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USDA-AMS
Attn: Jaina Nian
Room 2055-S, STOP 0201
1400 Independence Avenue SW
Washington, DC 20250-0201

Docket: AMS-AMS-22-0025

RE: Seed Industry Competition and the Intellectual Property System

Thank you for the opportunity to submit comments regarding the state of competition in the seed industry and the effectiveness of the current intellectual property (IP) system. Organic Seed Alliance (OSA) is a mission-driven organization that works nationally to ensure that farmers have access to the seed they need to be successful, and we achieve this mission through participatory plant breeding and research, practical education, and policy advocacy. We are joined by the Rural Advancement Foundation International - USA in delivering these comments.

The Biden Administration's July 9, 2021, Executive Order, titled "Promoting Competition in the American Economy," communicates a commitment to tackle anti-competitive conduct in agriculture and identify policy solutions that will strengthen the foundation and framework for antitrust law enforcement. President Biden's Executive Order engenders significant hope among farming communities and justice advocates that change is coming. This sentiment of hope was similarly felt during the Obama Administration, when the US Departments of Agriculture and Justice initiated an historic examination of competition concerns within agriculture. Unfortunately, these 2010 workshops, hearings, and public comments resulted in no meaningful action, *especially in the seed industry.*

Given this historic precedent under President Biden's previous tenure in the White House, we begin our comments by underscoring how important it is to have this inquiry coming from the Executive Branch and to see a primary focus *on seed*. A targeted examination of the seed trade through a combined antitrust and IP system lens is long overdue, and we applaud the Administration for shining light on this connection. Understanding the tension between antitrust law and IP law is especially important to uncovering solutions for enhancing competition in the seed industry, because while several agricultural sectors could *also* be described as having an oligopoly structure, including agrochemicals and fertilizers, seed is unique from every other input market because *it is a living, natural resource.* In other words, seed is not manufactured in a facility, but represents generations of natural evolution both alongside and in absence of human intervention. In this way, grower decisions pertaining to seed are not only economical; for many, they are also ethical and cultural.

We hope the comments that follow are helpful to the USDA in preparing a report for the Biden Administration as required by the Executive Order and in advancing policy solutions to ensure a diverse, fair, resilient, and open market for seed. Below are detailed responses to the USDA's questions in the request for comments. We conclude with recommendations that include policy and program solutions, as well as additional research needs.

I. Responses to USDA's Specific Requests for Comment

II. Recommendations

III. Conclusion

Responses to USDA's Specific Requests for Comment

Q. 1 Concerns with concentrated market power in the seed industry

Once managed as a public resource, seed is now one of the most privatized agricultural inputs today. Laws, policies, and industry practices governing intellectual property rights (IPR) on plant genetics have fostered dramatic marketplace and cultural changes in the last few decades. The commercial seed marketplace has undergone tremendous structural changes, with ever more market power concentrating in the hands of fewer companies.

IP rights have facilitated this extensive and rapid concentration. Beyond market domination at the retail level, growers, plant breeders, and independent seed companies are dealing with the consequences of concentration at the more fundamental level of ownership, where IP owners determine whether germplasm is shared and how it is used. The concentrated ownership of a living, self-replicating organism is what sets seed apart from other concentrated agricultural input industries, such as fertilizer and pesticides.

Concentrated power has profoundly negative impacts on the seed market, squeezing out competition from smaller and mid-size companies and trapping growers in contractual relationships that unfairly favor the IP owner and product manufacturer. (We elaborate on these problems in the questions below.) In seed, the dominant market players have pushed widespread reliance on a small number of genetically engineered (and largely genetically uniform) commodity crops that are designed to be used in tandem with proprietary agrochemicals without independent review of environmental and public health consequences.

To be clear, problems with concentrated market power in seed go well beyond the biotech trait industry. The conventional vegetable industry is also highly concentrated, and the number of utility patents on conventionally bred (non-GMO) plant varieties and genetic traits are in the thousands. Seed-saving and research restrictions are routinely placed on many commercial varieties whether genetically engineered or not.

For the past 30 years, rapid consolidation in the seed industry has largely gone unchecked by the US Department of Justice (DOJ). For example, the dominant seed company, the Monsanto Company, now owned by Bayer, achieved its No. 1 position in the seed industry *in less than a decade* by capturing the markets for corn, soybeans, cotton, and vegetables. Between 1998 and 2006, Monsanto achieved this tremendous market share by acquiring the leading companies in each of these crop sectors. Any divestitures or other requirements made by the DOJ as part of these acquisitions have proven ineffective in protecting an open and competitive market (see Q. 14).

Three of the biggest seed industry mergers in history occurred over the course of just three years (2016 to 2018). In this time, the "Big 6" (Monsanto, DuPont, Syngenta, Dow, Bayer, and BASF) consolidated into the "Big 4," now dominated by Bayer and Corteva (a new firm created as a result of the Dow–DuPont merger), and rounded out with ChemChina and BASF.

While the biggest mergers receive the most media attention, seed industry mergers and acquisitions are happening all the time, most without public visibility. For example, over the course of a five-year period, the top eight firms acquired more than 70 companies.[1] In 2018, 56 additional acquisitions and joint ventures took place among other top seed companies.[2] The Independent Professional Seed Association estimates that the US has lost hundreds of independent seed companies, and Dr. Philip Howard at Michigan State University has analyzed these losses by documenting nearly 400 ownership changes between 1996 and 2018.[3]

Economists have established that an industry loses its competitive character when the concentration ratio of the top four firms reaches 40% or higher. The seed industry has exceeded this benchmark. Three firms – Bayer (Monsanto), Dow-DuPont, and ChemChina (Syngenta) – collectively control more than half of the global seed market, up from a 22% share in 1996. By crop type it's even more concentrated, where four major biotechnology and chemical firms command 86% of the retail market for corn. The top two firms account for 66% of this market for corn and 62% of the retail market for soybeans.[4]

As we detail below, the existing IP system has helped drive this concentration. A positive feedback loop exists wherein major biotech firms use their financial and legal muscle to consolidate control over seed varieties and traits using expensive tools such as utility patents and aggressive litigation against farmers (see response to Questions 11, 15-16). Those strategies have helped those companies grow at the expense of farmers, especially small- and mid-scale farmers, who cannot hope to compete with a multinational firm's legal department. While the mechanisms differ slightly, RAFI-USA notes that this pattern parallels what we have seen in the contract poultry industry. When a company maintains the level of market concentration and financial clout as Bayer or Tyson, they can use the law and the courts as a cudgel.

The implications of this level of concentration are described next.

Q. 2 Concerns related to seed access, availability, pricing, and quality

The consequences of high concentration ratios in the seed industry include fewer variety options and less genetic diversity in our fields and marketplace; higher seed prices; and supply gaps for specific regions, cultural needs, and markets – such as organic. These consequences are examined below.

[1] Phil Howard, https://philhoward.net/2018/12/31/global-seed-industry-changes-since-2013/
[2] Phil Howard, https://philhoward.net/2018/12/31/global-seed-industry-changes-since-2013/
[3] Wilde, Matthew. 2009. "Independent Seed Companies a Dying Breed," *Cedar Valley Business,* May 31.; Phil Howard, https://philhoward.net/2018/12/31/global-seed-industry-changes-since-2013/
[4] Matson, James, M. Tang, and S. Wynn. 2012. "Intellectual Property and Market Power in the Seed Industry: The Shifting Foundation of Our Food System," University of Wisconsin Law School Government and Legislative Clinic, September 1.

Seed availability

In major crops, variety availability has decreased in significant ways. Below we describe how availability can be viewed through different lenses: 1) variety availability in major crops that have a GMO counterpart, 2) genetic diversity and uniformity across brands, 3) organic seed availability and quality, and 4) the regional appropriateness of varieties on the market.

1) Variety availability in major crops that have a GMO counterpart

Farmers rapidly adopted many GE crops – in particular corn, soybeans, cotton, and canola – beginning in 1996. Because plants adapt to conditions and inputs, including agrochemicals, it didn't take long for weeds to develop a tolerance for the chemicals that GE crops were engineered to resist.[5] Now with the target weeds also surviving the chemical control, farmers found themselves paying for a more potent mix of agrochemicals to control the weeds the GE crop technologies aimed to solve. Meanwhile, as the patent owners of GE traits gained more market power, they hiked up the price of their traited seed. Many farmers started to question the economic benefit of the GE cropping system and began to explore how to reduce both seed and chemical costs, while taking advantage of the price premium for non-GE crops.

In the late 2000s, demand for non-GE soybeans and corn steadily increased, but finding suitable non-GE alternatives proved difficult when the largest seed suppliers were pushing their more expensive traited varieties. Some regions were hit harder with non-GE seed shortages than others. In 2009, some university extension reported a doubling in conventional soybean sales, and shortages were reported across the South. University extension estimated that if Mississippi soybean growers planted all public and private conventional seed available, the amount would add up to no more than 3% of the state's soybean acreage (and just 0.5% if only the public varieties available were planted). Not only has choice in conventional seed diminished, single and even double traited corn is more difficult to locate.[6]

For example, farmers reported difficulty in finding Bt corn without the Roundup Ready trait. This means farmers who prefered these options can only access the newest genetics (read this as disease resistance, yield, and other valued traits contained in a single variety that are not GE) by paying for unnecessary traits. To drive farmers toward stacked traits, Monsanto implemented dramatic price increases for single and double stacked options while reducing single trait and conventional (non-GE) options in its own brands and subsidiary companies. Some of these companies eliminated conventional options altogether, so when a new high-yielding variety was introduced, it was only available with stacked GE traits. Each trait adds a royalty (or "technology fee") to the price of that bag of seed. Some farmers are paying three times what they paid ten years ago for a bag of GE seed corn. In soybeans, the royalty for the Roundup Ready trait added $4.50 per bag when introduced in 1996. Farmers paid a $17.50 royalty for the same trait in 2009.[7]

[5] Evans, J. A., P. J. Tranel, A. G. Hager, B. Schutte, C. Wu, L. A. Chatham, and A. S. Davis. 2016. Managing the evolution of herbicide resistance. Pest Management Science 72:74–80.
[6] Hubbard, Kristina. 2009. *Out of Hand: Farmers Face the Consequences of a Consolidated Seed Industry*, National Family Farm Coalition.
[7] Hubbard, Kristina. 2009. *Out of Hand: Farmers Face the Consequences of a Consolidated Seed Industry*, National Family Farm Coalition.

Mergers and acquisitions have directly impacted these seed prices and variety availability. As one example, Lewis Hybrids, a family-owned seed business founded in 1946, was acquired by Monsanto in 2007. A review of their seed catalogs shows how Monsanto's strategy to drive customers to purchase their traited products may not be as much about demand as it is a lack of choice. As stated, there was a resurgence in demand for non-GE soybeans and corn in 2009, yet following Monsanto's acquisition of Lewis Hybrids, the parent company worked quickly to eliminate non-GE soybean options and greatly limited non-GE corn despite demand for those products (see Table 1). Trisler Seeds (based in Illinois) and Heritage Seeds (Indiana) were part of Monsanto's 2006 purchasing spree under the holding company American Seed Incorporated, and both catalogs reflected the changes just described for Lewis Hybrids following their acquisition.[8]

Table 1. Number of varieties offered by Lewis Hybrids

Year	Conventional (non-GE) corn	Conventional (non-GE) soybeans
2006	32	6
2007 (acquired by Monsanto)	25	4
2008	19	3
2009	6	0

2) Genetic diversity and uniformity across brands

As described in Q. 13, seed relabeling is the practice of multiple seed companies selling the same variety under different names. This is especially apparent when analyzing hybrid corn genetics planted to most US corn acreage. Many farmers are unaware of relabeling practices and believe they are planting a diversity of corn genetics when in fact they're planting genetically uniform varieties sold under different trade names. According to data collected by the Farmers Business Network, about half of all corn and soybean seed on the market is relabeled.[9] This level of genetic uniformity spells disaster as weather events become more severe, unpredictable, and frequent; our climates change at local and global levels; and disease and pest pressures evolve. We only need to be reminded of the Southern corn leaf blight epidemic of 1970 and the vulnerability of genetic uniformity that this pathogen exposed, where approximately 85% of corn planted that year shared a common genetic background.[10]

[8] Hubbard, Kristina. 2009. *Out of Hand: Farmers Face the Consequences of a Consolidated Seed Industry*, National Family Farm Coalition.
[9] McCluskey, Cathleen and W.F. Tracy. 2021. "Engaging Farmer Stakeholders: Maize Producers' Perceptions of and Strategies for Managing On-Farm Genetic Diversity in the Upper Midwest," *Sustainability*, https://www.mdpi.com/2071-1050/13/16/8843/htm.
[10] H. Arnold Bruns. 2017. "Southern Corn Leaf Blight: A Story Worth Retelling," Agronomy Journal, Agricultural Research Service, May 5.

3) Organic seed availability and quality

The success of the organic label has been monumental, and consumer demand for organic products shows no sign of slowing. Between 2020 and 2021, organic food sales rose to $57.5 billion.[11] Organic producers are required to use organic seed when commercially available. Organic Seed Alliance monitors progress in organic seed sourcing through our *State of Organic Seed* report.[12] Although the organic seed supply has grown since the National Organic Program (NOP) was implemented 20 years ago, supply gaps and challenges remain.

Through a national survey conducted by Organic Seed Alliance and Organic Farming Research Foundation, certified organic producers identified the top three reasons for not planting more organic seed as 1) a specific variety was unavailable as organic (75% of respondents), (2) a lack of desirable genetic traits in organic seed (44%), and (3) insufficient quantities of seed for an organic variety (37%). While there are additional reasons organic producers aren't sourcing more organic seed, such as inconsistent enforcement of the NOP's organic seed requirement, the top three reasons identified by producers point to organic seed supply gaps. The findings were generally consistent across crop types. Even in the face of these challenges, the vast majority of organic producers responding to our survey (83%) believe organic seed is important to the integrity of organic food production.

When looking at specific crop types, limited availability of corn seed for specialized markets is apparent in the organic sector. One recent study found that organic farmers have "concerns around the lack of organic maize genetics on the whole" and many interviewees relayed a lack of access to "high-quality maize varieties bred to thrive in organic systems."[13]

This sentiment is further reflected in the organic producer data referenced above.[14] In this survey of nearly 1,000 organic producers, those who produce corn rank organic seed quality as a slight barrier in their sourcing organic seed, compared to organic vegetable and forage crop producers who do not consider seed quality a barrier at all.

