11 reasons why Europe needs to ban patents on food plant and farm animals

New applications to patent plants and animals derived from conventional breeding

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Published by

we thank Friends of the Earth Germany and the Salvia Foundation for funding our patent research.

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Summary

1. Introduction

‘Patents on life’, claiming plants and animals as ‘inventions’ were introduced in Europe in the 1990ies, when companies such as Monsanto started to produce genetically engineered plants. Patents on plant and animal varieties are explicitly prohibited in Europe.1 However biotech industry, supported by patent attorneys and the European Patent Office (EPO), succeeded in seed patents to become reality. The development was driven by vested interests: agrochemical companies, patent attorneys and the EPO, all profit from the business with patents. Meanwhile, according to official statistics, around 3700 patents on plants and nearly 2000 patents on animals were granted in Europe starting from very few first cases the 1980ies.

Patents confer monopolistic power: Without permission, plants and animals covered by patents can not be used by any other breeders, gardeners or farmers which want to generate new plant varieties, propagate seeds or use animals for further breeding. In many case, also usage of the harvest for food production is within the scope of the patents. This is completely different to current situation under plant variety protection system (PVP) which allows which allows breeders (but not the farmers) to use the vegetal material for further breeding. Further, in regard to animal breeding, there are no restrictions for farmers, for using their animals for further breeding or sell their offspring to other breeders in Europe.

Lack of legal and democratic control of the EPO

The rise of seed monopolies is fueled by substantial deficiencies in legal and political control of the EPO: The EPO profits from expansion of the patent business, since its own budget, to pay the salaries and pension funds is based on the fees for the examination and grant of patents.

In addition, there is no independent court such as the European Court of Justice to supervise the final decision making. The EPO is not part of the EU, but an intergovernmental body of its own law and regulations, only subjected to its own jurisdiction.

38 states, much more than belonging to the EU, are Members of the European Patent Organisation, also including countries like Switzerland and Turkey. The representatives from the government of its 38 contracting member states, constituting the Administrative Council of the European Patent Organisation, are supposed to establish political control. However, this council completely lacks transparency and does not foresee any participation for civil society organisations. At the same time, industry is invited as observer to its meetings, represented by its umbrella organisation BusinessEurope and the lobby organisation of patent attorneys, the European Patent Institute (epi).

Patent industry tries to turn life into a technical invention

While transparency, democratic structures as well as independent jurisprudence are largely missing, the interests of stakeholders gaining profits from patents, are prevailing. In reality, the EPO and industry just became business partners, driven by the same vested interests. Plants and animals as well as their genetic constituents are considered as a playing field for big business, no matter what the consequences are for food safety, food sovereignty, the breeders, the farmers and the consumers nor the environment, biodiversity and animal welfare.

In consequence, the patent system lost its balance between the patent industry and the broader public. In result, genetically engineered plants and animals were turned into patentable ‘inventions’, as before it only was the case with machines.

Success for the resistance against 'patents on seeds'
Industry was faced with increasing resistance when more and more patents were applied and granted on plants and animals which are derived from 'non-technical' but 'conventional' breeding. These methods are making use of non-targeted methods, such as random effects and biological processes, of crossing and selection, also including random mutations (spontaneously or induced). It is obvious that these patents are not based on real 'inventions' but an abuse of patent law for misappropriation of basic resources and common goods needed to daily living.

'No Patents on Seeds!' started in 2007 as an European coalition, gaining more and more support from civil society, farmers, breeders, the institutions of the EU and national governments. In June 2017, the Administrative Council of the EPO took the decision that no more patents on conventional bred plants and animals will be granted. This decision is based on a the wording of the European Patent Convention (EPC) which prohibits patents on 'essentially biological' breeding (Art 53 (b)). The decision of the Aministrative Council was a huge victory for the interests of broader public, as represented in many organisations of the international coalition of 'No Patents on Seeds!'.

Problem not solved
However, there were major deficiencies going along with the decision. Most relevant: Based on a proposal from the previous President of the EPO, the decision of the Administrative Council still allows for patents on variations in the genome ('mutations'). No difference was made between naturally occurring gene variants and random mutations on the one hand and on the other hand, technical interventions such as genetic engineering, including the new methods such as genome editing (e.g. applications of the 'gene-scissor' CRISPR/ Cas).

This legal loophole has far reaching consequences. Companies easily can escape the prohibition for patents on conventional breeding by using specific wordings: Within their patents, they now use a wording which confuses technical elements (such as usages of CRISPR/ Cas) with the methods of conventional breeding.

There is no doubt that industry already tries to exploit this legal loophole, as shown by the overview of patent cases provided in this report. In many cases, additional elements, that are not necessary, are introduced as 'technical toppings'. These 'technical toppings' are meant to give the illusion of real inventions. By this way, industry tries to disguise that the respective plants and animals, in real, are derived from conventional breeding.

A clear distinction between the profoundly different areas of biological processes (conventional breeding) and technical interventions (old and new methods of genetic engineering) can be made easily: Conventional breeding which starts from a broad range of genetic diversity, followed by further crossing and selection. On the other hand, if technical methods would have been used, the generation of plants or animals starts with insertion of additional DNA sequences or direct and targeted change of specific genes in the genome.

If this distinction is not established in patent law, breeders and farmers although avoiding the methods of genetic engineering (such as transgenesis or genome editing) still will be trapped by patents.

