:
WO2020249996
WO2020249798
WO2018219941

https://www.no-patents-on-seeds.org/en/report2022

# Granted patents on conventional breeding of plants



(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 560 330 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
**15.06.2022 Bulletin 2022/24**

(21) Application number: **18169122.1**

(22) Date of filing: **24.04.2018**

(51) International Patent Classification (IPC):
***A01H 1/04*** *(2006.01)* ***C12Q 1/68*** *(2018.01)*
***C12N 9/14*** *(2006.01)* ***C12N 15/82*** *(2006.01)*

(52) Cooperative Patent Classification (CPC):
**C12N 15/8255; A01H 1/04; C12N 9/0071; C12N 15/8216; C12Q 1/6895; C12Y 114/13088; C12Q 2600/156**

(54) **PLANTS WITH IMPROVED DIGESTIBILITY AND MARKER HAPLOTYPES**

PFLANZEN MIT VERBESSERTER VERDAULICHKEIT UND MARKERHAPLOTYPEN

PLANTES À DIGESTIBILITÉ AMÉLIORÉE ET HAPLOTYPES MARQUEURS

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(43) Date of publication of application:
**30.10.2019 Bulletin 2019/44**

(73) Proprietor: **KWS SAAT SE & Co. KGaA**
**37574 Einbeck (DE)**

- **MAURICE BOSCH ET AL: "Identification of genes involved in cell wall biogenesis in grasses by differential gene expression profiling of elongating and non-elongating maize internodes", JOURNAL OF EXPERIMENTAL BOTANY, vol. 62, no. 10, 14 March 2011 (2011-03-14), pages 3545-3561, XP055498299, GB ISSN: 0022-0957, DOI: 10.1093/jxb/err045**
- **RIBOULET C ET AL: "QTL mapping and candidate gene research from lignin content and cell wall digestibility in a top-cross of a flint maize**



(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 380 618 B1**

(12) **EUROPÄISCHE PATENTSCHRIFT**

(45) Veröffentlichungstag und Bekanntmachung des Hinweises auf die Patenterteilung:
**24.08.2022 Patentblatt 2022/34**

(21) Anmeldenummer: **16804741.3**

(22) Anmeldetag: **26.11.2016**

(51) Internationale Patentklassifikation (IPC):
***C12N 15/82*** *(2006.01)* ***C12Q 1/6895*** *(2018.01)*
***C07K 14/415*** *(2006.01)* ***A01H 5/10*** *(2018.01)*

(52) Gemeinsame Patentklassifikation (CPC):
**C12N 15/8273; C07K 14/415**

(86) Internationale Anmeldenummer:
**PCT/EP2016/078920**

(87) Internationale Veröffentlichungsnummer:
**WO 2017/089601 (01.06.2017 Gazette 2017/22)**

(54) **KÜHLETOLERANTE PFLANZE**

PLANT WITH TOLERANCE OF THE COLD

PLANTE RUSTIQUE

(84) Benannte Vertragsstaaten:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(30) Priorität: **27.11.2015 EP 15196721**

(43) Veröffentlichungstag der Anmeldung:
**03.10.2018 Patentblatt 2018/40**

(73) Patentinhaber: **KWS SAAT SE & Co. KGaA**
**37574 Einbeck (DE)**

(56) Entgegenhaltungen:
**WO-A1-2008/034648**
**WO-A1-2014/160304**
**US-A1- 2007 044 171**

- **Nino Baliashvili: "Feinkartierung eines QTL (Quantitative Trait Locus) für Kühletoleranz auf Chromosom 4 in Mais und dessen molekularbiologische und phänotypische Charakterisierung. Inaugural-Dissertation zur Erlangung des Doktorgrades der Mathematisch-Naturwissenschaftlichen Fakultät der Heinrich-Heine-Universität", , Januar 2011 (2011-01), Seiten I-V, 1-96, XP55273945,**



