

The Why Files

Seeds of dilemma: Who owns the genes that fill the stomach?

ENLARGE

Asgrow, one of Monsanto's many seed brands, advertised in a field of genetically modified soybeans in New York state. Changes in the seed landscape have alarmed some segments of the agricultural community. One of Asgrow's seed-corn varieties is covered by 20 patents from Monsanto and 12 from DuPont, says sociologist Jack Kloppenburg, a founder of the Open Source Seed Initiative.

Photo: [back roads traveller](#)

As farmers bring in their crops in the northern hemisphere, we're wondering: Who owns seeds and the genes that make them so productive?



The issue was raised this spring by the Open Source Seeds Initiative (OSSI) — a back-to-the-future effort to slow the trend toward greater protection of seeds under patents and other intellectual property rights. Open source grants users the “freedom to use the seed contained herein in any way you choose,” while requiring that “those freedoms are enjoyed by all subsequent users.”

The approach deliberately echoes the open-source software movement. Linux, for example, allows, even encourages, users to improve the product — without seizing proprietary rights in it.

In its first few months of operation, 36 varieties of 14 species have been listed as open-source seeds, and three seed companies are already selling some varieties, says Jack Kloppenburg, a co-founder of the initiative. Kloppenburg, a professor of community sociology at UW-Madison, says open-source seeds should appeal to gardeners and farmers “who want to enter the ethical market, in the same way they are attracted to shade-grown coffee, or organic veggies. It's seed you can feel good about.”

ENLARGE

Plant breeder Irwin Goldman displays “sovereign” carrots that he’s given to the Open Source Seed Initiative. People who accept open-source seeds pledge not to acquire patent or other protection when they distribute seeds from their crops — even if they sell those seeds. Goldman is a professor of horticulture at the University of Wisconsin-Madison and a founder of OSSSI.

Credit: The Why Files

A growing contrast

The ownership and sales of crop seeds is something that few people think about. But while protests about the purported health and environmental effects of genetically modified (GM) seeds have reaped headlines, the soaring use of biotech seeds in the biggest American crops — soybeans and corn (maize in the rest of the world) — have been accompanied by dramatic changes in the seed marketplace:

ENLARGE

Open-source seeds are covered by this “pledge,” built to parallel agreements on open-source software.

Credit The Why Files

Consolidation: Most of the large seed producers are now owned by giant chemical-industry firms, including Dow, DuPont and Monsanto.

Licensing: The big three are selling or licensing large numbers of genes and plant “traits.” Monsanto’s genes were present on 81 percent of corn acreage in the United States in 2009, up from 22 percent in 2000; the soybean ratio rose to 94.5 percent by 2009. ¹

“Technology use agreements”: Before planting biotech corn and soybeans seeds, farmers must sign away their right to replant the next generation of seeds. “Farmers aren’t buying seed, they are leasing seed,” says Kloppenburg. “The seed companies say, ‘You can’t buy until you sign this technology use agreement,’ sometimes called a stewardship agreement, that says you can only plant it for grain.”

ENLARGE

A picket sign says it all; protesters during the March Against Monsanto rally in Columbus, Ohio, in 2013.