New problems created by the EPO
This situation of legal uncertainty was turned into real legal chaos, when, at the end in 2018, the so-called Technical Board of Appeal of the EPO decided that the decision of the Administrative Council no longer should be applied. In its decision T1063/18 which is binding for all examiners at

the EPO, results in a situation of complete absurdity: while processes for conventional breeding still are regarded as being non-patentable, the resulting plants and animals nevertheless are considered as ‘inventions’. By applying this legal interpretation the exclusion of “essentially biological” breeding would become meaningless.

In reaction, the President of the EPO, in beginning of 2019, stayed all further patent procedures in the field of conventional breeding of plants and animals. In addition, the Administrative Council requested the highest legal institution of the EPO, the so-called Enlarged Board of Appeal to assess the decision of the Technical Board of Appeal. The Enlarged Board of Appeal (G3/09) is expected to come up with its decision in the first half year of 2020.

Political decisions to be taken in 2020

There are basic decisions that need to be taken by the government as soon as the Enlarged Board of Appeal will have been published its decision: To put an end to the uncertainty and the legal chaos around the decision making of the EPO, the European governments can take a choice between a change of the rules for interpretation of the EPC or a change of the EPC itself.

The (legally binding) rules for the interpretation of the EPC are fixed in the so-called Implementing Regulations. These regulations can be changed by a two-third majority of the 38 members of the Administrative Council – each member has one vote.

The other possibility is to call for a so-called Diplomatic Conference of the contracting member states. This conference has the power to change the text of the EPC itself to introduce a stronger wording for the exclusion of plants and animals from any patents.

In regard to plants and animals both ways might be successful. In any case, to overcome the strong lobby from biotech industry and from patent lobbyists, the political decision makers have to act with decisiveness and scrutiny to not again open up legal loopholes.

The report provides an overview on the demands of No Patents on Seeds! that have to be fulfilled to ascertain legal clarity.

International corporations gaining increasing control on food producting

If the patents on plants and animals are not stopped, corporations like Bayer (Monsanto), DowDupont (Corteva), BASF and Chemchina (Syngenta) will gain the long-term profits. They already own more than 60 percent of the international seed market by acquiring breeding companies all over the world. By patents on seeds they can shut down the free access to the biological diversity needed by all other breeders. A similar process is going in animal breeding where companies such as Genus and Hendrix, have increasing influence on the international market for breeding of pigs, poultry and cattle.

In result, a handful of big corporations will largely gain control on our daily food production. These international corporations will decide what we eat, what farmers produce, what retailers sell and how much we all have to pay for.

For several European countries, the situation will even become more pressing within next years, as soon as 26 countries of the EU will become part of what is called the Unitary Patent system. This new system simplifies the process for putting into force (‘validation’) of European patents on the

national level. Under these conditions, the situation e.g. in the Visegrad states (Czech Republic, Hungary, Poland and Slowakia) or Austria and Slowenia, will change dramatically. So far, most patents on seeds granted by the EPO did not come into force (were not validated) in these countries. In future, patents granted by the EPO automatically will become valid in these countries. Since the national breeders and farmers will not be able to defend their interests against hundreds or thousands of patents, on the long term it will become impossible to run own regional breeding enterprises.

The development will also have consequences for the global south, where more and more countries are brought into a situation that they have to accept patents on seeds. Thereby their food sovereignty is threatened as well as their regional traditions in producing, propagating and exchanging seeds.

From a global perspective, agro-biodiversity is one of the most important pre-conditions for the future of breeding, environmentally-friendly agriculture and the adaptability of our food production to changing conditions, such as climate change. Seen from this angle, to stop patents on seeds is not only necessary for specific sectors or regions, but a general need to safeguard agro-biodiversity, ecosystems and the adaptability of our food production systems to meet challenges such as climate change. In this context, patents on seeds should be considered as the biggest risk for global food security and regional food sovereignty.

Free the seeds!
No Patents on Seeds!, by its campaign in 2020 wants to achieve ‘freedom to operate’ for all breeders, gardeners and farmers that are involved in conventional breeding of food plant and farm animals. Access to biological diversity needed for further breeding shall no longer be controlled, hampered or blocked by any patents.

This ‘freedom to operate’ is the precondition for future of

- diversity in the fields
- farmers rights
- choice for consumers
- food safety and food sovereignty

2. An overview: some statistics on patents

At present, in Europe, an increasing number of patent applications are being filed on plants and animals. Around 3700 patents on plants have already been granted – most of them covering genetic engineering.