4) Regional appropriateness of varieties on the market

Some regions in the US are underserved because the market for organic seed is not large enough. This was true for organic commodity crop growers in the Southeast. The majority of corn and soybean varieties commercially available are bred for Midwest conditions and are not adapted to the climate conditions of the Southeast. The lines that were produced were not seen as profitable enough for a large company to produce. For this reason, in 2017 RAFI-USA began supporting a group of North Carolina farmers in forming a seed cooperative to grow the organic seed industry in the Southeast. RAFI-USA helped the cooperative write a grant to obtain their seed-cleaning

[11] Organic Trade Association. 2022. "US Organic Industry Survey 2022," https://ota.com/organic-market-overview/organic-industry-survey
[12] Hubbard, K. and J. Zystro. 2022. "State of Organic Seed 2022," https://stateoforganicseed.org/
[13] McCluskey, Cathleen and W.F. Tracy. 2021. "Engaging Farmer Stakeholders: Maize Producers' Perceptions of and Strategies for Managing On-Farm Genetic Diversity in the Upper Midwest," *Sustainability*, https://www.mdpi.com/2071-1050/13/16/8843/htm
[14] Hubbard, Kristina (Kiki), Jared Zystro, and Liza Wood, State of Organic Seed (Port Townsend, WA: Organic Seed Alliance, 2022).

equipment, a necessary piece of infrastructure for the coop's ability to operate. The market is still underserved because the demand for the seed is greater than the current availability.

Similarly, for farmers planting pollinator habitat, there is a shortage of pollinator seed available. There are a few large wildflower seed companies that sell regional mixes (e.g., a "Southeast" blend), but those mixes contain ecotypes from multiple states, so a Georgia farmer may be planting Virginia ecotype seeds as part of their mix. State-specific ecotypes and seed mixes are not available, in part because the equipment for wildflower seed harvesting and cleaning is specialized, presenting a much higher barrier to entry for seed companies.

The unmet demand for regionally and locally adapted organic and pollinator seed illustrates that a public good – such as appropriate seeds for farmers – should not be treated as something that the market forces of supply and demand will naturally take care of. In this case, needs remain unmet.

Seed prices

As seed industry consolidation steadily increased, so did seed prices. Farmers planting corn and/or cotton have seen a price increase of approximately 350% over the last three decades. This increase does not match inflation and has not been offset by increased productivity.[15] Corn farmers paid $26.25 in seed costs per planted acre in 1990 and in 2019 paid $93.48. Cotton growers paid $17.63 in 1997 per planted acre and $84.26 in 2019. Soybean growers paid $19.72 in seed costs per planted acre in 1997 and $62.39 in 2018, a more than 200% increase. Wheat seed prices have not increased at the same pace (approximately 100% between 1998 and 2017) and we conjecture that the slower increase in prices is due to the commercial unavailability of GE wheat varieties.[16]

Q. 4 Examining the existing IP system

Intellectual property rights have facilitated the extensive and rapid market concentration described above (see Q. 1). Beyond market concentration at the retail level, farmers, plant breeders, and independent seed companies are dealing with the consequences of concentration at the more fundamental level of ownership, where IP owners determine whether germplasm is shared and how it is used. Our comments that follow are a culmination of decades of work with seed growers and farmers, public and private plant breeders, independent seed companies, and policy experts.

The IP system and Congress' intent

The historical context of the current IP system governing plants is important to the USDA's examination of competition concerns in the seed trade. Congress first identified the competition

[15] Maurice E. Stucke and Allen P. Grunes. 2018. "An Updated Antitrust Review of the Bayer-Monsanto Merger," The Konkurrenz Group, March 6.
[16] All seed pricing collected at: USDA's Economic Research Service. "Commodity Costs and Returns," accessed on June 9, 2022, https://www.ers.usda.gov/data-products/commodity-costs-and-returns/.

concerns outlined in this Federal Register notice decades ago, concerns that likely would not have manifested had the Supreme Court honored the congressional record underscoring the intent of IP laws as they pertain to seed and had the DOJ strongly enforced antitrust laws.

Discussions related to IP rights on seed date back to the 1920s, and the first law to provide plant developers some level of protection passed in the form of the Plant Patent Act of 1930. The law only applies to asexual reproduction (and does not include microorganisms) because Congress long argued that sexually reproducing plants should not be awarded patents for fear of curtailing innovation, threatening the free exchange of germplasm, and increasing market concentration. Congress held this position for half a century, and still argued against patents on seed when passing the Plant Variety Protection Act (PVPA) of 1970. A 1966 congressional committee report states that while its members "acknowledge the valuable contribution of plant and seed breeders, it does not consider the patent system the proper vehicle for the protection of such subject matter."[17]

Plant Variety Protections

We believe the PVPA is a meaningful and reasonable IP protection for plant varieties, and we support PVP certificates when they are used and enforced in accordance with the law. That is, we strongly believe that any form of IP protection on seed should include the exemptions outlined in the PVPA: that growers can save seed for on-farm use and breeders may use the protected material to develop new varieties and conduct research.

While the cost of PVPs can be prohibitive for small-scale breeding programs, PVPs have successfully been used by many stakeholders in both the private and public sectors to release new varieties with exclusive marketing rights for 20 years. Importantly, the protection covers the variety, not specific genetic traits or phenotypes.

According to USDA's Plant Variety Protection Office (PVPO), between 2011 and 2021, most PVPs have been awarded to companies (89%) followed by a much smaller percentage of universities (10%) and government agencies (1%) (see Figure 1, Table 2). Figure 3 shows certificates by crop type, with certificates increasing for grains and oilseeds and decreasing for field crops. Each year, the PVPO receives more than 400 applications and on average awards 325.[18] They have never received an application from a Tribal Nation.

[17] Report of the President's Commission on the Patent System, To Promote The Progress of Useful Arts In An Age Of Exploding Technology 1-3 (1966).
[18] Personal communication with the Plant Variety Protection Office, August 12, 2021.

Figure 2. Number of PVP certificates, 2011 - 2021

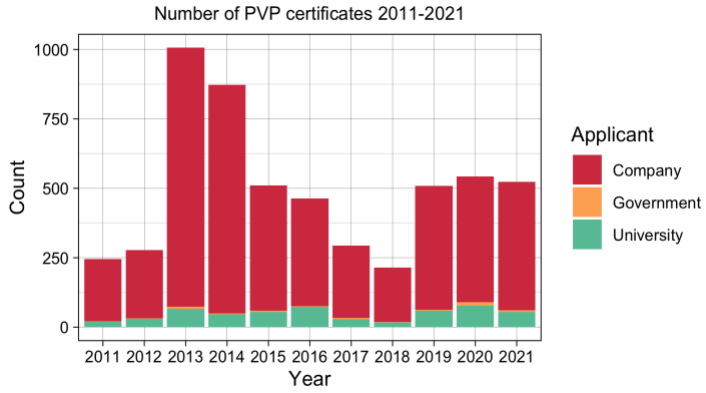
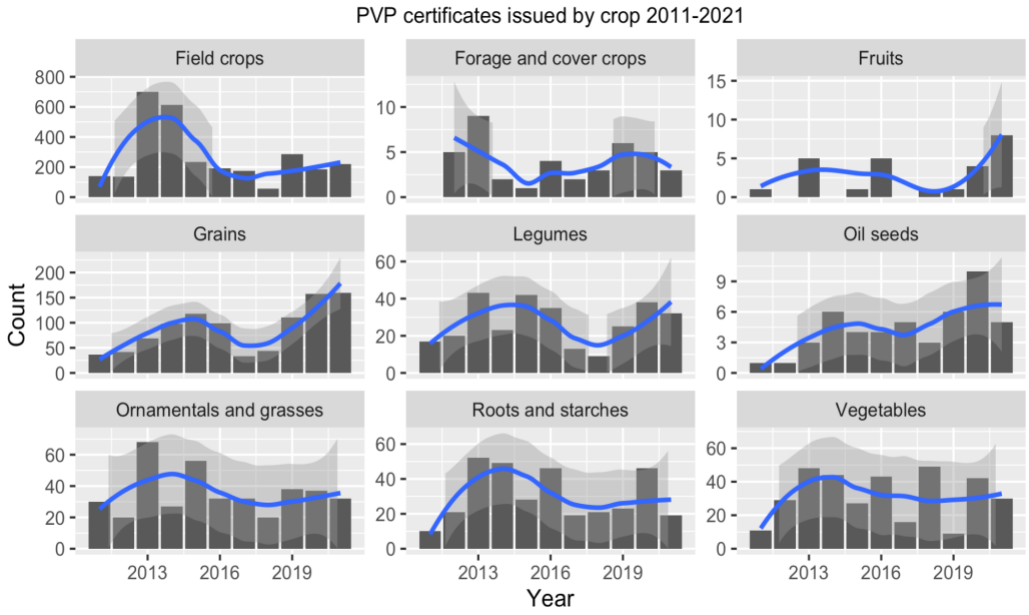


Table 2. Entities Issued a Plant Variety Protection Certificate, 2011 - 2021

Applicant	Number	Percent
Company	4881	89.4%
Government	53	1%
University	526	9.6%
Total	5460	100%

Figure 3: PVP certificates by crop, 2011 – 2021



We are concerned that PVPs are increasingly being coupled with seed-saving restrictions, which goes against both the letter and spirit of the law. Perhaps this trend is less surprising in private industry than it is in the public sector, where in 2016, Washington State University began coupling their PVP-protected wheat and barley varieties with royalty agreements and seed-saving restrictions. We are not opposed to royalty payments that help public breeding programs fill budget gaps resulting from waning public support for their programs (as WSU identified as a reason); however, restricting seed saving on PVP varieties negates the intent of Congress to support the independence of farmers, the economic and agronomic benefits of seed saving, and competitive markets. Oregon State University's Technology Transfer Office also routinely places seed-saving restrictions on their PVP vegetable varieties.[19] According to public plant breeders, their universities are coupling PVP certificates with additional licensing agreements to circumvent the breeder and grower exemptions in the PVPA.

More evidence of this trend is seen in the private sector. For example, the wheat variety offerings of WestBred (now owned by Bayer) are instructive. In their 2022 catalog, 89% of the varieties protected by a PVP also have a seed-saving restriction, 70% of the varieties with seed-saving restrictions are protected by a PVP only, and 54% of their PVP varieties are coupled with a utility patent. We suspect the coupling of PVPs and utility patents is part of the growing practice of using patents to cover specific genetic traits (not covered by PVPs) as opposed to a finished variety, though a deeper examination of these IP rights and other companies is needed. Still, the vast majority of PVP varieties from this one catalog alone are being enforced with additional restrictions that are in conflict with the intent of the PVPA.

Furthermore, Organic Seed Alliance has direct experience with these restrictions as they pertain to commercial varieties used in research trials. In 2014, we sought to obtain varieties for a regional variety trial for organic silage corn production. Two of the varieties were sourced from a major corn breeding company and were protected by PVPs. In order to obtain the seed, the company required us to sign a Material Transfer Agreement. One of the provisions of this agreement required that all data and conclusions were to be shared with the corn breeding company, and that no data could be released to any third party without the company's written consent. This covered data and conclusions from the entire trial – including the results from the other varieties in the trial. Ultimately, we were able to negotiate an amended agreement that allowed the research to be published without prior consent from the corn breeding company. However, that only happened through an individual exception made for this trial by a representative in the company's licensing department, and it took time and resources to achieve this end result. Restrictions on research and publishing findings are one reason why growers don't have more access to independently collected data on individual variety performance as well as how different varieties compare – data critical for guiding seed-purchasing decisions. Some seed companies prohibit their varieties from being used in performance trials that compare their varieties with those of competitors unless extreme conditions are agreed to and followed.[20] In the words of one public plant breeder, these restrictions have a "stifling effect on the honest evaluation of varieties."[21]

[19] Personal communication with Jim Myers, June 14, 2022.
[20] Personal communication with Seminis, August 5, 2013.
[21] Personal communication (anonymous), June 13, 2022.

While a PVP is technically not a patent, we have concerns they are being used as a less expensive way to achieve stronger enforcement rights by simply coupling these certificates with seed-saving restrictions, at times without applying for a formal patent. Though a sales contract is not illegal, we believe the Plant Variety Protection Office (PVPO) should conduct a survey of PVP certificate holders to understand how they are being enforced and if the exemptions included in the law are being upheld or routinely denied by additional IP restrictions. This data would help the USDA understand if the PVP system is still useful in serving its original intent of not precluding further breeding, seed saving, and research on protected varieties, and if changes to the law and/or other policies are needed. This data would also help the USDA understand its own question regarding whether the existing IP system is "appropriately balancing the need to incentivize innovation with the goal of ensuring public access to new and improved products at a reasonable cost." The breeder exemption in the PVPA is incredibly important to supporting innovation that grows the diversity and quality of our seed supply. The seed-saving exemption is also important and serves as a form of competition in the marketplace. In other words, these PVPA exemptions directly affect – and we argue benefit – the landscape of shifting choice in the seed trade and what seed companies can charge.

Utility patents

The concerns Congress expressed for decades regarding IP on self-replicating plants have been realized, but not because of the PVPA. In 1980, the U.S. Supreme Court upheld the first patent on a living organism in *Diamond v. Chakrabarty*. The PTO had originally refused to award this patent, which involved a genetically engineered bacterium, before Chakrabarty appealed. In 1985, in *Ex parte Hibberd*, the Board of Patent Appeals and Interferences effectively extended the *Chakrabarty* decision by allowing a broad utility patent on plant matter (*Hibberd,* 1985). A 2001 Supreme Court decision later affirmed in *J.E.M. Ag Supply vs. Pioneer Hi-Bred International* that the scope of the Patent Act was not limited by the Plant Patent Act or the PVPA. Although utility patents awarded for seed and plants increased after the earlier 1980 and 1985 decisions, this third Supreme Court ruling eliminated remaining uncertainties regarding utility patents on plants, opening the floodgates to further privatize seeds, plants, and genetic traits.