# Content of the KWS patents

***actual process***

existing population

genotyping
phenotyping

Claims:

All plants and gene variants
(EP 3560330: if not exclusively derived from crossing and selection)

Use of gene variants
for further breeding (selection)

Use of plants
for further breeding

***toppings  (not neccessary)***

additonal marker genes

random mutagenesis

CRISPR/Cas

transgenesis

# Effects of KWS-type patents



Claims:

All plants and gene variants
(Rule 28 (2): if not exclusively derived from crossing and selection)

Use of gene variants
for further breeding (selection)

Use of plants
for further breeding

***legal uncertainties: who is concerned?***

How about own breeding material, varieties from other breeders or native populations?

Who is allowed to use methods for identification?

***technical hurdles***

How to identify the gene variants / patented material in practice?

How to distinguish randomly mutated plants from those derived from crossing and selection?

***dependencies and costs***

Legal expertise / consulting

Lab analyis for identification

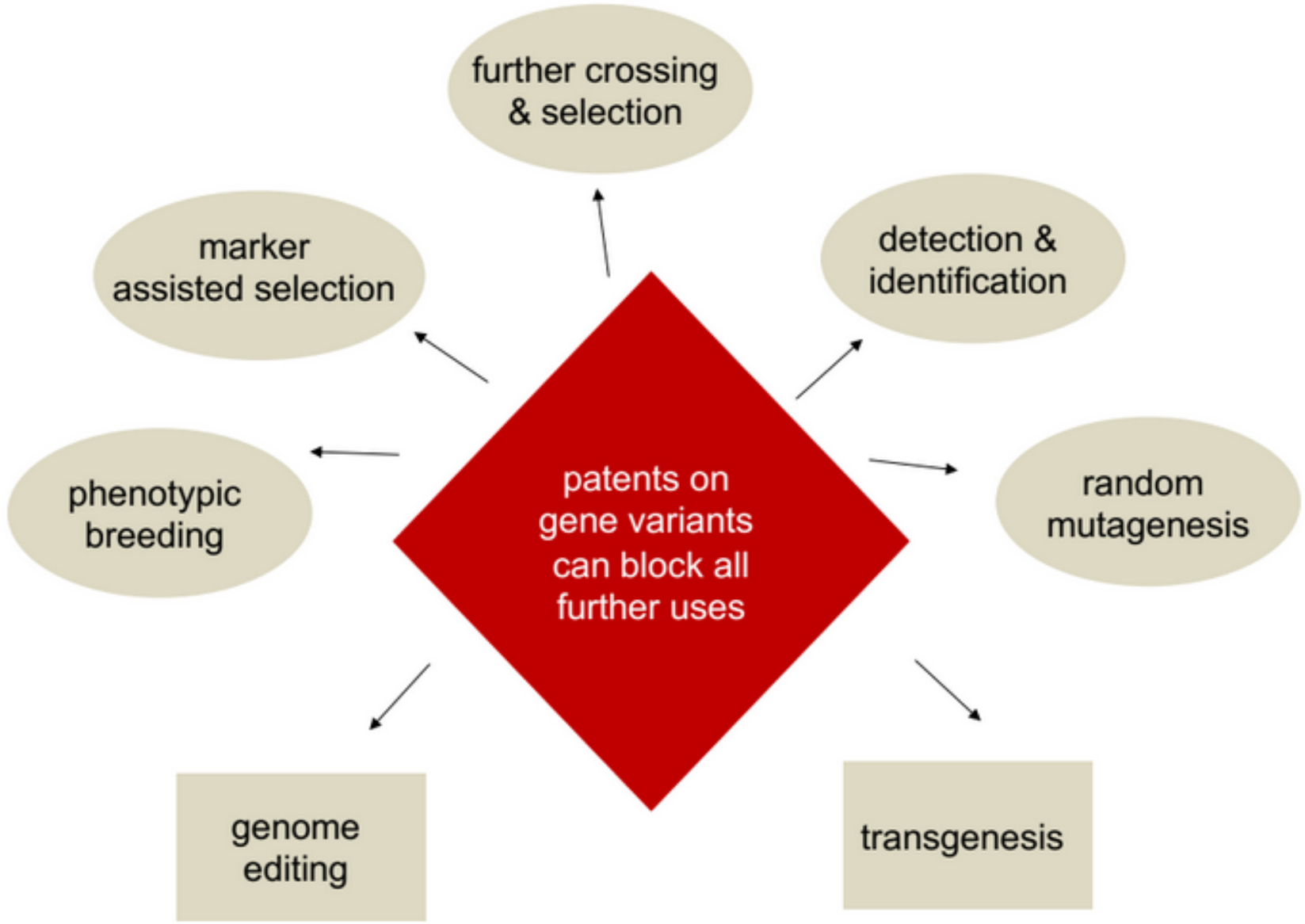
Lincense fees (maybe several patent holders)