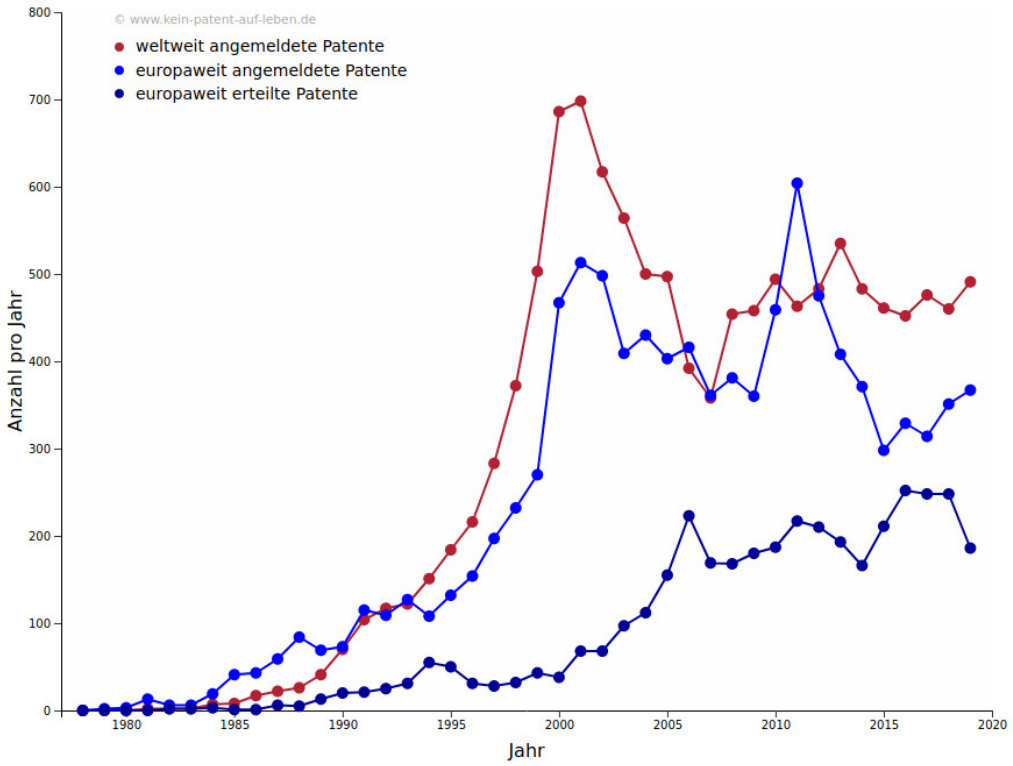


Figure 1: Patents on plants - number of patent applications on all plants under PCT/WIPO and at the EPO as well as of patents on plants granted by the EPO (EP B) per year. Research according to official classifications (IPC A01H or C12N001582). Source: www.kein-patent-auf-leben.de/patentdatenbank/
[english version needed]

In the last 10 to 15 years, there has also been a steady increase in the number of patent applications being filed on plants derived from conventional breeding, i.e. not genetically engineered. More than 1600 such applications have been filed and around 220 patents have been granted to date. Very often, based largely on trivial technical features, such patents actually abuse patent law, using it as a tool to misappropriate of biological resources needed for our daily food production.

Each single patent on conventionally derived traits can simultaneously impact the breeding of dozens or hundreds plant varieties. Therefore, depending on the business strategy of the patent holder, licences can be requested or access to biological resources blocked.

It should be noted that these patents are not limited to plants and seeds, but are also granted on the harvest e.g. kernels, fruits and vegetables and food production. For example, in 2016, patents

covering conventionally bred barley and the beer produced thereof were granted to the international companies Carlsberg and Heineken.

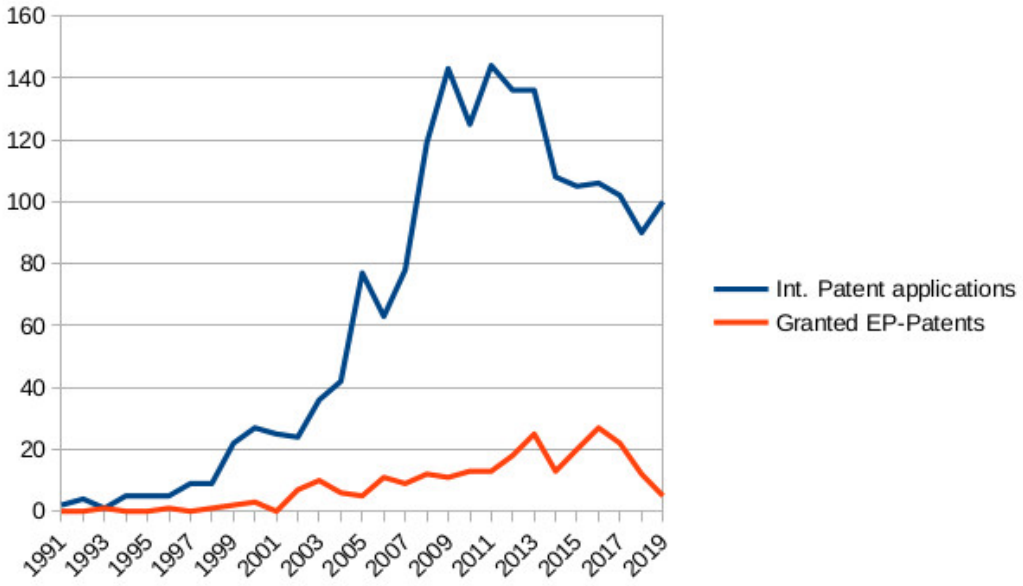


Figure 2: Number of patent applications (Applications) and patents granted on conventional plant breeding (Granted EP-Patents) by the EPO per year (own research).

3. Overview on patent applications in conventional breeding of plants and animals in 2018 and 2019

To get insight in most recent patent applications, No Patents on Seeds! performed detailed research on international patent applications at WIPO (World Intellectual Property Organisation). Patent applications filed at WIPO can cover more than 100 countries to be intended for patent protection. WIPO does not grant any patents, but is just a starting point for many companies. According to figures from last years, it can be estimated that two thirds of the patents as filed at WIPO will also become European Patent applications. Finally, around one third of the European Patent applications in this field will be granted (for comparison see Fig.1). Our research can be seen as being representative for recent international patent applications in this area, while it is hard to predict which of these applications finally will be granted by the EPO.

The research is based on searches of the relevant databases with relevant International Classifications (IPC A01H or C12N001582), names of relevant companies and on the analysis of the content of several hundred patent applications.