Of all the IP tools associated with seed, we are most concerned about the immediate and long-term impacts of utility patents on plant varieties and genetic traits. Our concerns are two-fold: First, it was never Congress' intent for utility patents to be awarded for products of nature; no one should "own" naturally occurring and self-replicating forms of nature, regardless of the methods used to identify or alter them. Second, utility patent holders enjoy far-reaching control over access and use of their protected products and can disallow research, plant breeding, and seed saving. A single patent can cover a plant, seed, tissue cultures, future generations, crosses with other varieties, and the methods used to produce it. While the PVPA has exemptions for breeders and farmers, utility patents can be legally enforced to forbid access to protected material for purposes of research, plant breeding, and on-farm seed saving. Patents therefore remove valuable genetic material from the diverse pool of resources breeders rely on for improving agricultural crops. When access to breeders and researchers *is* provided, it often hinges on restrictive licensing agreements, including restrictions on research questions and publishing

findings. These restrictions are a disservice to society and make our food system less secure in the face of climate change and new technologies.

The patent system has failed in its mission to strike a balance between benefiting inventors and benefiting the public. Understanding "public access" to patented varieties is confusing and an onerous exercise in navigating the IP system and communicating with the patent owner (if that's even possible). In many cases, a grower who wants to use patented seed must sign and abide by a highly restrictive contract – a "limited use agreement" – or they agree to restrictive terms through a "bag tag" licensing agreement simply by opening a packet or bag of seed (see Q. 11). In the modern system dominated by utility patents, research and seed-saving on new plant varieties and seed technologies have been foreclosed because utility patents do not come with seed-saving or research exemptions. Furthermore, the price of patented seeds has skyrocketed, especially biotech field crops (e.g., corn, soybeans, and cotton), and these prices have not been offset by productivity (see Q. 2).

Q. 5 - 7 Patent examples for which we have concerns about their novelty and nonobviousness, and ways the existing IP system suppresses competition and innovation

We find patent claims on plant genetic traits and phenotypes that exist in nature particularly problematic. There are patents that claim exclusive access over the ability to cross varieties in the National Plant Germplasm System (NPGS) known to have desirable disease and pest resistance. For example, Seminis patent US8859859B2 claims "a method of producing a cucumber plant having resistance to Downy Mildew (DM) comprising the steps of (a) crossing a cucumber plant of accession PI197088 with a second cucumber plant having at least one desired trait; and (b) selecting at least a first progeny cucumber plant resulting from the crossing that comprises resistance to Downy Mildew and the desired trait." PI197088 is an accession in the NPGS that, prior to the Seminis application, was being used by public breeding programs specifically for its high level of DM resistance.

While the Plant Variety Protection Act provides a more thoughtful system by recognizing the need for breeders to use germplasm to develop new varieties, including crossing varieties as just described, the utility patent system does not allow for these common breeding practices.

There are large variations in patent grant rates for plant varieties among different Art Units and examiners in the Patent Office. Coupled with the fact that individual examiners have a large degree of flexibility in choosing which databases and search strategies to use, this may indicate that the system as a whole is too subjective. In addition, because seeds are living, naturally-replicating, and naturally variable organisms, any plant that exists in nature could be considered prior art. Therefore, to do a truly exhaustive prior art search, especially for patent applications that claim specific phenotypes, a patent examiner would have to be aware of every example of the plant in question and each particular array of traits — an impossible task for any one person, no matter the time constraints.

On average, a patent examiner spends 19 hours reviewing a patent application, including the search for prior art. More experienced examiners spend less time on each patent; each promotion

for a patent examiner results in a 10-15% decrease in the number of hours the USPTO allocates them per application. Perhaps as a result, examiners with more experience tend to cite fewer instances of prior art in the application review process. They are also more likely to grant patents. In sum, examiners are rewarded for spending less time on the patent review process, resulting in less comprehensive reviews of prior art. As of April 2022, there were 676,937 patent applications awaiting review by the patent office.[22] Because the USPTO is a fee-based agency that depends on application and patent renewal fees to generate revenue, and because patent applications are increasing every year, it is likely that the organization will be underfunded so long as application trends continue, resulting in a continual backlog that degrades the quality of the patent review process and arguably results in the routine issuing of bad patents.

Paulina Borrego, a patent librarian for the Patent Trademark and Resource Center, underscored this fact when asked about patent examiner search behavior: "It's a 100% fee-based agency. So everything [the USPTO] does is based on churning out patents and making their workflow easier." Because there are incentives for the number of patents an examiner can process, prior art is often overlooked, especially when published in a medium unfamiliar to patent examiners. In fact, previously published patent applications account for the majority of prior art referenced by both applicants and examiners, resulting in a positive feedback loop in which the documentation most likely to prevent problematic patent applications from being granted are other granted patents – a system that devalues the knowledge and work of people who are unable or unwilling to pursue them.

<u>The existing IP system suppresses competition and innovation</u>

When examining utility patents to determine if "rewarding invention through protection from competition for a fixed term" is working well for plant breeders, the seed industry, and the growers and consumers they support, the first question to ask is: Who is benefiting most from the current IP system?

One way to answer this question is to look at who owns the most utility patents on crops. Utility patents are expensive, so it's no surprise that the top two industry leaders that have profited tremendously from IP rights on seed are also the top two owners of utility patents on plant varieties. Between 2004 and 2008, the two largest seed companies in the world (at the time, Monsanto and DuPont) accounted for 60% of patent applications on plant varieties.[23] Because this research has not been updated, we do not have access to current statistics on utility patent ownership. It would be helpful to have transparent data from the US Patent and Trademark Office on utility patent ownership on plant varieties, plant genetic traits, and phenotypes..

The two companies just mentioned were acquired by other firms in 2017 (DuPont by Dow) and 2018 (Monsanto by Bayer). IP rights on plant varieties and genetic traits are what make these companies valuable to investors and competitors. The enormous profits from licensing patented

[22] Patents Production, Unexamined Inventory and Filings Data April 2022, https://www.uspto.gov/dashboard/patents/production-unexamined-filing.html

[23] Pardey, Philip, B. Koo, J. Drew, J. Horwich, and C. Nottenburg. 2013. "The evolving landscape of plant varietal rights in the United States, 1930 – 2008," *Nature Biotechnology*, January.

products, or acquiring patent holders, led to dozens of acquisitions and mergers in a short timeframe, thus the oligopoly in the seed industry that we have today.

Yet, contrary to the claim that patents are necessary for incentivizing new product development, patents and restrictive licensing agreements have not spurred increased innovation in crop improvement. For example, in plant biotechnology, USDA documented that as the corn, soybean, and cotton markets became more concentrated "private research intensity dropped or slowed" relative to what would have occurred without consolidation.[24] That's why leading economists have long warned that firms become complacent and less likely to innovate when they can produce less and obtain a higher price for their input.[25] Market protection in the form of antitrust oversight is needed to prevent further concentration of economic power and to encourage innovation. The trend in less innovation as antitrust law enforcement decreased is well documented in other industries as well.[26]

Utility patents suppress innovation in the public plant breeding sector

There is no question that utility patents on crop types, plant varieties, genetic traits, and phenotypes are suppressing innovation, including in the public sector. One example is the patent on "bean-nut popping beans" (6,419,976), a type of bean that originated in the Andes region of South America at high altitudes and in warm climates. These beans are commonly found in Peru and Bolivia, where they are called "nuñas" and sold on the streets like popcorn.

Oregon State University plant breeder Jim Myers had developed a North American-adapted popping bean that he was ready to release when he accidentally stumbled upon the patent while teaching a student how to search the US Patent and Trademark Office database. This meant that the public breeding work he'd been doing for years, along with two other breeders at Colorado State University and University of Wisconsin, was infringing on this patent, as *the entire plant had been claimed as an invention* by Inland Empire Foods, Inc.

The patent claims any variety of popping beans that are adapted for northern climates, or those climates with a growing season shorter than 100 days. The patent also claims any bush beans adapted to flower "when day lengths are greater than or equal to 13 hours." The process of developing these northern climate bush beans is also claimed, ultimately disallowing anyone else from breeding for these same qualities, even if they arrive at the desired trait using a different selection process. The broad patent also claims the "leaves, stem, pollen, plant cells and seed." The patents also claim all nuña beans in the USDA Plant Introduction Collection.

With this knowledge, all three breeding programs shelved their projects and never released their popping bean varieties. *And neither did the patent owner.* This example demonstrates how utility patents can lock up plant genetics for decades—in this case a culturally important crop—and halt access to a food crop and any opportunity to further adapt this crop to changing climates. In this

[24] Fernandez-Cornejo, Jorge and D. Schimmelpfennig. 2004. AmberWaves, "Have Seed Industry Changes Affected Research Effort?" USDA/ERS, February.
[25] Harl, Neil E. 2000. "The Structural Transformation of the Agricultural Sector," In *A Food and Agriculture Policy for the 21st Century, Organization of Competitive Markets,* Organization for Competitive Markets.
[26] Open Markets Institute, "Innovation & Monopoly," https://www.openmarketsinstitute.org/learn/innovation-monopoly

particular case, the patent suppressed the competition of three public plant breeding programs and halted innovation efforts that would have resulted in new seeds, crops, and markets for growers and consumers.

Another utility patent worth exploring is "heat-tolerant broccoli" (6,294,715B), which covers broccoli plants bred to produce commercially acceptable heads under warmer growing conditions.[27] Broccoli is a cool weather crop, so identifying plants that perform well under heat stress allows these plants to be grown across a wider range of geographies.

The heat-tolerant broccoli patent makes broad claims to broccoli traits for heat tolerance by including all phenotypic characteristics in its description. By describing phenotype as opposed to genotype, the observable physical characteristics of the broccoli are claimed, making for a markedly broad sweeping claim to the ownership of this trait. In other words, the patent potentially covers any broccoli plant that produces a head size similar to that described in the patent, and that grows well under the stated temperature range. Furthermore, the progeny of the protected broccoli plants are also claimed in the patent, and the patent explicitly denies other breeders the right to develop new varieties from this protected material by restricting the practices of: "selecting, crossing, breeding or otherwise altering the broccoli plants of this invention."

When describing the heat-tolerant broccoli patent, one breeder shared: "The thing about utility patents is they last 20 years. They are absolute, meaning you can't do a thing with those seeds, nothing. You can't research with them, nothing. It closes that trait or variety from all plant breeding for 20 years. That's what a utility patent does."[28]

This plant breeder had been working on heat-tolerant broccoli prior to discovering the patent. He shared about discovering the patent, "Generally you don't know what's going on beforehand." Sometimes fully developed plant varieties are never released after these accidental patent discoveries, because plant breeders fear they are infringing the patent.[29]

A third patent example is "red lettuce" (8,143,487). Red lettuce is a head lettuce variety that is red to the heart. This quality in lettuce is challenging to breed for because the red pigment in lettuce typically requires the leaves be exposed to the sunlight's UV-radiation for the anythocyanin that causes the color to synthesize. Since sunlight does not reach the center leaves of a dense head of lettuce, breeders are selecting for traits that result in a red-to-the-heart lettuce without depending on light reaching the core.

The red lettuce patent covers a color change in lettuce that is bred using classical breeding practices. Neither the practices of establishing red-to-the-heart lettuce nor the idea of breeding for such a trait are novel. One plant breeder described the trait as the "Holy Grail" of lettuce

[27] Barham, Robert and David Joynt. (2001). *US Patent No. 6,784,345.* Washington, DC: U.S. Patent and Trademark Office.
[28] Personal communication (anonymous), December 16, 2013.
[29] Personal communication (anonymous), December 16, 2013.

because "what everybody wants in a lettuce is a lettuce that is red in the core."[30] This breeder described having worked on his own red-to-the-heart lettuce variety prior to 2005.

The patent claims that this red lettuce is different from "prior art" because it does not need UV-radiation to have a red color, even though the patent describes breeding for this trait by selecting lettuces that tend toward heart redness, including classically bred varieties available in the marketplace, such as varieties that exhibit red speckling in the heart. The patent describes that none of the lettuce varieties used to breed for the red lettuce "have the characteristic red leaves in the heart of the head." Therefore, the patent claims as an invention the "unique and new combination of genes from these red and green parent varieties, which is providing the completely red leaves in the heart of the head."

In the words of this same breeder working on his own red lettuce, "If this is about novelty and invention, I don't understand the inventiveness of just describing your latest lettuce that you've bred…"[31] In other words, this patent example appears to include breeding practices and breeding goals that are standard.

"I do not believe that because a human notices that a plant has a useful trait, that that human should be able to monopolize the trait," shared the breeder. "That doesn't seem right. I think it goes against the tradition of agriculture and I think it allows the concentration of economic power in farming."[32]

Organic Seed Alliance regularly fields questions from seed growers and plant breeders related to patent examples they come across on plants and genetic traits. Their confusion about what is actually covered by these patents is warranted, since patent descriptions are seemingly impossible to translate by anyone other than a patent attorney. Some of these examples include a patent on pink tomatoes (i.e., a phenotype that has long existed in heirloom varieties), drought tolerant plants, and "plants with an intense fruit phenotype." These examples and more than 100 others were listed in a letter sent by BASF to communicate their patent applications and awards to hundreds of vegetable seed companies (see Appendix B).[33] The broad claims listed in this letter provide good evidence as to why there is more confusion than ever in the seed industry about what is being patented and why. In some cases, this confusion leads to undue fear among smaller seed companies and breeders working with these crops and traits.

In reality, some of these protected traits are naturally occurring. They are neither novel nor constitute an invention by humankind, and they do not pass the non-obvious test. Furthermore, the broad nature of utility patents – take the Northern popping bean example above – are decidedly unjust. Many patents claim ownership over the methods used to develop a plant, the genetic traits within, and progeny produced. Furthermore, many companies now rely on utility patents for claiming ownership of finished varieties instead of applying for a PVP certificate, a more appropriate protection of marketing rights for a finished variety.

[30] Personal communication with Frank Morton, December 16, 2013.
[31] Personal communication with Frank Morton, December 16, 2013.
[32] Personal communication with Frank Morton, December 16, 2013.
[33] Hubbard, Kiki and Cathleen McCluskey. 2020. "How Patents Threaten Small Seed Companies," Civil Eats, September 11.

