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Concentration and IPRs in the Seed Industry: a View From the USA

By Jack Kloppenburg (Professor Emeritus, Department of Community and Environmental Sociology,
University of Wisconsin-Madison; Secretary, Open Source Seed Initiative)

Although seed industry concentration and the expansion of intellectual property rights (IPRs) are global phenomena, they appear in different ways depending on the specific legal, political and economic conditions in a particular country. For example, while USA law enforces the most extreme restrictions associated with patenting, its regulations also permit almost complete freedom to breed and market new plant varieties. In contrast to most other places in the world, the USA has no mandatory registration of varieties, no Common Catalog or national seed list, no VCU testing, and minimal marketing requirements. With this essay, I hope to provide colleagues and allies around the world with some insight into how the common challenges we face are being manifested in the United States.

The occasion for producing this essay was an open invitation in May 2022 from the United States Department of Agriculture (USDA) to provide input on anti-competitive market structures in the seed sector, and specifically how they relate to the intellectual property system. This USDA action is part of a broader initiative of the Biden Administration on “Promoting Competition in the American Economy.” A similar undertaking under Obama went nowhere, and I do not expect this one to have more success than its predecessor. Still, we do what we can. The USDA plans to release a report early in 2023. What follows is the commentary that I provided to the USDA.

The increasing concentration of market power – and therefore also political power, scientific power, and discursive power – in an increasingly small number of corporations is for me the defining social issue facing the world. This is true across all productive sectors and is just as acute in agriculture as it is in communications or pharmaceuticals or energy. Because crop production is the ultimate material foundation on which all human societies depend, the implications of concentrated market power in agriculture are very important indeed. And because the seed is the critical nexus of agricultural production processes, the seed sector merits very close attention and concern.

I welcome the USDA’s exploration of market power in the seed sector, and its focus on the way in which increasing concentration and the expansion of intellectual property rights (especially, but not limited to patents) have been mutually reinforcing. But I do wish to emphasize that the seed sector must be understood to include plant breeding. Seeds are themselves the product of complex processes of human ingenuity and labor undertaken by public and private firms, institutions and individuals. Increasingly, plant breeding has also been concentrated in fewer and larger firms. And intellectual property rights are deeply implicated in the transfer of this key activity from individuals and public institutions into the labs and fields of a corporate oligarchy comprised of the likes of Bayer, ChemChina, Corteva, and BASF.

The consolidation in the last few years of the “Big Six” (Monsanto, Bayer, BASF, Syngenta, Dow, Dupont) into the “Big Four” (Bayer, ChemChina, Corteva, BASF) has surely caught the USDA’s attention. And its attention to the traditional antitrust concerns about the effect of concentration on competition, prices, and innovation is warranted. But, really, the stakes are much, much higher. We really need to ask how the plant breeding and seed sector will stand up to the four horsemen of our current apocalypse: pandemics, geopolitical upheaval, climate change and uniformity.

The COVID pandemic has revealed just how fragile the supply chains of the globalized economy are. Seed production is global. Large companies depend on globally dispersed fields for counter-seasonal breeding and seed production. The war in Ukraine has revealed how quickly and unexpectedly supply chains and entire markets can be disrupted by geopolitical events. Climate change is rapidly advancing and will require equally rapid development of new cultivars for new conditions as temperatures, rainfall regimes, and pest and disease challenges proliferate. Finally, the ability to respond effectively to these challenges may be seriously limited by the uniformity of thought and imagination that comes with the concentration of

scientific and technical decision-making into the board rooms of a handful of companies attuned not to socially or ecologically desirable objectives but to the dictates of the bottom line. This uniformity of thought translates to crop genetic uniformity, and subsequently crop genetic vulnerability.

If the problem is concentration, the solution likely involves some element of de-concentration. That might mean breaking up the concentrated market actors, which is the traditional anti-trust approach. But that route is always politically difficult. There is another way. The USDA can act to support the generation of diversity: social diversity, economic diversity, scientific diversity, genetic diversity. This is what we might call the generative option and – while not without serious challenges, after all it requires a reorientation of resources – its emphasis is on what can be built and encouraged rather than on what must be constrained and regulated. To meet and unseat those Horsemen and to flourish, I think we need to deploy all of the ingenuity and imagination and energy and skill that we can mobilize in order to allow diverse breeders to generate diverse cultivars for diverse ecosystems for diverse farmers for diverse eaters.