Around 450 patent applications were filed on plants and plant breeding from beginning 2018 till end of 2019, with more 100 patents concerning conventional breeding, some of these are overlapping with patents on genetic engineering, especially new methods also called ‘genome editing’.

For this report, around 70 patent on plants and plant breeding were found to be the most relevant and therefore examined in more detail. Others, especially if the technical description did not allow a proper categorizing, were put aside.

The examples revealed by research of No Patents on Seeds! encompass alarming examples for patent applications such as covering

- all plants of the one species which are derived from mutagenesis, no matter what biological characteristics the plants might show;
- around 80 plant species at once which show the described biological characteristics;
- all plants with desired biological characteristics no matter if derived from random mutagenesis, genome editing or transgenesis or just from crossing and selection;
- plants and seeds as well as the harvest and food products derived there off;
- plants derived from phenotypical breeding with random mutagenesis as ‘technical topping’ just introduced to render it patentable;
- specific DNA sequences and all cells, plants, inheriting it.

The most patent applications were filed by Bayer (Monsanto) followed by the Dutch company Rijk Zwaan which, according to media, has been starting to file for patents in reaction to defend itself against the international corporations. However, as shown in figure 4, the numbers of all plant patent application per year is much higher for the agrochemical companies (such as Bayer). Thus on the long term, it can be considered as unlikely that breeding companies such as Rijk Zwaan will survive as independent enterprise under these conditions. As the experience shows, the dynamics within the patent regimes is mostly in favor of the bigger companies.

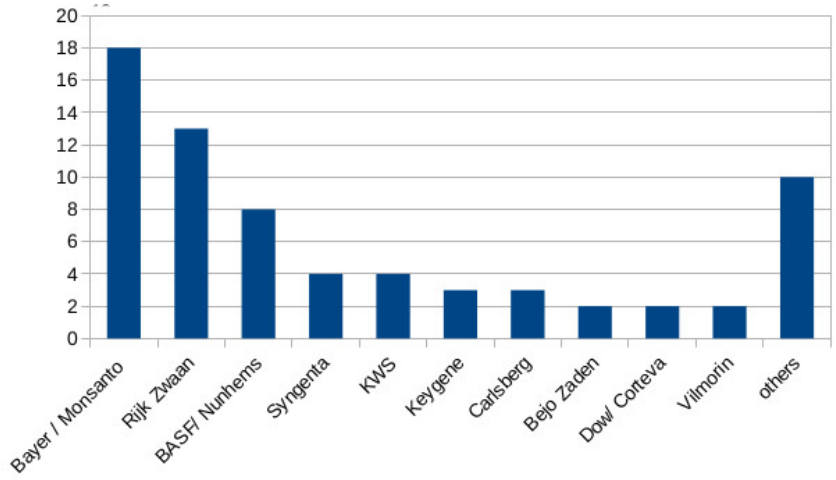


Figure 3: Companies which filed patent application at WIPO 2018 – 2019 concerning conventional breeding (own research).

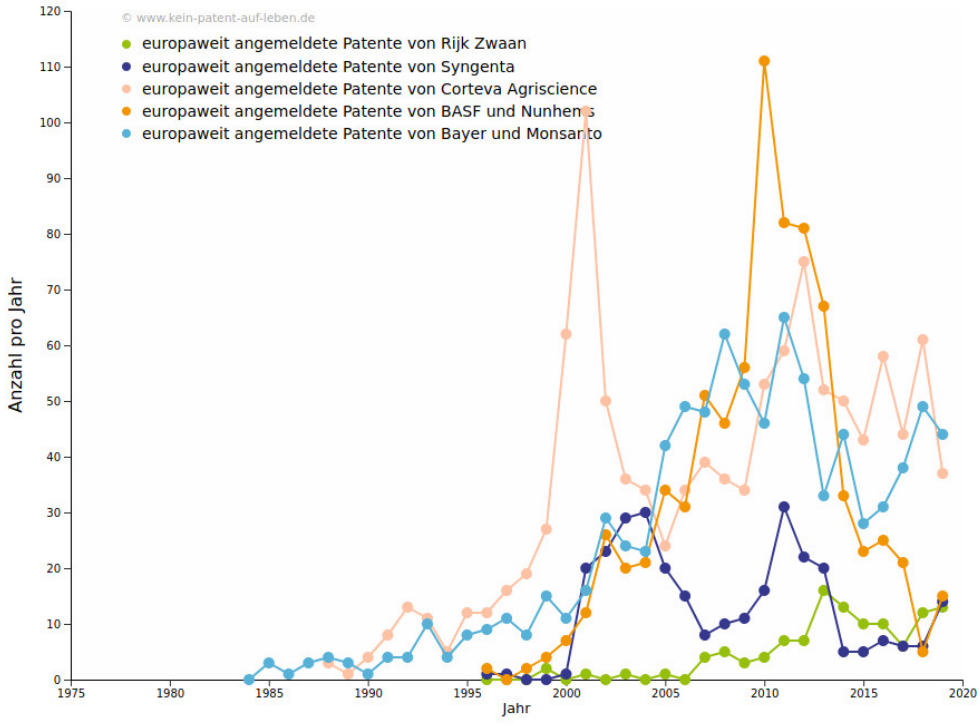


Figure 4: Patents on plants - number of patent applications on all plants under PCT/WIPO categorized by companies. Research according to official classifications (IPC A01H or C12N001582). Source: www.kein-patent-auf-leben.de/patentdatenbank/
[english version needed]

Most patents were concerning breeding of melons, followed by spinach and maize. Plant species explicitly mentioned in several of the patents are listed in figure 4, others patent concern also allium, artichocke, eggplant, banana, basil, beet, broccoli, cassava, cauliflower, cellery, cotton, endive, potato and rice.