In our view, what these patent descriptions represent is time and resources: time spent documenting a plant developer's methods (which are typically not novel), germplasm lines, and specific characteristics achieved, regardless of whether these germplasm lines already existed, or these characteristics have already been achieved by others (perhaps with different germplasm lines and methods), or the "invention" is obvious to other breeders. In other words, documentation does not make an improved plant variety novel enough to warrant a patent for invention.

The takeaway: Increased market power results in access to more resources, time, and staff – including a legal team – allowing larger companies to lock out competition simply by having the resources to pursue more patents.

The role of the Bayh-Dole Act

The practices of patenting and licensing have been more visible in the private seed trade, and therefore the consequences as well (i.e., market concentration, legal disputes, higher seed prices, and seed-saving and research restrictions). How patenting and licensing have impacted public plant breeding and other seed research at our land grant universities is less understood, though evidence points to academic research becoming more privatized over the past quarter century.

More industry funding is directly supporting university research.[34] And universities increasingly use patents and licensing to disseminate research as opposed to placing it in the public domain. Bhaven N. Sampat has documented this shift.[35] Universities were historically reluctant to patent and license their inventions for fear they might be seen as compromising their commitment to "open science" and their institutional mission to broadly disseminate knowledge. However, the 1970s saw a marked growth in university patenting, likely because of the increase in "use-oriented" basic research in fields like molecular biology, as well as a decline in federal funding for university research. Following this trajectory, the Bayh-Dole Act of 1980 allowed universities and businesses to obtain the rights to any patents resulting from grants or contracts funded by any federal agency. Not only did Bayh-Dole make it easier for universities to patent and license their research, it largely eliminated the reluctance to do so. The number of universities involved in patenting and licensing more than quadrupled between 1980 and 1990. The number of patents awarded to universities also climbed following its passage, from fewer than 300 a year to more than 3,000, and universities now earn almost $2 billion annually from licensing.[36]

These figures are now widely used to boast the success of Bayh-Dole by claiming the law was necessary for improving technology transfer of publicly funded research. But numbers demonstrating increased patenting and licensing of university research (and income generated) don't necessarily mean more outputs are being transferred, that the public good is being served,

[34] Mowery, D. C., R. R. Nelson, B. N. Sampat, and A. A. Ziedonis. 2001. The growth of patenting and licensing by U.S. universities: an assessment of the effects of the Bayh-Dole act of 1980. Research Policy 30:99–119.
[35] Sampat, B. N. 2006. Patenting and US academic research in the 20th century: The world before and after Bayh-Dole. Research Policy 35:772–789.
[36] Sampat, B. N. 2010. Lessons from Bayh-Dole. Nature 468:755–756.

or that profits are coming back to research and development programs. In fact, evidence has emerged that challenges these supposed benefits.

First, the claims that Bayh-Dole was necessary to enhance technology transfer are unfounded, and the value of public research and the potential risks of passing Bayh-Dole were neglected during the bill's hearings.[37] Second, the arguments for Bayh-Dole dismiss other forms of research dissemination, despite surveys showing that most industries rank patents and licensing near the bottom of the list when asked how they learn from university research.[38] Publications, conferences, consulting, and informal exchanges ranked highest – channels that keep research in the public domain, benefiting future academic research as much as industry. And, third, some universities have strayed from the purpose of Bayh-Dole. While generating income from patenting and licensing was not an established purpose of Bayh-Dole at the time of its passage, a survey of technology transfer office managers shows that license revenue, inventions commercialized, and patents awarded were important outcomes by which these university offices measure their success.[39] Altogether, university technology transfer for the public good may not be driving patenting and licensing decisions as much as their desire to generate income. However, there remains a major gap in literature on how Bayh-Dole has impacted plant breeding and seed research specifically.

Technology transfer of publicly-bred varieties

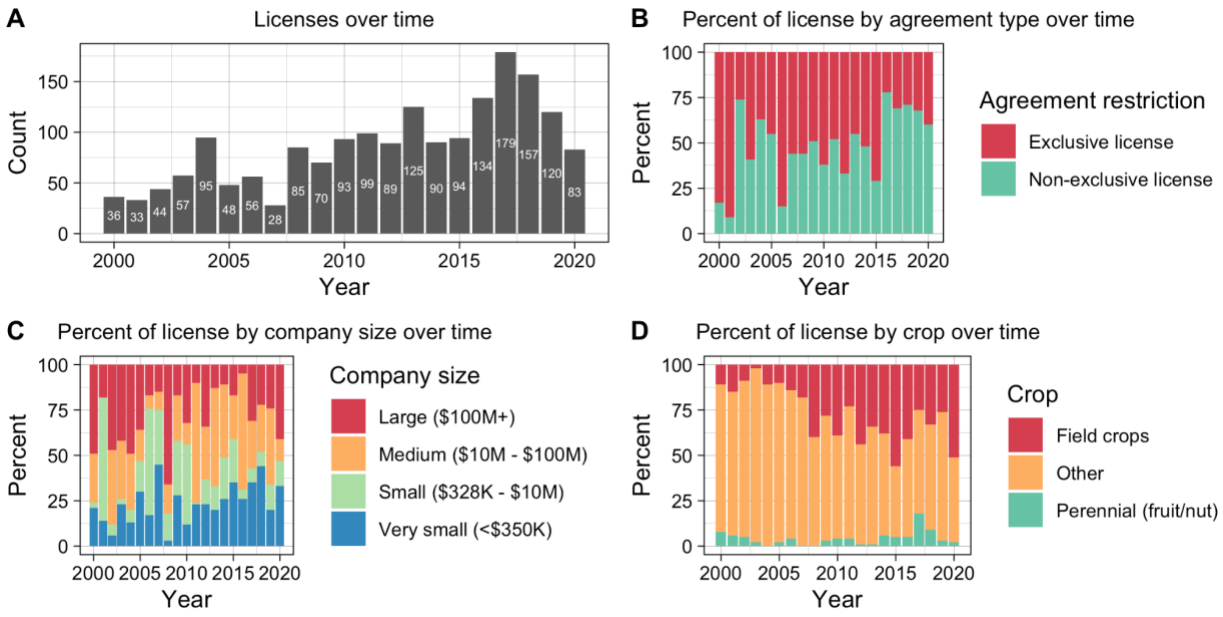
To help map trends in plant breeding and technology transfer between industry and universities, preliminary data collected by a team at University of California, Davis sheds light onto Land Grant Universities' (LGUs) plant varieties licensing activities over the past 20 years.[40]

Based on data from 14 LGUs, they find that university licensing rates continue to climb, nearly doubling between 2001-2010 (609 licenses) and 2011-2020 (1206 licenses) (Figure 4A).Throughout these 20 years, 21% of plant varieties patented at universities have been licensed to international or multinational companies, funneling that innovation far beyond the public benefit of the region in which it was developed, and even beyond national borders. Furthermore, 46% of universities' plant variety licenses were exclusive, limiting further innovation or breeding with the material to only one licensee (Figure 4B). Nearly 60% of license agreements were made to large companies with more than $10 million in annual revenue (Figure 4C). Of that 60%, nearly half were very large businesses with annual revenue higher than $100 million. Additionally, universities have shifted toward licensing (and therefore focusing breeding efforts on) high-value crops, namely field crops like corn, soybeans, and cotton, as well as

[37] Sampat, B. N. 2006. Patenting and US academic research in the 20th century: The world before and after Bayh-Dole. Research Policy 35:772–789.; Mowery, D. C., R. R. Nelson, B. N. Sampat, and A. A. Ziedonis. 2001. The growth of patenting and licensing by U.S. universities: an assessment of the effects of the Bayh-Dole act of 1980. Research Policy 30:99–119.
[38] Cohen, W. M., R. R. Nelson, and J. P. Walsh. 2002. Links and Impacts: The Influence of Public Research on Industrial R&D. Management Science 48:1–23.
[39] Jensen, Richard and Marie Thursby. 2001. "Proofs and Protoypes for Sale: The Licensing of University Inventions," The American Economic Review, 2001-03-01, Vol. 91 (1), p. 240-259.
[40] Wood, Liza, Adam Vera, & Victoria Fletcher. *Public science for the public good? An evaluation of plant variety innovations at Land Grant Universities*. Unpublished: preliminary data

perennial fruit and nut trees (Figure 4D). This is alongside a decline in minor crop licensing, including minor grains and berries. An exception to this are roots, mainly sweet potato, for which plant variety licenses have increased over the last 10 years.

Figure 4. Summaries of preliminary data from 14 Land Grant University Technology Transfer Office licensing history for plant varieties. A) The total number of licenses issued, B) The percent of licenses issued based on exclusive or non-exclusive agreement restrictions, C) The percent of licenses issued to companies of different size categories based on annual revenue, D) The percent of licenses issued for different crop types, categorized to highlight the increase in field crop licenses.



Together, these data suggest that Technology Transfer Offices at Land Grant Universities are licensing plant varieties to large and sometimes international companies through exclusive licensing strategies. It is also important to note that this trend is similar across universities, regardless of the amount of public funding a university has received. Using USDA's recent awards database, researchers have identified the federal grant amounts each LGU has received over the last 20 years for seed systems research and plant breeding.[41] In the sample of 14 LGUs, award amounts range from $150,000 (University of Hawaii) to more than $25 million (University of California, Davis). Some may argue that universities with lower public funds should license higher-valued crops to more competitive companies as an income generating scheme to support their plant breeding activities. However, these data show no difference in the patterns of plant breeding and licensing at universities with different gradients of public plant breeding funding. And in some cases, the highest publicly-funded universities are more likely than their lower-funded counterparts to establish more restrictive exclusive license agreements.

[41] USDA, NIFA award portal accessed on June 14, 2022 at https://portal.nifa.usda.gov/lmd4/recent_awards?report_title=Recent%20Awards&from_site=NIFA&search_label=Awards%20Listing

These preliminary data on LGUs and their patenting and licensing behavior show an example of how the current IP system surrounding seeds is detracting from the public good. Specifically, it is affecting public institutions' innovation strategies for plant variety breeding and licensing. Data suggests that universities are not choosing companies or agreement models that allow these public plant variety innovations to be shared widely with regionally relevant industry partners.

Utility patents suppress innovation in organic seed

We are often asked how the IP system impacts the organic seed market. One way organic plant breeders and seed producers are impacted is through limited access to germplasm, a trend that extends – and is arguably worse – in the private sector. For example, hybrid seed corn companies that do not have the financial resources for their own breeding programs rely on licensing inbred lines for their organic seed production. The largest biotechnology companies (the dominant players in the seed industry) own most of these lines and have been unwilling to license them in an untreated form; that is, without chemical seed treatments prohibited in the national organic standards. It is illegal to use these lines without a license.

The president of Albert Lea Seed House, Mac Ehrhardt, estimates that of more than 1,940 hybrid lines available, only 8% are available as a non-GE line *and* in an untreated form. Although these numbers were collected a few years ago and the total number of lines might be different, Ehrhardt says that the order of magnitude is still the same today – "access is extremely limited."[42] Field corn is one of the most widely planted organic crops in the US and yet choice in organic seed continues to be limited due to lack of access to appropriate lines. The lack of access to more appropriate lines serves as a barrier for expanding choice in organic hybrid seed corn, since lines can neither be treated nor intentionally carry a genetically engineered (GE) trait. Furthermore, it is common for germplasm licensing agreements to prohibit testing for patented, GE traits. This puts companies that want to protect their reputation as a supplier of "clean" seed for organic production in a vulnerable position of risking litigation if they decide to test illegally.

Q. 8 Strategies for promoting access to germplasm for the development of new varieties

To promote access to germplasm, there must be universal exemptions for plant breeding, research, and seed saving across the IP system, regardless of the tool or strategy being used – be it a utility patent or PVP. Given the prevalence of restrictive IPR on our seed supply, requiring these exemptions across the IP system is the single most impactful strategy for promoting access to germplasm for developing new varieties.

Increasing funding for the National Plant Germplasm System (NPGS) would also increase access to germplasm for variety development. These public germplasm collections, also known as seed banks, are critical to preserving and expanding our rich agricultural heritage. In 1990, Congress established NPGS within the USDA to maintain and distribute important plant germplasm. They serve several parallel functions, including providing a healthy and stable source of genetic material so that plant breeders, researchers, and growers can develop and assess new varieties,

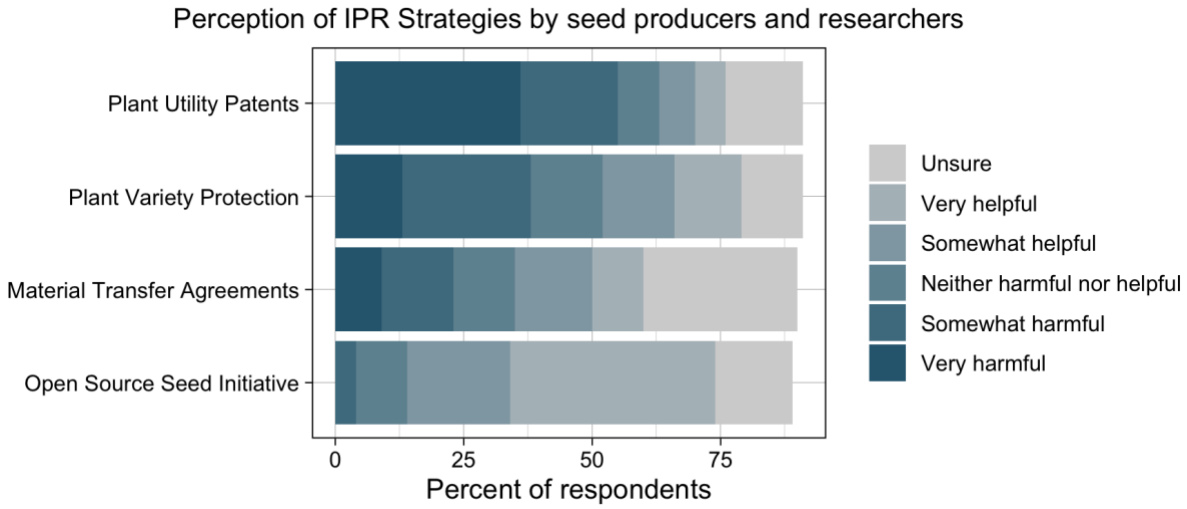
[42] Personal communication, June 14, 2022.

distributing seed to impacted regions during periods of instability, and rematriating varieties to their Native seed stewards and habitats – preserving the cultural connections between land and seed. With roughly 250,000 requests for seeds annually, NPGS requires stable funding to meet high demand. Understaffing is also a primary concern. At least one-third of NPGS managers will reach retirement age by 2025. The value of our germplasm collections cannot be fully realized without dedicated funding for maintaining and growing capacity.