PLANT BREEDING AND CULTIVAR DEVELOPMENT

Although much attention has been paid to the highly visible consolidation of the “Big Six to the Big Four,” the structure of the seed sector is in fact poorly documented and deserves much more study. It is sometimes argued that there are many independent seed companies not owned by the Big Four. This is true, but what is less well known is that the varieties offered by those “independent” companies are usually varieties bred by or containing material developed and licensed by the dominant firms. Concentration of market power is paralleled by concentration of breeding effort. Since breeding objectives are oriented to the most lucrative markets, there is a convergence toward varieties in a few crops that are very similar in genetics and traits. This genetic uniformity is hidden from farmers and is further obscured in the market by the common practice of “relabeling” in which a single variety is marketed by different companies under different brand names. As breeding technologies and practices become more complex and expensive, fewer firms are able to compete. The Big Four are largely focused on recombining a narrow set of elite lines in a narrow set of lucrative crops (e.g., corn, soy, cotton, canola) while adding a similarly narrow set of “stacked” GM traits. Market concentration means genetic concentration and genetic concentration means genetic vulnerability. The problem of concentration of breeding effort in the private sector is compounded by the secular erosion of public plant breeding capacity generally, and the diminution of finished cultivar development specifically (for recent and excellent documentation see Shelton and Tracy 2017). Pushed out of cultivar development, too much of public capacity has been relegated to a subordinated, complementary provision of “pre-breeding” and “germplasm enhancement” which serve and subsidize the narrow objectives of private seed companies.

A robust public option could and should be available to counterbalance the narrow breeding objectives that are pursued by a concentrated private sector elite narrowly motivated by market incentives. The federal Agricultural Research Service

(ARS), the 1862 and 1890 Land Grant Universities, the Tribal Colleges and Universities, and the state Crop Improvement Associations were constituted to serve farmers and the public interest and they can and should be recalled to this mandate. There are indeed still truly independent seed companies – some legacy, some start-up, many very small – that provide a firm foundation for deconcentration/generation. Further, there is a substantial and overlooked set of independent/freelance breeders, many with affiliated small seed companies, who are doing what the Big Four are not doing – developing open-pollinated, organic, value-added, and regionally/locally adapted varieties for agroecological and sustainable farmers and gardeners (see osseeds.org and Deppe 2020). Together, the public sector and the alternative private sector can be a powerful platform for deconcentrating plant breeding and thereby the seed market. Supporting these actors will have the effect of significantly spurring innovation regardless of how the concentrated sector of conventional breeding and seed sales is treated.

A generative approach to diversifying the plant breeding and seed sector could involve:

- revitalizing plant breeding (and specifically finished cultivar development) at public institutions (the Agricultural Research Service, the 1862 and the 1890 Land Grant Universities, and the Tribal Colleges and Universities);
- revitalizing farmer-public institution cooperation on cultivar development and seed distributions (e.g. via participatory breeding programs and reinvigorated Crop Improvement Associations and certified seed programs);
- recognizing, funding, and supporting the many independent/freelance breeders who are right now creating diverse cultivars;
- funding and supporting the wide array of small and medium-sized seed companies that are offering seed of those diverse cultivars;
- enhancing transparency for seed purchasers by eliminating “relabeling” or curtailing it by requiring clear and prominent identification of variety name distinct from brand name.

INTELLECTUAL PROPERTY

The three dominant forms of IPRs used to restrict access to crop cultivars in the United States are Plant Variety Protection certificates (PVPA), utility patents, and Materials Transfer Agreements (MTAs). PVPAs were instituted in 1970 to give patent-like protection to the breeders of novel cultivars. The reach of PVPAs is limited by a breeder’s exemption and a farmer’s privilege. The former allows breeders to use the material for research and the development of new cultivars, and the latter allows farmers to save and replant seed of the protected variety on their own land. Since the determination in 1985 that plants and their genetic and biophysical constituents are patentable subject matter, utility patents have largely superseded PVPA. This is because patents do not permit exemptions for breeders or privileges for farmers. MTAs are not strictly IPRs, but are a form of “private ordering.” They are contracts or licenses that legally specify the conditions under which plant genetic resources are exchanged between parties.