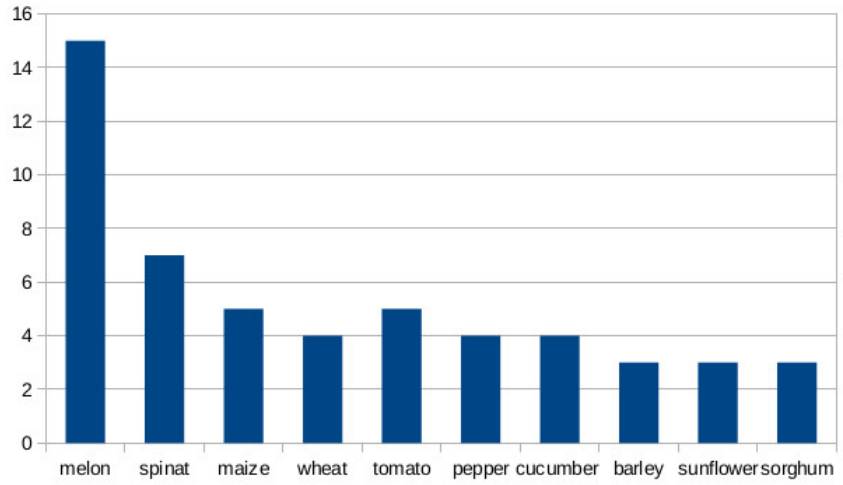


Figure 5: Plant species most frequently named in patent applications on conventional breeding filed at WIPO 2018 – 2019 (own research).

In addition, ten examples for patent applications on livestock were examined in more detail, these examples covered species such as bovine, porcine, ovines, equine, caprine, rabbit and poultry. The patents concern breeding methods and characteristics such as increased muscles, sex selection, acceleration of the breeding process and selection for health conditions (for more details see below).

4. Exploiting the legal loophole: Patent applications on plant breeding using random mutations

There are several examples for patent applications concerning at random mutagenesis by using chemicals like EMS (ethylmethansulfonat) which for example are brought in contact with kernels. It is known since the early 1980ies that EMS can be used to induce mutations in plants, the method is used in conventional breeding since many years. According to international data bases1, there are more than 3000 varieties known to be marketed and stemming from mutagenesis breeding. If random mutagenesis would have been regarded as a patentable technical invention in the past, a large number of plant varieties already on the market would have been subjected to monopoly claims.

Since the decision of the Administrative Council opened a legal loophole for patents on random mutations, many companies now are mentioning mutation breeding in their patent applications as 'technical topping' even in case the method was not applied. There are other examples were also methods of genetic engineering are mentioned to give the impression that the patent applications are based on technical processes.

Examples

(4.1) All Cassava plants, no matter which biological characteristics they show

Patent application WO2019121603 covers all cassava and manioc plants (Manihot esculanta) which are subjected to chemical mutagenesis, no matter which biological characteristics are finally derived. What does the company claim to have invented? The Dutch company Keygene claims to be the first to perform mutation breeding with chemicals (using N-ethyl-N-nitrosourea, ENU) on Cassava. But instead of only claiming the process how to apply the chemical, the company claims all treated cells, plantlets or plants as their patented invention. Cassava (Maniok) is an extremely an important food for many countries, especially Africa, South America and Asia, thus such a broad patent can have huge impact on further breeding.

This example shows how patents are used for misappropriation of important food plants by simple chemical methods. There are several other examples for patent applications following a similar strategy (...).

(4.2) A patent covering 80 plant species

The company Kleinwanzlebener Saatzucht (KWS) claims around 80 plant species being resistant to the funghal disease Northern corn leaf blight (WO2019038339). What does the company claim to have invented? KWS exposed plants from several resources to plant pest. Those plants which showed resistance, were analysed in more detail and DNA sequences were identified which is involved in the biology of the cell membrane. After that, random mutagenesis was performed by known procedures (bringing EMS in contact with pollen) and plants were identified inheriting the favorable DNA sequence. The process as described by KWS is starting with well known methods to expose plants to diseases. Plants identified by this this process can be used for further breeding without any further technicalities. In addition, KWS performed some technical procedures, which

however are not necessary to obtain the respective plants, but simply are used as ‘technical topping’ to hide that there is no real invention.