Q. 10 Alternative IP strategies to utility patents on seed

As part of the *State of Organic Seed, 2022* report, OSA collected data from nearly 180 seed producers, seed companies, and researchers to better understand their perspectives on IPR strategies (Figure 5).[43] Responses indicate that the majority of organic seed stakeholders (55%) find utility patents to be very or somewhat harmful, calling attention to the importance of alternative IPR strategies. One such alternative, the Open Source Seed Initiative (described more below) proves this point, with 60% of stakeholders identifying this strategy as very or somewhat helpful.

Figure 5.



Trademarks have emerged for plant breeders as an alternative to other, more formal IP strategies because they do not impose restrictions on seed saving and breeding. Trademarks allow a plant breeder to associate the quality of a variety with a particular brand, while allowing them to still participate in the network of plant breeders in an ethical way – a network that is built on mutual understanding and reciprocal sharing of germplasm. Occasionally, a plant breeder with a new variety to share will couple a PVP with a trademarked brand for that variety. This strategy allows the breeder exclusive rights to market the variety for the first 20 years, while providing them the ability to build a market presence and reputation for quality that can sustain seed sales after the PVP expires.

[43] Hubbard, Kristina (Kiki), Jared Zystro, and Liza Wood, State of Organic Seed (Port Townsend, WA: Organic Seed Alliance, 2022).

The ability to control a brand name, by way of trademarking, is important to many seed growers because the iterative nature of plant breeding and natural regional adaptation means that plant varieties have constantly changing phenotypes that vary according to environmental pressures and the types of selection being performed by individual seed savers. Especially among heirloom seeds, single crop varieties can vary widely from seed seller to seed seller, all while being marketed under the same name, which creates some confusion for consumers. Trademarking is an appropriate strategy for navigating this problem, because it rewards a seed grower or plant breeder for maintaining quality and consistency in the varieties they sell and enables them to build a brand reputation without restricting others from doing the same.

This is not to assert that trademarking is always a more ethical strategy for IP protection. In some cases, trademarks are actually deliberately used to obscure seed genetics. For example, in regard to the issue of seed relabeling (see Q. 13), we are aware of instances in which companies marketing conventional commodity crops will market the same genetics under different trademarked names, creating the illusion of diversity and choice while perpetuating on-farm homogeneity.

Trademarks can also be paired with licensing agreements that allow a company to stipulate the conditions under which the seed is grown. For example, Kamut™ is a trademarked name for Khorasan wheat. The company, which popularized the variety for its use in snacks and for gluten-sensitive people, stipulates that the wheat can only be sold as Kamut™ if grown under certified organic production and is bought and processed through the company. These requirements allow Kamut™, the company, to maintain the quality of its products and market their environmental values, without restricting the sale or use of Khorasan wheat, the variety, for other growers.

However, licensing agreements aren't always a fair and useful assertion of IP rights. In addition to the fact that these strategies often require significant financial resources to pursue and defend them, many licensing agreements are written in ways that are deliberately obscure. For example, the proliferation of bag tags has severe implications that hobbles breeders' access to germplasm and their ability to innovate (See Q. 11, 15-16). In an effort to combat the effects of bag tags and other forms of IPR that restrict seed saving and breeding, several groups of plant breeders and seed savers have adopted "pledges" that use the same mechanism as bag tags, but instead require that the purchaser pledge not to restrict others' ability to save the seed. For example, varieties published under the Open Source Seed Initiative Pledge have a statement printed on the seed packet that stipulates that "the purchaser of the seed cannot restrict others' use of the seeds or their derivatives by patents or any other means."

Strategies like these are evidence that seed growers and plant breeders are forced to make serious concessions, and to invent workaround strategies, as a response to the modern landscape of IPR. At present, there is no one-size-fits-all IP strategy that best suits seed grower and plant breeder needs while also supporting the need for reciprocity, access, and ethical compensation in plant breeding and seed growing; instead, seed growers and plant breeders are often layering multiple IP mechanisms to develop a strategy that best suits their financial needs and moral standards.

The overlapping array of available strategies that can, at times, contradict or negate each other, creates significant confusion, both for plant breeders looking to market their varieties, and also for seed growers interested in saving or researching seed varieties who need to know the seed in their possession might be restricted (see Q.13).

Q. 9, 11, 15 - 16 Seed sale agreements and licensing contracts undermine a grower's autonomy and negatively impact research, innovation, and access to germplasm in both the private and public plant breeding and seed production sectors. Furthermore, the landscape of IP enforcement negatively affects farmers, plant breeders, and smaller seed companies.

Contracts governing the sale and use of proprietary seed (also known as licensing agreements or technology stewardship agreements) have become significantly more complex than a simple exchange of money for goods.[44] The benefits that flow to the IP holder extend far beyond the bounds contemplated by patent law. These contracts categorically transfer liabilities, including market burdens and genetic contamination events, directly to the farmer. Any losses incurred due to drops in market value, the presence of unwanted GE traits, resistant weeds or pests, or any number of other scenarios are always attributable to the farmer. The contracts routinely include provisions granting the IP holder 24/7 access to the farmer's land to take genetic samples for infringement investigations, Internet service provider records, and financial information that gives the patent owner a huge leg up in court. Finally, because the contracts specify with a large degree of precision how seeds are to be grown, managed, and harvested – including restricting seed saving – a grower's ability to innovate is outright removed. All complaints about a product must be argued through industry-led arbitration and growers sign away their right to class-action litigation.[45]

Today, the scope of licenses that communicate patent rights (or simply serve to transfer material and dictate the terms even in absence of a patent) has expanded beyond their traditional use. In many cases, growers do not own the seed they purchase; instead, they enter into a "limited use license." Many licenses now transfer IP without transferring many presumed rights of the user, upsetting the balance that public policy aims to achieve between IP owner rights and the public interest.

In agriculture, the ability of IP owners to restrict seed saving epitomizes this shift away from the public interest. With the proliferation of patenting and licensing, farmers began seeing licensing agreements on their seed bags ("bag tag" contracts) that communicate patent rights to growers. The aggressive enforcement of bag tags is most notable with agricultural biotechnology products though bag tags are increasingly found on non-GE, conventionally bred seed bags and even vegetable seed packets (see Appendix A).

[44] See Bayer's Technology Use Guide for licensing agreements stipulating these terms: https://tug.bayer.com/tsa/united-states/

[45] See Bayer's Technology Use Guide for licensing agreements stipulating these terms: https://tug.bayer.com/tsa/united-states/

Many growers of GE crops – specifically, soybeans and cotton – suffered a rude awakening beginning in the late 1990s when the Monsanto Company began spending millions of dollars on private investigators to go after farmers who were allegedly infringing its patents by saving seed. By 2005, the company had carried out thousands of investigations and filed approximately 100 lawsuits against its customers.[46] Some of these cases resulted in million-dollar judgments and bankruptcy. Litigating a patent infringement action is extremely costly, and the high cost favors large corporations. Farmers accused of infringement may feel pressured to settle because defending themselves in court may drive them to bankruptcy. That is why many more farmers than were sued paid expensive settlements and signed gag orders to avoid legal action. Once Monsanto started down this path of using strong-arm tactics, rivals followed. DuPont started investigating seed saving among its farming customers in 2013.[47]

In response to these aggressive lawsuits targeting farmers, Ohio Representative Marcy Kaptur introduced legislation in 2004 and 2013 to establish a registration and fee system that would allow farmers to legally save patented seed. "Companies deserve a fair return, not an exorbitant return," Kaptur said.[48]

Other states, including California, Indiana, Montana, North Dakota, and South Dakota, have passed "Farmer Protection Acts" in response to these patent infringement lawsuits and intrusive investigations.[49] These states now have laws in the books that require notice, permission, or a court order before the IP holder may come onto a farmer's land and take samples. This is important because it prevents IP holders from strategically taking samples without notifying farmers, which has led to situations where farmers had no opportunity to take duplicate samples as part of their defense.

In 2019, New York passed a law that creates an affirmative defense for farmers accused of patent infringement for unauthorized use of GE crops when they can show that they did not knowingly introduce the traits and that they did not knowingly gain from them. As patent infringement is a strict liability crime, farmers remain at risk for infringement even when the GE traits blow over from a neighbor's field.

In general, patents and other restrictive forms of IPR, such as egregious licensing agreements, have created a culture of fear not only among rural communities but also among public plant breeders and researchers. For example, the same licenses that restrict farmers from saving seed also restrict independent research. In 2009, 26 corn-insect specialists submitted anonymous comments to the Environmental Protection Agency (EPA) about licenses enforced by biotechnology firms, stating, "as a result of restricted access, no truly independent research can be legally conducted on many critical questions regarding the technology."[50] Specifically,

[46] Center for Food Safety. 2005. *Monsanto vs. US Farmers,*
[47] Kaskey, Jack. 2012. "DuPont Sends in Former Cops to Enforce Seed Patents: Commodities," *Bloomberg,* November 28.
[48] Ferguson, Ellyn. 2013. "Kaptur Bill Would Protect Seed Patents, Farmers," *Roll Call,* February 8.
[49] Wong, Amy and Kiki Hubbard. 2021. *A Seed Policy Roadmap for Seed in the Pacific Northwest,* Organic Seed Alliance.
[50] Pollack, Andrew. 2019. "Crop Scientists Say Biotechnology Seed Companies Are Thwarting Research," New York Times, February 19; Also see: Editors. 2009. "Do Seed Companies Control GM Crop Research?" *Scientific American,* July 20.

scientists said the licenses were keeping them from researching the effectiveness and environmental impact of GE crops. Instead, university scientists have to seek permission, which is sometimes denied or comes with strings attached, such as whether the findings can be published. This appears to be common practice across industries, where one survey of industry executives shows that 27% of their university licenses include clauses that allow deletion of information from papers before they are submitted.[51]

RAFI-USA notes that consolidation in the seed industry, in concert with the existing seed IP legal and regulatory framework, has resulted in a situation that has many parallels to the ways that contract poultry farmers are mistreated:

- The farmer takes on the bulk of the financial liability in the situation: for seeds, through contracts that severely limit liability; for contract poultry, via the tournament system and the massive debt they take on for facility construction and upgrades.
- Companies dictate farm management at a detailed level: for seeds, through contracts that specify how seeds are to be grown, managed, and harvested; for contract poultry, by virtue of the fact that integrators own and provide all relevant inputs, and through contracts that specify on-farm operating procedures, flock pickup times, etc.
- Information asymmetry. Companies have massively more information, and more access to information, than farmers: for seeds, farmers have difficulty confirming with certainty the IP restrictions attached to the seed they buy, and relabeling obscures the actual genetic diversity (or lack of diversity) of the seeds they are buying; for contract poultry, growers are not currently provided with relevant information regarding the quality of the inputs they receive, nor are they in a position to conduct operational planning in relation to integrator decision processes regarding flock assignments, layout times, and other factors that integrators adjust to manage their overall supply.
- Erosion of legal recourse. For seeds, as noted above, farmers sign arbitration clauses and give up their right to class action lawsuits. Contract farmer advocates fought to get mandatory arbitration clauses removed from poultry contracts, so farmers can now opt out of arbitration; however, the "competitive injury" standard established by the courts means that there is no realistic way for a farmer to prevail in a court case about unfair treatment.
- Restrictive product/equipment requirements. For seeds, farmers are required to use specific agrochemicals along with the seeds they have purchased. Contract poultry growers, when installing equipment or making upgrades, are required to purchase specific equipment from specific suppliers to meet company specifications.
- Legal and financial intimidation. As noted above in this question, seed companies have pursued a concerted strategy of legal intimidation of farmers, including gag orders. Contract poultry farmers also have a hard time speaking up publicly due to fear of financial intimidation through the tournament and their vulnerability to financial disaster given the large amounts of debt they usually hold.

[51] Thursby, Jerry G. and M.C. Thursby. 2003. "University Licensing and the Bayh-Dole Act," *Science*, Vol. 301, August 22.

Companies pursue these practices in direct proportion to their ability to dictate these terms. Consolidation, power imbalances, and our existing legal and regulatory framework all enable, perpetuate, and worsen this treatment.

Q. 12 Sales practices, including bundling and stacking traits, lock growers into certain product choices and communicate a false narrative of choice

In Q. 2 we described ongoing practices of stacking traits and bundling seed and herbicides as packages. We described how growers are likely planting more stacked trait options because these are the options most available. Dicamba-tolerant soybeans and cotton provide another example where growers feel locked into seed product packages. In this case, some farmers are adopting dicamba-tolerant soybeans as a necessary strategy to protect their crops from dicamba drift that destroys non-tolerant varieties and threatens their livelihoods.

Monsanto and BASF released their products knowing that dicamba would cause widespread damage to soybean and cotton crops that weren't resistant to dicamba. In fact, internal documents cite "protection from your neighbors" as part of the companies' marketing strategies to sell more of their products. The companies also prevented independent scientists from conducting their own tests and declined to pay for studies that would potentially give them more information about dicamba's real-world impacts.[52]

In 2018, there were 3,200 complaints regarding dicamba drift damage. Monsanto and BASF rightfully predicted that complaints would decrease over time given that internal market research documents showed that "defensive planting" was increasing sales of their products.[53] A BASF employee wrote in a 2016 report that "the only thing most acres of beans have in common is dicamba damage," so it's no surprise that Bank of America reported in a market research document the following year that many farmers were switching to dicamba-tolerant crops to protect themselves. In 2018, nearly half of all soybeans planted had the patented dicamba-resistant trait and by 2019 70% of cotton planted had the trait. In July 2021, Arkansas had already reported 650,000 acres of soybeans damaged due to dicamba, a state where two-thirds of soybean acres are planted to dicamba-resistant varieties.[54]

Bill and Denise Bader, owners of Bader Farms in Missouri, lost their peach orchard due to dicamba drift and sued Bayer and BASF in 2020. In the words of the couple's attorney, "This is the first product in American history that literally destroys the competition. You buy it or else."[55]

[52] Hettinger, Jonathan. 2020. "'Buy It Or Else' Inside Monsanto and BASF's Moves to Force Dicamba on Farmers," Investigative Midwest Center for Investigative Reporting, December 4.
[53] Hettinger, Jonathan. 2020. "'Buy It Or Else' Inside Monsanto and BASF's Moves to Force Dicamba on Farmers," Investigative Midwest Center for Investigative Reporting, December 4.
[54] Steed, Stephen. 2021. "650,000 acres of soybeans damaged by dicamba this summer, state estimates," *Arkansas Democrat Gazette*, July 19, https://www.arkansasonline.com/news/2021/jul/19/dicamba-loss-looking-likely-for-soybeans/
[55] Hettinger, Jonathan. 2020. "'Buy It Or Else' Inside Monsanto and BASF's Moves to Force Dicamba on Farmers," Investigative Midwest Center for Investigative Reporting, December 4.