What is the relationship between IPRs and market concentration? Well, in 2015, the top four companies accounted for 85 per-

cent of corn and 76 percent of soybean seed sales. In 2008, the top three companies held 85 percent of patents on genetically modified (GM) corn and 69.6 percent of patents on GM soy and cotton. *Prima facie*, there would appear an important relationship. But we lack the data to explore it with any confidence. If there is a serious lack of study of the structure and operation of the seed industry, there is a concomitant gap in attention to IPR matters. How many patents on crop varieties are there? What companies hold them? What are the patent claims? What are the effects of the claims on the prospects and possibilities for further research or breeding? Do the claims cover naturally occurring traits? In what sense are the claims truly novel? In what sense are the claims truly non-obvious? How many of the patented materials are actually used in any way? How is the process of patent “evergreening” (creation of new but closely related patents to an expiring patent) accomplished and what are its effects? How are the patented materials licensed? To whom are they licensed? What are the terms of the license? Apart from scattered anecdotes and a handful of episodic, infrequent, and narrowly conceived studies, we simply do not know. We need to know. Systematic, comprehensive studies should be immediately undertaken by the ARS.

Although the lacunae in our understanding are very serious indeed, there is much information that warrants a high degree of concern. Patents are appealing for companies precisely because farmers cannot legally save and replant patented seed. Monsanto employed very aggressive legal actions against farmers in an effective program against infringement. This campaign has now been out-sourced to private enforcement firms and the “Farmers Yield Initiative” (FYI) which provides a tip line for farmers to inform on each other for patent and PVPAs violations. The willing and active participation of the Plant Variety Protection Office and some Land Grant Universities in this FYI undertaking is unsavory at best. Inculcating a climate of fear and mistrust in farm country is not good public policy. Further, if farmers are restricted from saving patented or PVPAd seed, they should at least have the right to know what it is that they are banned from “making” by replanting. But, just as “relabeling” is intended to confuse them, so is the information on seed “bag tags” designed to misdirect and dilute their understanding of what they are planting. Bag tags and labels on corn and soy seed typically state that the seeds contained therein “may be protected by one of more of the following patents,” and then list many patents (I counted 32 on one bag) that “may” (or may not?) be embodied in the seed.

The limitations on use and the uncertainties accompanying the proliferation of patented materials are even more restricting for plant breeders in competing firms and for breeders in public institutions than they are for farmers. Farmers are at least permitted to grow the patented seed “solely for planting a single commercial crop.” Breeders are not permitted to make any use other than what might be negotiated with the patent holder. The effects are far-reaching. Before beginning a breeding program, the breeder must undertake a study of whether the plant materials intended for use in the program are covered by IPR encumbrances of some sort. This exploration of the parameters of “freedom to operate” is time, energy, and resource intensive and is a major disincentive for use of the material in question. The effect is to push breeders into silos in which they work only with material they already know to be unencumbered. This tendency to the narrowing of the working gene pool of breeders is

antithetical to the very core of productive and innovative plant breeding which depends on free access to genetic diversity. The negative impacts are compounded by what is reported to be patenting of naturally occurring traits, and the lax standards of novelty and non-obviousness by which the US Patent and Trademark Office (USPTO) now appears to be operating.

The confusion is yet further compounded by the complex patterns of licensing and cross licensing of the many patents involving many crops. Ironically, the widespread proliferation of patents of uncertain provenance and application has become a serious problem for the companies themselves. In order to try to work their way out of the “patent thicket” or “anticommons” of their own creation, sixteen of the largest companies have established the International Licensing Platform-Vegetables (ILP-V). The pooled germplasm from these companies is freely shared with each other, with royalties to be negotiated later or, if no agreement is reached, for the determination to be made in arbitration by an appointed third party. If the biggest companies themselves need to find a way to cut through the legal and bureaucratic tangles of the patent thickets, how much more is it necessary to free up smaller companies and public institutions without the deep pockets to underwrite the lawyers and accountants needed to obtain the elusive “freedom to operate.”

Alas, rather than commit to germplasm exchange policies that facilitate access and strengthen innovative breeding, public institutions have generally chosen to implement restrictive IPR policies. Land Grant Universities have taken to mimicking private practice, and not only are patents and/or PVPAs on new varieties often sought, but any exchange of materials, even between public scientists, is now accompanied by an MTA. MTAs set out provisions of permitted use and specify ownership of the research results flowing from use of the covered material. In a recent study, 67.7 percent of public plant breeder respondents reported that their freedom to operate was restricted by MTAs (Shelton and Tracy 2017). Of course, since there is no research exemption for patented material, public breeders cannot use patented seed for any purpose – even for a simple variety trial – without the express permission (via MTA) of the patent owner and this is not uncommonly refused by private firms. Corporate concentration and the accompanying emphasis on MTAs has now proceeded so far that patents are no longer even the chief means of denying access to germplasm to public scientists or farmers. Just as the land grant breeder must sign an MTA, so must the farmer sign a “Technology Use Agreement” (i.e., a form of MTA) in order to get permission to lease (yes, lease, not own) the patented seed they acquire.