Based on this concept, the company claims the method to be applied on around 80 plants species as well as all resulting cells and whole plants and their progeny resulting thereof. According to claim 9 the plants are “*selected from the group consisting of Hordeum vulgare, Hordeum bulbusom, Sorghum bicolor, Saccharum officinarium, Zea spp., including Zea mays, Setaria italica, Oryza minuta, Oryza saliva, Oryza australiensis, Oryza alta, Triticum aestivum, Triticum durum, Secale cereale, Triticale, Malus domestica, Brachypodium distachyon, Hordeum marinum, Aegilops tauschii, Daucus glochidiatus, Beta spp., including Beta vulgaris, Daucus pusillus, Daucus muricatus, Daucus carota, Eucalyptus grandis, Nicotiana sylvestris, Nicotiana tomentosiformis, Nicotiana tabacum, Nicotiana benthamiana, Solanum lycopersicum, Solanum tuberosum, Coffea canephora, Vitis vinifera, Erythrante guttata, Genlisea aurea, Cucumis sativus, Marus notabilis, Arabidopsis arenosa, Arabidopsis lyrata, Arabidopsis thaliana, Crucihimalaya himalaica, Crucihimalaya wallichii, Cardamine nexuosa, Lepidium virginicum, Capsella bursa pastoris, Olmarabidopsis pumila, Arabis hirsute, Brassica napus, Brassica oleracea, Brassica rapa, Raphanus sativus, Brassica juncacea, Brassica nigra, Eruca vesicaria subsp. sativa, Citrus sinensis, Jatropha curcas, Populus trichocarpa, Medicago truncatula, Cicer yamashitae, Cicer bijugum, Cicer arietinum, Cicer reticulatum, Cicer judaicum, Cajanus cajanifolius, Cajanus scarabaeoides, Phaseolus vulgaris, Glycine max, Gossypium sp., Astragalus sinicus, Lotus japonicas, Torenia fournieri, Allium cepa, Allium fistulosum, Allium sativum, Helianthus annuus, Helianthus tuberosus and Allium tuberosum, or any variety or subspecies belonging to one of the aforementioned plants, preferably wherein the plant cell, tissue, organ, or whole plant in step (i) is selected from Zea mays or Triticum spp., or any variety or subspecies belonging to one of the aforementioned plants.*”

Furthermore, the patent is not restricted to random mutagenesis but expanded to all methods that might be applicable, “*preferably a stable introduction mediated by conventional plant breeding, or a stable introduction by means of molecular biology, comprising genome editing, or a combination thereof.*” (claim 13).

This example shows how the company use ‘technical topping’ to hide that there is no real invention. In real, standard methods in conventional breeding were used such as exposure to plant pests, followed by further crossing and selection. Based on this known methods, an extremely broad range of plants is claimed as invention of KWS. By this way, the company tries to benefit from the legal loophole as introduced by the Administrative Council in 2017 which considered random mutations as patentable invention. There are several other examples for patent applications following a similar strategy (...).

(4.3) Non browning endive, derived from a ‘hot water test’

The Dutch breeder Rijk Zwaan claims endive plants (*Cichorium endivia* L.) which were are non-browing after being brought in contact with warm water (EP3427575). What does the company claim to have invented? By bringing leaves from endive plants in contact with hot water, plants showing a non-browning phenotype were identified. These plants can be used for further plants to achieve the desired characteristics. In addition, after performing random mutagenesis (by using EMS chemicals), plants with the respective genotype were identified. However, this additional step is not necessary since suitable plants easily can be identified by using the ‘hot water test’. Therefore, mutagenesis was used as ‘technical topping’ to give the impression of a technical

invention. In addition, to confuse the facts, also methods such as “CRISPR … radiation, gene silencing, RNAi, or a combination thereof” are mentioned in the claims (claim 15), although these techniques were not used to produce the plants.

There is an example for a similar patent granted just recently: In June 2018, one year after the decision Aministrative Council, the EPO granted a patent on lettuce derived from conventional breeding (EP2966992). In the patent, the lettuce seeds, plants and the harvest of lettuces that grow in a hotter climate are claimed. The reason: In the patent, DNA sequences were added as ‘technical topping’ to render the plants patentable – just as it the case with the new patent application on endive. *No Patents on Seeds!* has filed opposition against this patent.

This case shows that the decision of the Administrative Council in 2017 widely opens the door to escape the prohibition regarding patents on conventionally breeding by considered random mutations as patentable invention. The Administrative Council also opened the door to overlapping scope of claims, covering both, genetic engineering (genome editing) and conventional breeding. There are several other examples for patent applications following a similar strategy (...).

(4.4) Further patents on beer

The company Carlsberg which is one of the largest breweries in the world, heavily was critized in public for three ‘patents on beer’ that have been granted in the year 2016 and 2017 (EP numbers). Oppositions against these patents were filed, involving xy organisations, such as (name). While no final decisions have been taken on these patents, the company now again uses well known processes of random mutations to turn seeds, plants and resulting food and beverages into an ‘invention’ (WO2019129736, WO2019129739, WO2019134962). So what is the ‘invention’? Seeds from barley plants were brought into contact with chemicals (EMS) and then further selection was performed for desired characteristics such as changes in the starch composition. While there is nothing new or technical in this process, the company claims the resulting seeds, plants, harvest, food and beverages as its invention.

This example again shows, how the legal loopholes as introduced by the Administrative Council in its decision from June 2017, opens up the road for big corporations to grab our daily food from field to fork, from barley to beer, without having invented anything. There are several other examples for patent applications following a similar strategy (...).

figure: Patent on beer

5. Exploiting the legal chaos: Patent applications on all kinds of methods used for conventional plant breeding

In June 2017, the Administrative Council of the EPO took the decision that no more patents on plants and animals, derived from processes of conventional breeding, will be granted. More specifically, the decision excludes patents on those plants and animals bred by crossing and selection. In reaction, the EPO revoked the patent on Monsanto’s ‘severed broccoli’ (EP 1597965). This broccoli variety which is derived just from crossing and selection is supposed to grow a little bit higher and can therefore be harvested more easily. However, after the decision of the Technical

Board of Appeal of the EPO (T1063/18), Monsanto (Bayer) has announced it will file an appeal against the decision.

There are several new patent applications filed in 2018 and 2019 which can be used to exploit this legal chaos.

(5.1) Muskmelon with red flesh

Monsanto (Bayer) and its vegetable breeding company Seminis filed for a patent on muskmelons with red flesh (WO2019040455). What does the company claim to have invented? Melons were characterised by measuring their color. Plants with more intensive red flesh were crossed with other melons to combine the color with sweet taste and early ripening. After that, some marker genes were identified that could be used to select the desired plants in addition to the red color of the plants. The company claims the plants, the fruits, and seeds which inherite a trait that gives a red color to the flesh of the fruit.