Contracts and stewartship

Further use of the own varieties

# Patents on plant genes can block all further uses of plants and genes

non-technical breeding




genetic engineering

# Legal situation

# Legal background: Patents & technical inventions concerning plants

- EU patent directive 98/44 allowed patents on technical inventions concerning plants and animals (Art. 4.2) for the first time in Europe.
- This is in form of an exemption from Article 53 (b) of the European Patent Convention (EPC), which prohibits patents on plant varieties as well as on plant breeding based on essentially biological processes.
- The wording of EU directive (1999) and the historical background (EPC 1973) make it clear that the exemption from the prohibition is only applicable to plants derived from genetic engineering (including genome editing).
- Therefore, the prohibitions in Article 53 (b) are fully applicable to plants derived from essentially biological processes with outcomes that cannot be directly controlled by technical means, e.g. random mutations or crossing and selection.
- If patents on technological inventions are granted, the scope of the patents has to be restricted to the specific technical processes and any products thereof, so that conventional breeding is not affected.

# Art 53 (b), EPC and EU Directive 98/44/EC, Art 4

**Art 53 (b), EPC and Article 4 (EU Patent Directive): <u>the probitions</u>**
The following shall not be patentable:
(a) plant and animal varieties;
(b) essentially biological processes for the production of plants or animals.

**Article 4 (EU Patent Directive): the <u>exemption</u> from the prohibitions**
Inventions which concern plants or animals shall be patentable if the technical feasibility of the invention is not confined to a particular plant or animal variety.

# Random mutations are technical inventions?

Within the meaning of Article 53 (b), the processes of ‘random mutagenesis’ have to be considered as essential biological (conventional breeding): these processes do not allow the direct insertion of an intended trait in a targeted way. They are simply a tool to enhance genetic diversity. The processess and resulting genetic changes cannot be considered to be technical inventions within the meaning of the EU patent directive (G02/07 and G1/08).