To be clear, the problem we are underscoring here directly relates to concentrated market power and IPR. In the case of dicamba-tolerant crops, market power has translated into regulatory approval for these new traits and new applications of dicamba. Market power, coupled with excessive licensing agreements, has also resulted in the complete transfer of liability for problems associated with the products from patent owners to growers and herbicide applicators.

Documentation of "defensive planting" also makes this issue pertinent to seed industry competition and IPR. Growers feel forced to plant particular products not because it's the best product for their farm, market, or bottom line, but as a primary strategy for *protecting* their farm and bottom line from a product with which they cannot coexist. Evidence of marketing strategies to promote defensive planting only adds insult to injury.

In this way, concerns and questions related to dicamba-tolerant seed technologies go beyond the regulatory approval of a GMO or an herbicide that causes harm. This product package is a clear example of market power dictating which production system will dominate the landscape and marketplace, making it very difficult for a diversity of production systems and markets to coexist. In the case of some growers – such as organic soybean producers – they have no other option but to adjust planting times and hope their crops survive, and if they do, that they can achieve acceptable yields and maintain organic certification status of the product. The other option is to stop growing crops sensitive to chemical drift altogether. This latter option demonstrates just how large the threat of market power can be to the *existence* of production practices and systems that are in conflict with the dominant system.

Q. 13 and 17 Seed labeling does not sufficiently communicate IP protections or genetic background. There is a need to increase IP literacy and data accessibility.

We regularly hear from seed growers, farmers, plant breeders, and seed savers that there remains a dearth of information about IP protections on the seed they buy and if they should be worried about saving, breeding, or growing that seed to sell without that knowledge. We also hear from plant breeders who find it hard to navigate the IP system when they want to release a variety. For plant breeders and seed growers not affiliated with or connected to a university program or a commercial seed company, navigating IPR in the current seed system is *very difficult.*

Determining when and how IP protections apply to seed imposes undue burden on farmers and seed growers. At present, there is no industry standard that determines how information about IPR restrictions are transferred along the value chain. Instead, the onus of communicating IP is on the variety developer or the wholesaler who wishes to assert their rights, and the onus of seeking out information on IPR is on the end user who might be interested in saving their seeds. In a series of interviews with public and private seed growers conducted by OSA in 2021, nearly all seed growers interviewed referenced frustration at the lack of transparency about the way that information about IPR on seed is transferred along the seed value chain. One person, a former breeder who went on to work for a seed exchange network, said that "what is really missing from the picture is a platform where information on what is restricted and how it's restricted is transparent." Another university breeder agreed: "I don't think you're ever fully certain about what's possible [to breed with] and what's going to get you in trouble." There isn't a

comprehensive source of information about different types of restrictions on specific seeds. Therefore, people who are interested in working with new varieties of seeds must resort to researching multiple sources to identify the different ways a seed might be restricted by IPR. One grower explained their process:

> You could check the PVP database, and you could double check by searching Google patents. [Even then,] the commercial variety name that's listed in the catalog isn't often the same as the name listed on the patent. If the seed is sold in bulk, the patent number should be on the bag. But then somebody takes that bag and breaks it into a thousand seed packages, and they don't put the patent number on the label. So you can see how you wind up having patented seed in your hand and not know it.

The lack of transparency in the patent and license system, and the difficulty of navigating the patent database (see Q. 18), means that seed growers are often forced to operate in a legal gray area, and to accept the fact that they could be prosecuted for unwittingly violating IP rights about which they had no prior notice. While some might argue that it is the end user's responsibility to obtain "freedom to operate," the means for doing so at present require the seed grower to search multiple databases, which are cumbersome and difficult to navigate.

Further, some suspect that major seed companies might *intentionally* obscure the identity of varieties they patent to skirt certain patent requirements. For example, Jim Myers, the Oregon State University tomato breeder who introduced the first domesticated anthocyanin-pigmented tomato to the market, said that he has found patents for anthocyanin-pigmented tomatoes that make no mention of the breeding history required to achieve that phenotype:

> Now what I'm seeing in utility patents – and patent examiners are allowing this—is that companies are kind of glossing over the breeding history. I don't think they should be allowed to do that. For example, the Yoom tomato. This is Syngenta's Indigo tomato. They have it utility patented. I found what I think is the utility patent for Yoom. And [in the patent application,] the variety is numbered, it's not named. They're very cagey in there. They don't even really talk about the anthocyanins or the pigments of the fruit…

Patenting a variety by its number rather than its market name makes it extremely difficult for the public to ascertain whether the variety they've purchased has associated IP.

<u>Seed relabeling and the illusion of choice</u>

Relabeling is the practice of multiple seed companies selling the same variety under different names. For example, wielding dozens of proprietary trademarks, Monsanto has sold the same varieties of hybrid corn under different trade names to bolster the illusion that diverse options were being maintained. Many farmers are unaware of relabeling practices and the question remains: Why is this allowed?

In 2021, researchers conducted interviews with field corn producers in the Upper Midwest regarding their ability to assess and manage on-farm diversity in their fields without genetic

information about the seed they were planting.[56] Researchers identified the lack of genetic background information available to farmers, as well as this relabeling practice, decades ago.[57] But as concentration in the seed corn industry worsens, so too does genetic uniformity in our fields. It is possible for a farmer to unknowingly purchase the same variety from various companies labeled under different names. Farmers need to be aware of relabeling practices to avoid unknowingly planting the same variety, which is especially important to farmers who manage on-farm diversity by planting multiple varieties each year, and in particular for those planting a limited number of varieties on their farms.[58]

The marketing practice of seed companies labeling the same hybrid under different names is so prevalent in the US that the Farmers Business Network (FBN) built a business offering tools to navigate seed relabeling and genetic diversity, including the FBN Seed Finder. The Seed Finder database is populated with information from seed tags submitted to the company by farmers in the network. Farmers send photos of their seed tags to FBN; these tags include the original variety name per federal and state seed labeling regulations (see Figure 6). The FBN analyzes the seed tags and uses this information to populate the Seed Finder database. Farmers can then search varieties within the Seed Finder database to inform their planting choices. Among these details is the ability to see if a variety is being sold under different names and, if so, what they are. This helps ensure growers who purchase seed from multiple companies or multiple brands owned by the same company are not buying the same varieties relabeled as something else (see Table 3). According to their data, *about half of all corn and soybean seed on the market is relabeled.*[59]

[56] McCluskey, Cathleen and W.F. Tracy. 2021. "Engaging Farmer Stakeholders: Maize Producers' Perceptions of and Strategies for Managing On-Farm Genetic Diversity in the Upper Midwest," *Sustainability*, https://www.mdpi.com/2071-1050/13/16/8843/htm

[57] Smith, J.S.C. Diversity of United States hybrid maize germplasm; Isozymic and chromatographic evidence. *Crop Sci.* 1988, *28*, 63–69.

[58] McCluskey, Cathleen and W.F. Tracy. 2021. "Engaging Farmer Stakeholders: Maize Producers' Perceptions of and Strategies for Managing On-Farm Genetic Diversity in the Upper Midwest," *Sustainability*, https://www.mdpi.com/2071-1050/13/16/8843/htm

[59] McCluskey, Cathleen and W.F. Tracy. 2021. "Engaging Farmer Stakeholders: Maize Producers' Perceptions of and Strategies for Managing On-Farm Genetic Diversity in the Upper Midwest," *Sustainability*, https://www.mdpi.com/2071-1050/13/16/8843/htm

Figure 6. Two seed tags sent to the Farmers Business Network by farmers in their network. These tags are from two different seed companies who have given the same maize variety (10039423) two different product names: (a) seed tag sample from Beck's seed of variety 10039423 being sold as 5140HR; (b) seed tag sample from Seed Consultants, Inc. of variety 10039423 being sold as SCS10HR43.

Seed Company: Beck's
Product Name: 5140HR (brand name)
Variety Name: 10039423

Seed Company: Seed Consultants, Inc.
Product Name: SCS10HR43 (brand name)
Variety Name: 10039423

Table 3. Seed companies and their brands

Bayer	Syngenta	Corteva Agriscience	Agreliant
Dekalb	NK Seeds	Pioneer	AgriGold
Channel	Golden Harvest	Mycogen	LG Seeds
Fontanelle	Phoenix	Brodbeck *	Producers Hybrids *
Gold Country Seed	Innotech	Dairyland	Great Lakes *
Jung Seed Genetics	AgriPro	Pfister *	Wensman *
Kruger Seeds		Prairie Brand *	Golden Acres Genetics *
Lewis Hybrids		Agventure	Pride
REA Hybrids		Curry Seed Company *	
Specialty Hybrids		Hoegemeyer Hybrids	
Stone Seed		NuTech Seed	
Stewart Seeds		Terral Seed	
Hubner Seed		Doeblers Pennsylvania Hybrids *	
Westbred		XL Brand Distributed by Beck's Hybrids	
Asgrow		Power Plus Distributed by Beck's Hybrids	

Q. 14 The implications of seed industry mergers

The extent of mergers in the seed industry has resulted in unjust market power and negative consequences to US agriculture, many of which we described above, such as concentrated ownership of IP rights, less diversity and choice in the marketplace, higher seed prices, increased barriers to accessing germplasm, less innovation, and slower growth in underserved seed sectors, including organic. While the DOJ has at times required divestitures as part of merger approvals, these demands have been insufficient in protecting competition. For example, when Bayer acquired Monsanto, the DOJ required the German company to sell its vegetable arm, Nunhems. Although a smaller firm, KWS, made a bid for Nunhems, Bayer instead was allowed to sell this division (and others) to another German chemical company, BASF, which happens to be the fourth largest seed company. In this way, divestitures at times only serve as a re-shuffling of power at the top of the deck, since the market share of the largest firms still increases. It is possible that Bayer could acquire BASF down the road, which would return prior seed divisions back to the conglomerate.

Furthermore, while Bayer made promises of job growth and greater innovation as part of its case to acquire Monsanto, within two years of the merger being finalized, Bayer announced it would cut 12,000 jobs, or about 10% of its global workforce.[60] Seed companies also often decrease their variety offerings after mergers. In 2000, the world's largest vegetable seed company, Seminis, acquired several smaller international seed companies. The mergers resulted in a decision by Seminis to drop more than 2,000 varieties from production in a single season (25% of its product line).[61] Five years later, Seminis was acquired by Monsanto (and is now owned by Bayer).

Q. 18 Access to information on utility patents

For decades, the US Patent and Trademark Office has been aware that its database for granted and pending utility patents was cumbersome, difficult to search, and "did not provide users with the convenience or similar functionality as those used by [US PTO] examiners."[62] Even patent librarians formally trained by the US PTO tended to use either Google's patent search function or the European database Espacenet. It is unreasonable to expect farmers, seed growers, and plant breeders — those most equipped to answer questions about an application's legitimacy — to have the time to monitor such a system, especially considering that many farmers have limited access to technological resources. The US PTO made an attempt to address this issue earlier this year, with the introduction of the Patent Public Search tool, a web-based service that allows the public to search pending and granted public applications under one interface. While purported to be more user-friendly, the application still requires the user to have a computer that can run the program as well as working knowledge of field codes, Boolean, and proximity operators, as well as the time to search for pending applications pertinent to their crops.

[60] BBC News. 2018. "Bayer to cut 12,000 jobs and sell," November 29.
[61] "Earmarked for Extinction?" RAFI-USA, July 17, 2000, https://www.etcgroup.org/sites/www.etcgroup.org/files/publication/318/01/geno_earmarked.pdf
[62]https://www.uspto.gov/about-us/news-updates/uspto-launches-new-patent-public-search-tool-and-webpage

As of now, the submission of third party references of prior art are quite rare. In February 2022, a writer at patentlyo.com reported that "Out of every 10,000 issued patents [across all sectors], only about 14 include prior art submissions from third parties."[63] While the efficacy of the Patent Public Search tool has yet to be seen, the fact remains that b*reeders and seed growers who have no intention of pursuing utility patents for the seeds they work with should not be expected to defensively monitor patent applications that might encroach or inhibit their freedom to continue working with those seeds.*

Further, 35 U.S.C. § 122 provides patent applicants the ability to request that their application not be published so long as the patent is only filed in the US and not internationally. This means that some patents may not even be publicly available for review until after the patent is already granted. The public, therefore, is inhibited in its ability to support the prior art search, both by a lack of access to information, and by the lack of resources to execute the kind of searching and monitoring such a process would require to be effective. In sum, the US PTO should not expect the public to fill the gaps patents examiners are unable to meet due to insufficient agency funding, when in fact the problem persists that conducting prior art searches on plant phenotypes is an impossible task at the outset. The USDA should establish an office to monitor these patents and patent applications per our recommendations below.

Q. 19 Concerns or challenges related to data

In general, we believe growers should have the freedom to opt into data sharing as opposed to being forced into data-sharing agreements to access inputs, including licensing agreements that accompany some seed purchases. For example, "technology stewardship agreements" require growers to sign away their federal privacy act rights and grant technology owners permission to review government crop records for their farm.[64] These agreements also give technology owners permission to examine and copy their customers' records and receipts. There are also numerous documented cases of farmers being intrusively investigated for alleged patent infringement in ways that are an assault to personal freedoms, including privacy. (See Q. 9, 11, 15 - 16).