The patent shows how normal plant breeding, based on the selection of a phenotype is turned into a invention with zero technological effort, just by adding some information on marker genes. These kind of patents were excluded by the decision of the Administrative Council in 2017. However, the patent nevertheless might be granted if the legal uncertainty prevails as triggered by the decision of the Technical Board of Appeal of the EPO in 2018. There are several other examples for patent applications following a similar strategy (...).

(5.2) Cereal plantlets stored in a refrigerator

Bayer filed a patent on cereal plants that are derived from plantlets being stored in a liquid at low temperature for some weeks (WO2019001793). Surprisingly these plants showed a higher yield after planting. What does the company claim to have invented? As Bayer states in its patent, it was just a surprising observation (page 2): "*This invention is based on the serendipitous observation that cereal plantlets, such as wheat plantlets … temporarily immersed in a liquid medium at low temperature had a higher yield.*." While this observation might be surprising, it is not based on an invention, but what is called an epigenetic effect: Due to the stress condition during storage, the gene regulation in the plant cells was changed, resulting in increased yield under normal growth conditions. Thus in result, it is not an targeted technical intervention but just a 'normal' biological reaction. For example reaction to cold conditions is known to be an important factor for enhancing germination in many plant species.

The example shows an another attempt to exploit the loopholes as introduced by the Administrative Council in its decision in 2017 which considered only crossing and selection as "*essentially biological*" methods for breeding which are excluded from patentability. The Administrative Council did not take into account that there are other techniques used in conventional breeding which are essential biological but not technical. There are several other examples for patent applications following a similar strategy (...).

(5.3) Pepper plants derived from Biopiracy

The University of California, which is cooperating with corporations such as DowAgro Sciences (Corteva) applied for a patent on pepper plants (such as chili pepper) having a “low destemming force” which means the fruits can be harvested easier (WO2019191675). What does the company claim to have invented? As it is desecribe in the patent, the plants were simply found in samples collected in Mexico. After the native trait was introduced in commercial varieties, as marketd in New Mexico (US): “*We have screened a set of wild and semi-domesticated pepper accessions recently collected in regions of Mexico for disease resistance and horticultural traits. Among these is a semi-domesticated C. annuum accession, UCD-14, that has oblong fruit with firm texture and medium pericarp thickness that easily abscises when picked at the mature green stage, leaving the pedicel and calyx behind (destemmed). This line has been crossed with jalapeno, New Mexican (‘NuMex Garnet’) and blocky (‘Maori) types. We have shown that the destemming trait can be readily transferred through a phenotypic evaluation (…)*”.

In addition to these non-technical steps in breeding, which are the heart of the ‘invention’, the University of California added further technical ‘toppings’ which are are not necessary to breed the plants. DNA sequences were identified that correlate with the selected phenotype and which are supposed to identify the plants also by genotyping. The patent claims the method of selecting and crossing and also the resulting plants and a method to harvest pepper by “*shaking the pepper plant*”.

The patent shows how normal plant breeding, based on the selection of a phenotype is turned into a invention with zero technological effort, just by adding some information on marker genes. These kind of patents were excluded by the decision of the Administrative Council in 2017. However, the patent nevertheless might be granted if the legal uncertainty prevails as triggered by the decision of the Technical Board of Appeal of the EPO in 2018. There are several other examples for patent applications following a similar strategy (...).

(5.4) Basil with resistance to downy mildew as found in native plants

BASF, together with its daughter companies Hild (Germany) and Nunhems (Netherlands) claims for Basil (Ocimum basilicum) plants with resistance to downy mildew (a fungal plant disease) (WO2019068647). What does the company claim to have invented? Wild plants ‘found’ in a seed bank of the USDA (India and other regions in Asia are supposed to be the original center origin) were identified to show resistance to downy mildew and crossed with commercially traded varieties. After that, some technical ‘topping’ was added further technical ‘toppings’ which are are not necessary to breed the plants as desired. It was shown that the trait is likely to go along as a recessive, monogenetic inheritance. Marker genes were identified that go along with the desired trait. BASF claims the plants as well as pollen and seeds and all further breeding as its ‘technical invention’.

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6. Patents for grabbing farm animals

The European Patent Office has already granted several patents on the conventional breeding of animals. In particular, in 2007/2008 several patents were granted on the breeding of pigs and cattle. Patents on animals can have a huge impact on agriculture: For example, if patents on cattle are granted, the farmers can still sell the milk and meat but cannot use the animals for further breeding without the consent of the patent holder. Most of the patents were revoked after opposition by civil society organisations.

However, just recently, in 2018 a patent was granted a patent on salmon which are fed with specific plants (EP1965658). The patent claims the salmon and the fish oil. *No Patents on Seeds!* has filed opposition in 2019.

There are several new patent applications filed in 2018 and 2019 on conventionally bred farm animals which can be granted if the uncertainty and legal chaos around patents on conventional breeding is not ended.

Figure: patents on salmon

(6.1) Selecting cells and 'inventing' sperms

The French company Genes Diffusion uses a technical device and fluorescent marker to select sperm cells according to the expected sex of the offspring (WO201834281, EP3570978). What does the company claim to have invented? A technical process of separating cells according to their sex is described. The technical device can be used for bovine, porcine, ovine, equine, caprine species and rabbits. The company is not only claiming the technical process but also the selected sperm cells as its 'invention'.