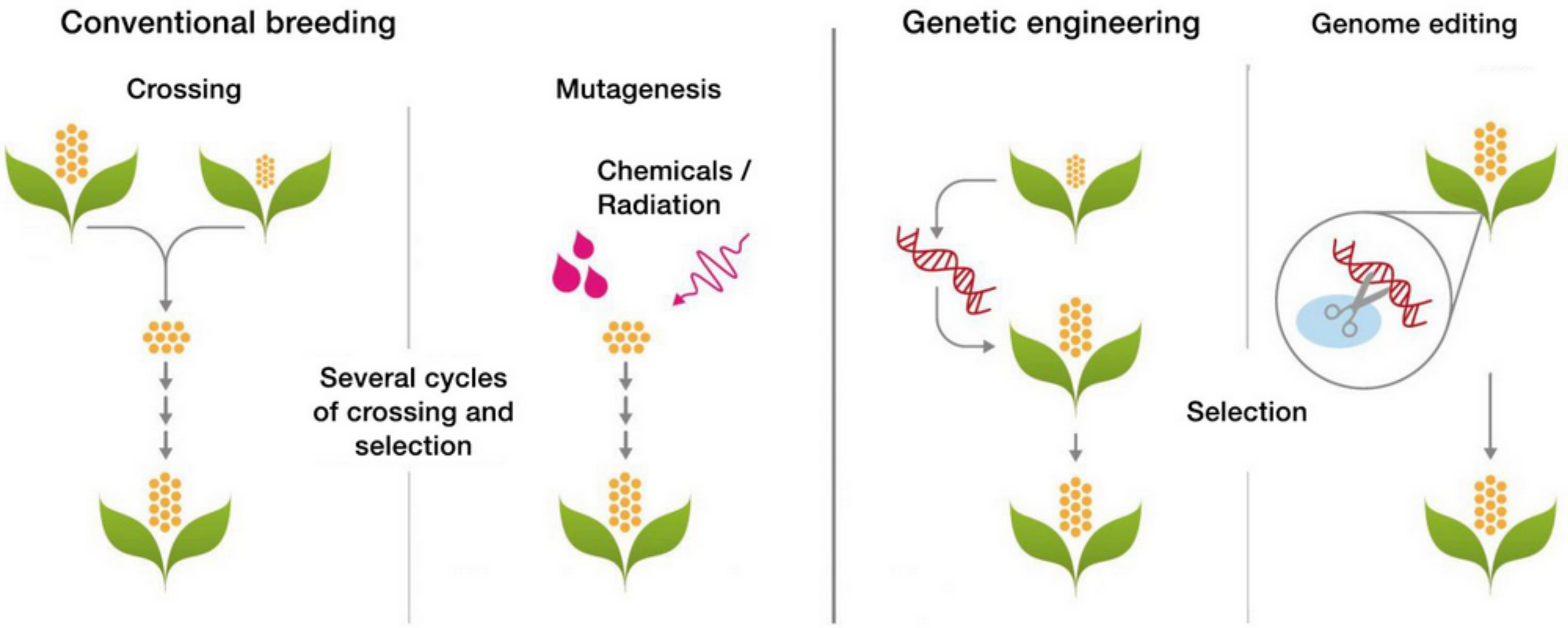



Figure 4: Differences between conventional breeding (including random mutagenesis) versus genetic engineering (including genome editing): conventional breeding always needs several cycles of crossing and selection to achieve to a desired trait, while GE can be used to directly insert new traits into a plant.

# Plant variety protection (PVP) law and breeders exemption

The PVP law gives freedom to operate for all breeders to use all varieties on the market to breed even better varieties and market them independently.

Under patent law, there is only a limited breeders exemption: One may breed, but is not allowed to market the new variety without license contract.

Thus patents can be used to control, to hamper or even block access to the biological resources needed by all breeders. It ends the freedom to operate.

# Consequences for KWS maize patents



No technical invention in the meaning of EU Dir. 98/44

Violation of Art 53 (b):

- The plants claimed are plant varieties
- The processes used are essentially biological

# Conclusions

Patents on processes including crossing and selection, or the use of naturally occurring or randomly generated genetic variations, have to be prohibited, as well as the extension of patents on genetically engineered processes to plants and animals and plant and animal varieties obtained from conventional breeding.

The correct interpretation of the EPC should be implemented as soon as possible by a simple majority vote in the Administrative Council of the EPO.

In addition, national legislation of the contracting states of the EPO should be adopted with the inclusion of the correct interpretation of patent laws.

The EU should take a lead.

A first model law was established in Austria, in 2023. Article 2, para 2.3. reads (own translation):

“*A process for breeding of plants or animals is essentially biological, if it is exclusively based on natural phenomena such as crossing, selection, non-targeted mutagenesis or random genetic variations that occur in nature.*”

https://www.parlament.gv.at/gegenstand/XXVII/ME/229?selectedStage=100

# Thanks for your attention!




https://www.no-patents-on-seeds.org/en/report2023