RESISTING CONCENTRATION AND IPR ENCLOSURES

These secular, historical tendencies in germplasm ownership and control have a powerful momentum. They are not, however, unopposed. The Rocky Mountain Seed Alliance has inaugurated a “Patent Free Seeds” program. Similarly, the Organic Seed Alliance has launched a “Seed Patent Watch” initiative. The question of whether or not patents should be allowed for organic seed is particularly interesting. The National Organic Standards Board (NOSB) has established four criteria for determining what genetic modification methods should be excluded from use in organic

production. Criterion number 4 reads “...the application of restrictive intellectual property protection (e.g., utility patents and licensing agreements that restrict such uses to living organisms, their metabolites, gene sequences, or breeding processes) are refrained from” (NOSB 2021). Now, “refrained from” is surely ambiguous. But what if this intimation of exclusion were acted upon more forcefully? Could patents be banned in organics?

The most concrete, practical, and potent response to the problematics of seed sector concentration and IPRs has been the emergence and growth of the Open Source Seed Initiative (OSSI). The creation of OSSI was inspired by the free and open software movement that has provided alternatives to proprietary software. OSSI’s affiliated breeders agree to release their newly developed cultivars only with the OSSI Pledge: “*You have the freedom to use these OSSI-Pledged seeds in any way you choose. In return, you pledge not to restrict others’ use of these seeds or their derivatives by patents or other means, and to include this Pledge with any transfer of these seeds or their derivatives.*” This “copyleft” commitment, when transmitted with any further distribution of the seed or the seed of any new varieties or germplasm bred from it, preserves the unencumbered exchange of plant germplasm for breeding purposes and guarantees the rights of farmers and gardeners to save and replant seed. OSSI recruits breeders (“OSSI Variety Contributors”) who formally commit to offering one or more of their cultivars only under the OSSI Pledge. “OSSI Seed Company Partners” agree to sell at least one OSSI-Pledged variety, to market the seed by labeling it with the OSSI logo and/or name, to acknowledge the OSSI breeder in variety descriptions, and to include the Pledge and information about OSSI in their print and on-line catalogs. OSSI’s portfolio currently includes over 500 OSSI-Pledged varieties contributed by 50 OSSI Variety Contributors. Seed of these varieties is available from 78 OSSI Seed Company Partners. Admittedly a radical approach, the open source pathway is increasingly recognized as a legitimate alternative to the conventional system (see OECD 2018, Bjornstad 2016, OSA 2022).

RECOMMENDATIONS

A variety of actions might be taken in order to reduce or eliminate the barriers to the exchange of plant genetic resources that are created by the inappropriate and excessive use of Intellectual property rights, including patents and Material Transfer Agreements. Among these are:

- The ARS should immediately initiate a comprehensive, systematic, and extended study of all dimensions of the structure of the seed industry and its patterns of use of intellectual property rights (this could be done in cooperation with the Federal Trade Commission).
- The ARS should work with the USPTO to systematically examine patents on crop genetic resources in order to explore and assess
 - the distribution of the patents across crops
 - the distribution of the patents across owners
 - the overall character of the claims made in relation to their

- effect on the enterprise of plant breeding as a whole
- the degree to which patent claims overlap with naturally occurring traits
- the degree to which patent claims are non-obvious
- the degree to which patent claims are novel.
- The ARS should review its IPR policies to consider
 - eliminating any exclusive release arrangements
 - ensuring that its release arrangements impose no restrictions on subsequent research or breeding activities.
- The ARS should encourage Land Grant Universities to examine their IPR policies to consider the public policy and equity implications of exclusive release, MTAs, and patents, and to ensure that there are no restrictions on the use of patented/protected material for further research.
- The USDA’s Agricultural Marketing Service (AMS) should cease the participation of the Plant Variety Protection Office in the Farmers Yield Initiative.
- The AMS should examine the participation of Land Grant Universities and other public agencies (e.g., Crop Improvement Associations) in the Farmers Yield Initiative.
- The ARS should remove the links on its “Intellectual Property” web page to the Farmers Yield Initiative and the Seed Innovations Protection Alliance.
- The NOSB should act on criterion four of its Excluded Methods Determinations to make patents an excluded practice in organics.

Above, I have noted the paucity of studies of the seed industry and its relation to plant breeding and IPRs. There is nevertheless some useful and suggestive documentation. In the interests of clarity I have made very limited use of citations in the body of my statement. **Those who would like to pursue various themes further are directed especially to the following references:**

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