If the patent is granted, the breeding material will be fully under control of the patent owner. Patents on sperm cells used in animal breeding are already an major issue in the US where company Inguran holds a far reaching patent monopol on sex selection in cattle breeding being challenged by other breeding companies such as Genus and ABS global.

The patent shows that grabbing control on the biological material needed for animal breeding might also become an issue in Europe. In this context, the text as adopted by the Administrative Council in June 2017 tries to exclude patents on cells from animals which can be used as propagation material (gametes). However, the patent nevertheless might be granted if the legal uncertainty prevails as triggered by the decision of the Technical Board of Appeal of the EPO in 2018. Patents on gametes of animals such as sperm cells or oocytes might in the end allow the patent holder to control, interfere, hamper or even block conventional breeding of livestock. There are other examples for patent applications following a similar strategy (...).

(6.2) Speed up breeding by using embryos instead of adult animals

The company Inguran is US company which has a history in filing patents on livestock breeding and is involved in long lasting legal legal battles in the US about patents, involving other companies such as Genus and ABS Global. Now Inguran tries to expand its business and tries to get a patent on usage of embryos of mammalian species for extraction of cells (gametes such as oocytes and sperm cells) used in further breeding (WO2019100018). In result, several breeding generations can be created without involving adult animals: "*the invention encompasses selecting one or more embryos - rather than reproductively mature animals - as parents of the next generation in a breeding program*".

What does the company claim to have invented? In short, Inguran proposes to extract the gametes from embryos: "One aspect of the invention comprises deriving gametes, both oocytes and sperm, directly from in vitro, or in vivo, embryos." Listed are mammalian species such as "*swine, ovine, bovine, equine, deer, elk, buffalo, or the like (…).*" Also "*non-human mammalian species such as canines and felines, as well as primates, including but not limited to chimpanzees, and gorillas, as well as whales, dolphins and other marine mammals*" are listed in the description of the patent.

The invention is supposed to spare costs and speed up breeding: "the invention allows a breeder to greatly reduce or entirely eliminate the need for maintaining and caring for young and adult animals". Inguran suggests to apply the process over several generations: "*This process is repeated multiple times, with each set of derived gametes used to generate a subsequent generation of embryos.*" As additional technical topping, the generating of the embryos by methods such as cloning and using embryonic stem cells are mentioned. Among others, Inguran patent claims the method to "*generate a line of non-human mammalian species.*" This wording of the claim means that that also the resulting animals are considered as being a patented invention.

This 'invention' raises substantial and profound ethical questions related to animal welfare which apparently are set aside due to expected profits by the company. Producing embryos, carried out by surrogate mother animals, just to destroy them for cell extracting, goes along with animal suffering on several steps of the process and is likely to turn breeding into a business of unnecessary cruelty.

The example shows how companies are trying to introduce technical aspects into conventional breeding which allows them IP rights. Although in the end the patent is based on crossing and selection (of embryos) it might escape the prohibition as defined by the decision of the Administrative Council in 2017, which allows for patents even in cases when no targeted technical intervention is involved. It also might escape current interpretation of the ethical boundaries in patent law (Art 53 a, EPC). The patent application shows the need to clearly restrict the patents in animal breeding to purely technical processes which do not involve any animal suffering.

(6.3.) Selecting genes and claiming a herd of animals

The Livestock Improvement Corporation Limited (New Zealand) claims a patent for breeding of dairy cows based on analyses of a specific gene (WO2019125187). What does the company claim to have invented? The company compared biological characteristics such as milk production by dairy cows with data from gene analysis by using standards methods. They identified the variant of a natural occurring gene that is supposed to influence the amount of milk produced. The company claims the "generation of animals" and "forming a herd" just by using a test to identify the relevant gene. The way the claims are phrased, not only the method but also the resulting animals would within the scope of the claims.

The example shows an another attempt to exploit the loopholes as introduced by the Administrative Council in its decision in 2017 which considered usage of random mutations and gene variants for breeding as patentable invention. There are other examples for patent applications following a similar strategy (...).

7. Conclusions and demands

The basis for European patent law, the so-called European Patent Convention (EPC), in essence excludes plants and animals from patentability. As Article 53(b) reads, no patents on plant or animal varieties may be granted:
"*European patents shall not be granted in respect of:*
(…) plant or animal varieties or essentially biological processes for the production of plants or animals; this provision shall not apply to microbiological processes or the products thereof."

However, in recent years the EPO has granted thousands of patents on plants and animals, mostly eroding these prohibitions in the EPC.

There are three crucial areas that need changes to make current prohibitions of patents on plants and animal varieties and essentially biological methods for breeding effective:

1. Definition of "essentially biological processes"
It has to be made clear that the term "essentially biological processes" covers all conventional breeding processes, including random mutagenesis, as well as all individual steps in the process, such as selection and / or propagation.

2. Definition of 'products' used or derived from breeding
It has to be made clear that all "products" used in or emanating from "essentially biological processes" are captured by the exclusion from patentability, including all plant/animal parts, cells and genetic information.

3. Limiting the scope of protection
In the context of plant and animal breeding, the EPO must not grant "absolute product protection" which enables a patent on a plant or animal derived from a technical process to be extended to all conventionally bred plants with the same traits.

The necessary changes can be brought about by clarifications in the Implementing Regulations of the EPC. However, if the Administrative Council is not able to solve a problem, a Diplomatic Conference has to be to change the text EPC and to introduce legal certainty and clarity for breeders, gardeners, farmers and consumers in Europe.