Q. 20 The dominant seed system ignores the needs of underserved communities (including tribal) and markets (including organic) and lacks resiliency in the face of climate change

We appreciate that the USDA is examining impacts to historically underserved growers and the communities they feed. Some of these communities are navigating the current IPR system with the goal of protecting culturally important varieties from corporate appropriation while identifying meaningful strategies for ensuring these varieties can continue to co-evolve with their communities in perpetuity.[65] Other communities are navigating the process of establishing their

[63] Crouch, Dennis. 2022. "USPTO Third Party Submissions," Patentlyo. February 2.
[64] See Bayer's Technology Use Guide for licensing agreements stipulating these terms: https://tug.bayer.com/tsa/united-states/
[65] Personal communication, Reagan Wytsalucy, member of the Navajo Nation, May 20, 2022.

own seed banks to protect culturally important varieties from being patented and to ensure future generations have access to them.[66] The ability to save seed, to maintain the integrity of culturally important varieties (e.g., without fear of GMO contamination), and to adapt plants to changing climates (e.g., drought conditions) are common themes in conversations with members of historically underserved communities. There is also a fear of drawing too much attention to the varieties they steward for fear of appropriation (e.g., putting them in public seed collections or prior art registries). As already stated, the IPR system is difficult to navigate unless you are a multinational company with a legal team leading this work.

Recommendations

Q. 22 USDA policies and programs could do more to facilitate access to seeds. Congress also has a role to play in enhancing competition in our seed system and addressing problems with the current IP system.

There are a number of policies, practices, tools, investments, and strategies that the USDA can adopt to enhance competitiveness in seed. Some of these were described under our recommendations related to the IP system above. The USDA can also support competitiveness and the resiliency of US agriculture in the face of climate change by increasing investments in public plant breeding projects; requiring these projects to remain in the public domain (free from seed-saving, breeding, and research restrictions); increasing capacity within the National Plant Germplasm System and addressing IP and access concerns; supporting access to organic seed; and ensuring that market dominance does not place growers in a position where they feel forced to plant specific seed products because coexistence with these products is infeasible.

- The USDA could support and/or host a reliable database for all commercially available organic seed to support the competitiveness of this sector.

- The public plant breeding sector serves as an important complement to the private seed trade. Congress and USDA should ensure that public programs are well funded to ensure a resilient and diverse seed supply and to train the next generation of plant breeders. Public funding of new plant varieties pales in comparison to private spending, and the gap is ever widening. The public plant breeding sector often focuses on grower needs and markets underserved by the private trade, including the organic market, varieties bred for specific regions and environmental conditions, and a diversity of crops that the private sector doesn't view as lucrative. Our public plant breeding programs, coupled with our public seed collections, are essential strategies in helping US agriculture adapt to changing climates – more extreme and unpredictable weather patterns and temperatures – and mitigate the consequences.

- In small grains specifically, there is a pressing need to support alternative seed distribution systems (e.g., business support for small grains seed production and distribution and support for seed increases of non-IP restricted varieties).

[66] Personal communication, Rudy Arredondo, National Latino Farmers and Ranchers, May 25, 2022.

- Supporting the research and education needs of seed producers is a major gap in USDA's competitive research grant funding. The USDA should identify seed producer challenges as a funding priority throughout NIFA grant programs.

- The USDA should consider the appropriate role of federal agencies in monitoring the patenting of public research, especially when broad dissemination is in the best interest of the public. In particular, the USDA should ensure that publicly funded plant breeding and other seed research remains in the public domain (free from restrictive IPR) by including language in contracts with their competitive grant program awardees that restricts the patenting of publicly developed varieties and requires seed-saving, breeding, and research exemptions for users of grant-funded products.

- The National Plant Germplasm System (NPGS) is more important than ever as seed becomes more privatized and access to germplasm is limited or outright restricted. Unfortunately, there remain huge backlogs for germplasm requests and maintenance at NPGS facilities. The state of *in situ* conservation efforts nationwide is in crisis mode. For example, many farmers report not having requests fulfilled as well as not having access to quantities necessary for variety trials. The USDA and Congress should ensure that our public seed collections have ample resources, staffing, succession planning, accession grow-outs, and a better cataloging system. These public seed collections should be kept public through policies and strategies that keep these collections in the public domain – free from seed-saving, breeding, and research restrictions. The USDA should also work with historically underserved tribes and other communities to return seed back to original stewards and to properly acknowledge original stewards in the collections.

- The USDA can also level the playing field in the context of who pays for failed coexistence between different production systems and markets. In our comments above, we detailed how unchecked market power has led to the approval and mass planting of seed technologies that are wreaking havoc on ecosystems and growers' livelihoods and markets. Dicamba-tolerant crops is one example of how unequal the playing field is in our agricultural markets and landscapes. One product is being allowed to dominate the market and landscape at the expense of coexistence. Leveling the playing field means growers having a genuine choice in what they produce and for what market, and the ability to coexist without fear of harm. "Defensive planting" of dicamba-tolerant crops is the epitome of unchecked market power forcing American farmers into a product.

Q. 23 Recommendations for improving the IP system

The current IP system, as it relates to seed, suppresses competition and innovation, and infringes on the freedom of farmers. It is our view that the current patent system is being misused – in some cases outright abused – to the detriment of open access to germplasm, public and private research, choice in the seed marketplace, and the resiliency of our food and farming systems. Our recommendations for improving the current system focus on transparency of IPR associated with seed on the market; ensuring access to protected plant genetics for breeding, research, and seed-saving purposes; ensuring thorough and consistent reviews of patent applications for seed and

genetic traits, including reviews of prior art; relying on the Plant Variety Protection Act as the strongest IP for sexually reproducing plants; and transferring liability for harm caused by protected products to the IP owner.

- The US PTO and USDA should partner on a coordinator position and office to serve as a liaison between the two agencies to improve transparency and monitoring of plant genetics protected by utility patents, and to address complaints. The office should also collaborate on a regularly released newsletter and easily navigable database *specific to plants/genetic traits* that are under review for a utility patent or have already been awarded IP. US PTO's existing databases continue to be challenging to navigate. Furthermore, to increase transparency, patent applicants should not be allowed to be kept from the public while under review. This may require an act from Congress (see Q. 18).

- Because research regarding patent ownership has not been updated, we do not have access to current statistics on utility patent ownership and which entities are benefiting most. It would be helpful to have transparent data from the US PTO on utility patent ownership on plant varieties, plant genetic traits, and phenotypes.

- The US PTO can leverage the existing patent librarian network to disseminate information about patents associated with seed.

- The internal US PTO policies and procedures need to be made consistent to cover all databases and resources regarding prior art.

- Funding for the US PTO should be a public source given that they technically provide a public service. The fee-for-service model rewards fast-paced reviews and does not center the public good.

- Utility patents should not be awarded for plants, plant parts, and genetic traits. The 1970 Plant Variety Protection Act should be re-established as the strongest IP protection for sexually reproducing plants as intended by Congress.

- The US PTO should explore integrating a mechanism for listing all current market names associated with patents related to plant varieties.

- The USDA can develop rules that require seed companies to communicate IPR on seed labels.

- The USDA should conduct a survey of PVP owners to better understand how they are being enforced and if they are being used as the law intended, primarily the exemptions for seed-saving and breeding and research are being honored.

- Congress should re-evaluate the Bayh-Dole Act in the context of publicly funded plant breeding and other seed research. These findings should inform changes to the law, as well as changes to IP policies at universities and federal agencies administering research grants. Before Bayh-Dole, patenting and licensing policies varied between federal

agencies given their differing missions and research and development programs. Plant breeding is a field of research that relies on the free exchange of germplasm and knowledge to succeed as a discipline and serve the public good. Therefore, agencies administering plant breeding grants should implement clauses in these contracts to ensure publicly funded research remains in the public domain.

Q. 24 Recommendations for improving antitrust enforcement

- Our response in Q. 2 details the harms already experienced by farmers as a result of mergers, in the form of reduced seed availability and higher prices. As RAFI-USA stated in our comment (docket FTC-2022-0003) on modernizing the enforcement of antitrust laws regarding mergers, we believe that changes are necessary.

- Assessment of the impact of potential mergers must be broad and holistic, acknowledge the harms of the existing level of concentration, and pay close attention to the impacts of regional concentration. Regional impacts are important for farmers generally, given that farmers invest deeply in their land and soil and so geographic movement is not a realistic option. When it comes to seed, an additional concern must be considered: the suitability of seed varieties for various climatological and ecological conditions. There is no single seed variety of a crop that will be ideal for farmers across the nation. When a national or multinational seed company is pursuing efficiency and the greatest return on investment, it will concentrate on varieties that serve the greatest number of farmers - for example, midwestern farmers when breeding soybean and corn varieties. This has left out farmers in other parts of the country - the Southeast, for example. For a healthy and resilient food system with a robust diversity of seeds and genetics available to adapt to increasing climate disruptions, we will also need a robust diversity of plant breeders and seed companies within and across regions. Antitrust regulators must take these specifics into account when assessing the impact of seed company mergers.

- Renew a strong public commitment to enhance and enforce antitrust laws the way they were originally intended: to curtail combinations of market power that limit entry to those markets, increase prices, decrease innovation and marketplace options, and monopolizes any one market.

- We also support a moratorium on new merges in the agricultural sector and a statutory cap on levels of concentration in agricultural markets.

- Congress and the courts should reject coercive and oppressive seed sale contracts and promote balanced model contracts with regulatory requirements for seed companies to adhere to them.

Conclusion

We must step up our response to the misuse of utility patents on seeds and restrictive licensing agreements, and work to decentralize our nation's plant breeding, seed production, and distribution systems. Because of the complexity of IP issues, especially as they pertain to seed, the role of numerous decision makers and stakeholders must be considered in the policy pathway moving forward, including historically underserved growers who want to reclaim stewardship and sovereignty over their seed supply. The pathway forward must clearly articulate which forms of IP protections are appropriate for supporting a diverse and resilient seed supply that can grow and adapt to our climate crisis.

Agrochemical and biotechnology companies that control much of our seed supply have merged with or acquired a significant number of competitors, and though some have drawn antitrust scrutiny, no meaningful action has been taken to further investigate the impacts of this level of consolidation and break up "Big Seed." Independent seed companies say the licensing agreements they sign with larger firms unreasonably restrain competition. University breeders say these agreements keep them from conducting important research on protected products. And growers have been stripped of their time-honored right to save seed. The public must be protected from predatory practices that ultimately hinder innovation, independent research, and the resiliency and security of our seed and food supplies.

The balance of power is currently tipped toward IP owner rights and away from the public interest. This imbalance must be seriously considered as part of any investigation that includes a hard look at the interface of IP laws and antitrust laws. For starters, restrictions on research, germplasm exchange, and seed saving must be removed from IPR associated with seed, including licensing agreements, since independent breeding, research, and farm adaptation relies on access to protected germplasm for purposes of innovation and information sharing.

For all proposed and pending acquisitions and mergers that could result in higher concentration ratios among the biggest players, the DOJ and USDA should establish a public process that assesses how the merger will impact the structure of agriculture. This assessment should be made public with ample opportunity for public comment prior to any governmental action on the merger. Given the level of concentration in seed and other agricultural sectors, we strongly support a moratorium on major agricultural mergers.

Antitrust law must be enforced when there is evidence of anticompetitive conduct. If the DOJ determines that anticompetitive conduct exists as a result of concentration in the seed industry or an abuse of patent and licensing rights, it should use all remedies at its disposal through the Sherman Antitrust Act and Clayton Antitrust Act to eliminate these practices. Breeders and growers deserve to operate freely, without fear of infringing patent rights or conducting research that could reflect poorly on industry. And farmers deserve an open and fair marketplace that encourages innovation and provides a variety of seed options at competitive prices.

Utility patents are the wrong tool for awarding IP to plant developers. Their application, especially coupled with restrictive licensing agreements, has resulted in devastating economic and social consequences. Utility patents should not be awarded for seeds and plants, or for any living organism for that matter. Though not a silver bullet to the multifarious challenges discussed in our comments, confronting the abuse of patents and other restrictive forms of IPR is

paramount to building broad support for decentralized models of plant breeding, seed production, and distribution that center diversity, equity, and shared benefit.

While the scope of patentable subject matter under the utility patent statute is incredibly expansive, the Plant Patent Act and Plant Variety Protection Act were concerted efforts by Congress to bring asexually reproducing plants, and later, sexually reproducing seeds, under the scope of IP protection in a thoughtful way. Each Act was applicable to highly specific types of plants, dealt with infringement in different ways, and most notably, the PVPA included a seed-saving and research exemption. Such deliberate language would have been practically useless if utility patent protection was available for plants at the time. The expansion of patentable subject matter under the utility patent statute to include plant varieties, genetic traits, and phenotypes has played an enormous role in the rapid consolidation of seed industry power in recent decades.

The public needs tools and other forms of support to understand and access information about existing patents on seed. Many farmers, seed growers, plant breeders, and seed savers relay that they often don't know if they are infringing a patent, and it's difficult to find out. This reality creates undue fear in our universities, on our farms, and in our backyards, serving as another barrier to innovation and our ability as a society to co-evolve with the seeds that sustain us.

Preliminary data on land grant universities' patenting and licensing behavior show how the current IP system associated with seeds is detracting from the public good. Specifically, it is affecting public institutions' innovation strategies for plant variety breeding and licensing. Data suggests that universities are not choosing companies or agreement models that allow these public plant variety innovations to be shared widely with regionally relevant partners.

Thank you again for the opportunity to provide comments regarding the state of competition in the seed industry and the effectiveness of the current IP system. Please let us know how we can support your efforts moving forward.

Respectfully,

Kiki Hubbard
Organic Seed Alliance

Margaret Krome-Lukens
Rural Advancement Foundation International – USA

Liza Wood
Center for Environmental Policy and Behavior
University of California, Davis

Appendix A: Sample seed packet licensing agreement (“bag tag”)

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Appendix B: BASF letter to seed companies communicating patent rights

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U2004.0010 / Nunhems' Utility Patent applications

NUNHEMS B.V. is an international vegetable seed company which is occupied with research, sales, marketing and production of (seed of) vegetable varieties for the professional market. It has registered offices at Napoleonsweg 152, 6083 AB Nunhem, Municipality of Leudal, The Netherlands.

It is NUNHEMS' mission to deliver the best products to our customers. For this reason, NUNHEMS protects the results of its breeding and research activities by intellectual property rights, including Patent and Plant Variety Protection.

In conjunction with this policy, NUNHEMS has filed Utility Patent applications, listed under U.S. Patent application numbers and issued patent numbers in Annex A.

The protection of U.S. Patents and applications covers all the material and information described in the claims (as can be found on http://patft.uspto.gov/).

I. Patents and Patent Applications on Plant Traits and Methods

Publication # PCT	Publication # US	Title	Varieties Containing Trait
WO2009059777	US8710303 B2 (US2011047642)	New cucumber plants with a compact growing habit	Hi Jack; Hi Power; Hi Tona; Hi Lisa; Hi Land; Hi Force; Ad Raise F1
WO2009092560	US8816155 B2 (US2011041217); US8704045 B2 (US2012045565); (US2010319081); US9986700 B2	Onions with high storage ability, high soluble solids content and/or low pungency	S7210 (⁺Sunions™)
WO2010142465	US9532520 (B2) (US2012084881) (US2015156978)	Drought tolerant plants	
WO2012069539	US10517249 B2 US9763399 B2 (US2013152223) (US2014020139)	Dual Purpose Pollenizer Watermelons	
WO2013120781	US10433512 B2 US10582683 B2 (US20170156278) (US2015040265)	Triploid watermelon plants with a *bush* growth habit	
WO2013127988	US9603319B2 (US2015216137)	TSWV resistant Capsicum plants	
WO2013135726	US9551008 B2 (US2015047067)	Tomato plants with intense phenotype and TYLCV resistance	NUN 03484 TOF (NUN 03484); NUN 03485 TOF (NUN 03485)
WO2014049002	US9622430 B2 (US20150237816)	Solanum lycopersicum plants having non-transgenic alterations in the ACS 4 gene	
WO2014079896	US9832943 B2 (US2015282446)	Solanum lycopersicum plants having non-transgenic alterations in the ACS 2 gene	
WO2014090968	US10034441 B2 (US2015313107)	Melon plants with Melon Yellowing associated Virus (MYaV) resistance	
WO2014118150	US9901047 B2 (US2015366152)	Solanum lycopersicum plants having pink fruits	
WO2015036469	US2019185878 A1 US10258002 B2	Spinach plants that are resistant to downy mildew (RPF12 gene)	Cepheus; Pegasum; Serpens; Canopus;

Publication # PCT	Publication # US	Title	Varieties Containing Trait
	(US2016177330) (US2017027127)		Regor, Cursa
EP2848114	US9624507 B2 US10258001 B2 (US2017027126)	Spinach plants that are resistant to downy mildew (RPF11 gene)	Hydrus; Volans; Canopus, Virgo, Antalia, Canopus, Scultptur, Eridanus, Nembus
WO2015040098	US2019014732 A1 US10212898 B2 (US2016205886)	Plants with an intense fruit phenotype	
WO2015185475	US10334797 B2 (US2018146633)	Melon plants with a dominant Melon Yellowing Associated Virus (MYAV) resistance gene	
WO2015177206	US10362742 B2 (US2017202168)	Melon plants with Whitefly Resistance	
WO2015136085	US10440914B2 (US2016374303)	Bremia lactucae Resistant Plants*	
WO2008119618	US9364014B2 (US2010104728)	Process of Producing Tomato Paste	
WO2016059090	US10306851 B2 (US2017238493)	Yield QTLs in Cucumber Plants	
WO2016059092	US10306850 B2 (US2017238492)	Yield QTLs in Cucumber Plants	
WO2016066748	US2017318770 A1	Lettuce Plants Comprising Resistance against Nasonovia ribisnigri Biotype 1	
WO2016113329	US2018049384 A1	Citrullus lanatus producing fruits with high texture fruit flesh	
WO2016177696	US2018288960 A1	Introgression of a Yield QTL in Cucumis sativus Plants	
WO2017012951	US2018208628 A1	New species of Tobamovirus	
WO2017060350	US2018310514 A1	Watermelon Plants with Cucumber Vein Yellowing Virus (CVYV) Resistance	
WO2017178520	US2019110426 A1	Introgression of Two Yields QTL in Cucumis sativus Plants	
WO2017202715	US2019194672 A1	Seedless Fruit Producing Plants	
WO2018011075		ToLCNDV Resistant Melon Plants	Coliseo
WO2018060444		Parthenocarpic Watermelon Plants	

Publication # PCT	Publication # US	Title	Varieties Containing Trait
WO2018193044		TOLCNDV Resistant Melon Plants	
WO2019068647		CGMMV Resistant Citrullus Plants	
WO2019068647		Complete Resistance to Downy Mildew in Basil	
WO2019145446		Spinach Plants Resistant to at least Peronospora farinosa Races 8 and 10 to 16	
WO2019145447		Spinach Plants Resistant to at least Peronospora farinosa Races 8, 9, 11, 13, and 16 a	

II. Utility Patents and Utility Patent Applications on Varieties

Application Title	Commercial name of variety	Publication Number	US Patent Number
Artichoke			
Hybrid Artichoke variety NUN 4060 AR	Sambo	US2012/0227122	8,669,420
Hybrid Artichoke variety NUN 04325 AR	Green Queen	US2014/0053292	9,398,748
Artichoke variety NUN 04455 AR	Green Triumph	US2018/0070546	10,212,909
Carrot			
Hybrid carrot variety PURPLE ELITE	Purple Elite	US2013/0305401	9,000,266
Hybrid carrot variety PURPLE SNAX	Purple Snax	US2013/0305403	9,012,724
Hybrid carrot variety Rebel	Rebel	US2013/0305402	8,952,220
Hybrid carrot variety TROOPER	Trooper	US2013/0239242	9,131,650
Hybrid carrot variety SLENDERCUT	Slendercut	US2013/0247241	9,012,725
Hybrid carrot variety NUN 89141 CAC	Snow Man	US2013/0305404	8,962,923
Hybrid carrot variety NUN 85180 CAC	Hoss	US2013/0263305	9,480,211
Hybrid carrot variety NUN 85190	Bulldog	US2014/0173772	9,060,476
Hybrid carrot variety NUN 85021 CAC	Eaglepak	US2014/0182007	9,006,516
Hybrid carrot variety NUN 85931 CAC	NUN 85931 CAC	US2014/0245473	9,107,356
Hybrid carrot variety NUN 89849 CAC	Rubyqueen	US2015/0201573	9,480,212
Hybrid carrot variety NUN 85933 CAC	Highcut	US2017/0142921	10,327,403
Carrot Variety NUN 85192 CAC		US2019/0174698	
Carrot Variety NUN 85936 CAC		US2019/0174699	
Carrot Variety NUN 89853 CAC		US2019/0183083	
Carrot Variety NUN 85935 CAC		US2019/0313592	
Cucumber			
Cucumber variety NUN 5545 CUP	Logan	US2013/0074203	9,234,207
Cucumber variety NUN 52007 CUP	Tacana	US2015/0181825	10,201,145

Application Title	Commercial name of variety	Publication Number	US Patent Number
Cucumber variety NUN 55513 CUP	Prolix	US2015/0181826	10,172,315
Cucumber variety NUN 53016 CUP	V 5016	US2015/0181827	10,172,316
Cucumber variety NUN 43003 CUL	Sepire	US2016/0007550	10,098,311
Cucumber variety NUN 53019 CUP		US2016/0021840	10,064,352
Cucumber variety NUN 53025 CUP	V 5025	US2017/0086403	10,264,753
Cucumber variety NUN 53031 CUP	V 5031	US2017/0079231	10,271,504
Cucumber variety NUN 55516 CUP		US2018/0077889	10,492,409
Cucumber variety NUN 52010 CUP		US2018/0184605	10,448,592
Cucumber variety NUN 52011 CUP	V 5211	US2018/0184609	10,455,785
Cucumber variety NUN 51024 CUP	Proscore	US2018/0368350	
Leek			
Leek variety Nun 08412	Nunton	US2013/0202775	9,179,637
Leek variety NUN 10401 LEL	Chiefton	US2017/0332596	10,219,465
Leek variety NUN 50215 LEL	Shafton	US2018/0184611	10,206,354
Lettuce			
Lettuce variety Intred	Intred	US2012/0137383	8,754,293
Lettuce variety NUN 09050 LTL	Multigreen 50	US2014/0289883	9,380,756
Lettuce variety NUN 09055 LTL	Multired 55	US2012/0144517	8,796,512
Lettuce variety Multigreen 60	Multigreen 60	US2013/0145504	9,144,223
Lettuce variety Multigreen 57 LTL	Multigreen 57	US2013/0219544	9,198,395
Lettuce variety NUN 06075 LTL	Luminous	US2013/0247244	9,198,396
Lettuce variety NUN 06109 LTL	Copious	US2015/0313171	9,999,197
Lettuce variety NUN 09070 LTL	Skrunch Red 70	US2015/0320004	9,426,965
Lettuce variety NUN 06117 LTL	Vicious	US2016/0295826	9,913,452
Lettuce variety NUN 09085 LTL	Greenflash	US2016/0316709	9,756,829
Lettuce variety NUN 06773 LTL	Themes	US2017/0359993	10,334,806
Lettuce variety NUN 09102 LTL	Skrunch 102	US2018/0255742	10,575,484
Lettuce variety NUN 09131 LTL	Elemental	US2018/0255722	10,561,092
Lettuce variety NUN 05379 LTL	Batigol	US2018/0255740	10,561,093
Lettuce variety NUN 00162 LTL	Nupic	US2018/0255741	10,595,487
Lettuce variety NUN 09094 LTL	Thorflash	US2018/0288959	
Lettuce variety NUN 09127 LTL	Bravaflash	US2018/0359979	
Lettuce variety NUN 07839 LTL	Tearflash	US2019/0274271	
Lettuce variety NUN 09117 LTL	Skrunch 117	US2019/0037794	
Lettuce variety NUN 6040 LT	Coraton	US2019/0110424	
Lettuce variety NUN 06193 LTL	Technova	US2019/0223400	
Lettuce variety NUN 09111 LTL	Multigreen 111	US2020/0077609	
Lettuce variety NUN 09148 LTL		US2020/0077610	
Lettuce variety NUN 01201 LTL		US2020/0068830	
Lettuce variety NUN 06147 LTL	Momentous	US2020/0068832	
Lettuce variety NUN 06132 LTL		US2020/0068831	
Melon			

Application Title	Commercial name of variety	Publication Number	US Patent Number
Melon variety NUN 1101 ME	Sunny Dee	US2012/0311731	8,742,209
Melon variety NUN 26181 MEM	Sense 181	US2014/0123333	9,210,849
Melon variety NUN 26191 MEM	Sense 191	US2014/0109252	9,185,859
Melon variety NUN 35007 MEM	Crispy Pear	US2015/0143572	9,516,826
Melon variety NUN 21267 MEM	Silverock	US2015/0156980	9,516,827
Melon variety NUN 26357 MEM	Sweet East	US2015/0156981	9,516,828
Melon variety NUN 26147 MEM	Durawest	US2016/0073603	9,844,194
Melon variety NUN 16121 MEM	Zielo	US2016/0157451	9,867,342
Melon variety NUN 31017 MEM	Silverball	US2017/0042107	10,154,631
Melon variety NUN 71504 MEM	Crispy frost	US2017/0064917	9,980,447
Melon variety NUN 22521 MEM	Sunglow	US2017/0105375	9,980,449
Melon variety NUN 16215 MEM	Zentauro	US2018/0077890	10,334.798
Melon variety NUN 68106 MEM	Coliseo	US2018/0206444	10,463,006
Melon variety NUN 12105 MEM	Sunpeek	US2019/0104701	
Melon variety NUN 16227 MEM	Zendero	US2019/0320608	
Melon variety NUN 16108 MEM	Sense 108	US2019/0297817	
Melon variety NUN 75015 MEM	Crispy Dream	US2019/0327924	
Melon variety NUN 76267 MEM	Mokaya	US2020/0077612	
Melon variety NUN 76307 MEM	Tanager	US2020/0077613	
Melon variety NUN 76207 MEM	Turan	US2020/0077611	
Onion			
Onion variety NUN 03010 ON	Sofire	US2013/0180002	9,516,851
Onion variety DULCIANA	Dulciana	US2014/0007274	9,591,816
Onion variety NUN 2002 ON	NUN 2002 ON	US2015/0319948	9,578,821
Onion variety NUN 08003 ON	Rhea	US2016/073604	9,516,825
Onion variety NUN 17210 ONL	S7210 (+Sunions™)	US2016/0128290	9,986,700
Onions of variety I37853B, I37554A, I37554B, and progeny thereof with high storage ability, high soluble solids content and/or low pungency	NUN 17210 ONL	US2011/0041217	8,816,155
Onion variety NUN 07206 ON	Airoso	US2017/0142922	
Pepper			
Pepper variety NUN 70048 PPH	Aviator	US2018/0160640	
Pepper variety NUN 89004 PPS	Summak	US2019/0320609	
Pepper variety NUN 89006 PPS	Tapuni	US2019/0082647	
Pepper variety NUN 89007 PPS	Katzi	US2019/0327927	
Spinach			
Hybrid spinach variety ANDROMEDA	Andromeda	US2012/0222147	8,563,807
Spinach variety NUN 05004 SPS	Alcor	US2018/0098518	10,349,593
Spinach variety NUN 06258 SPS	Crater	US2019/0230880	
Spinach variety NUN 05048 SPS	Minkar	US2018/0317416	10,383,300
Spinach variety NUN 06202 SPS	Tabit	US2018/0317417	10,463,001

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A United States patent prevents, among other things, the unauthorized use of the patented technology and/or germplasm. Therefore, unlicensed or unauthorized use of NUNHEMS' technology and/or germplasm covered by one or more claims of the U.S. Utility Patent Applications or issued patents listed in Annex A is a violation of NUNHEMS' intellectual property rights.

We invite you to contact us for more information about the U.S. Utility Patent Applications or issued patents listed in Annex A That includes requests for a non-exclusive license in the event that you wish to use any of the technology covered by any of these Patent Applications or issued patents.

Yours sincerely,

Nunhems B.V.

Rob Huijten
Head of Legal & Industry Affairs

Annex: 1