Paul and Cathy

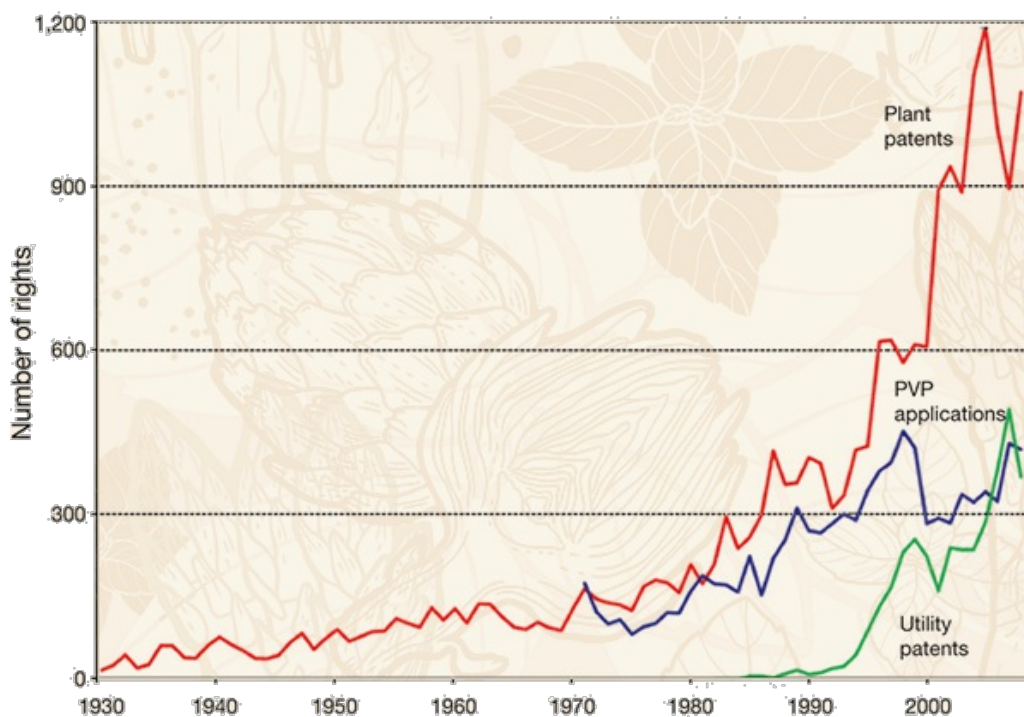
Monsanto, already under fire in some quarters for its GM seeds, has taken farmers to court for such replanting. The company is a sponsor of “[Farmer’s Yield Initiative](#),” a group with “the collective goal of advancing wheat research, education, seed certification, and the enforcement of intellectual property rights under the Plant Variety Protection Act (PVP) and patent laws.”

Increasingly, patents are being granted for vegetables, not just major grain crops, says Kloppenburg. “Monsanto is simply the exemplar of practices that are filtering all the way down” into smaller markets for vegetable



seed.

Ownership issues plague the diminishing band of university researchers who perform essential breeding of the plants that feed us, raising the question of whether they can get the plant varieties they need to create refined, marketable varieties. “We have reached a point in plant breeding where most of the stuff is not available,” says Goldman. “Our freedom to operate has shrunk.”



U.S. trends in granted plant and utility patents, and applications filed for plant variety protection (PVP), between 1930 and 2008.

[Pardey et al. 2013](#)

And it's not just corporations that are cordoning off their genetic resources, Goldman adds: “I can't get seeds from other public institutions unless I agree to pay a royalty, so we are all breeding in silos. It's the thing we all talk about with other plant breeders: What are we going to do?”

Patents and other intellectual property rights are being used “to consolidate corporate control over genetic resources,” says Kloppenburg. “It's a problem for American farmers, who have fewer places to get seed. Even though it appears that there are many independent seed companies, that's fairly deceptive. Many companies are owned [by the majors], and the independent ones are licensing their seeds or traits from the big guys.”

Enforcement of intellectual property rights is normal and to be expected, says GianCarlo Moschini, a professor of economics at Iowa State University. Although “patents are sometimes questionable, without the protection of intellectual property, there would be no justification for a private company to invest the massive amount of resources they do in research and development to develop a new process, product or technology. If we want private firms to

invest in innovation, they have to have a way of recouping their investment. Most people would agree that you would not have a pharma industry without strong intellectual property protection. These companies are for-profit, they invest huge amounts, Monsanto invested \$1.5 billion last year in research and development; these are activities that employ scientists, engineers and technology to produce new things that are valuable, and you can't expect that sort of investment without patent protection."

ENLARGE

Seeds represent tomorrow's food — and their production is a major industry.

Photo: [KSI Conveyors](#)

Plants: Three types of intellectual-property protection in the United States

Plant patent: A 1930 law [protects](#) a "distinct and new variety of plant" that is asexually reproduced, "other than a tuber propagated plant or a plant found in an uncultivated state."

Plant variety protection (PVP): A 1970 [law](#) protects plant varieties that are "uniform, stable, and distinct from all other varieties."

Utility patent: The same protection afforded drugs, microprocessors and other inventions, utility patents offer the strongest protection; available since 1980.

Although the 1970 PVP protection expanded the 1930 law, Goldman says the 1980 Supreme Court decision applying utility patents to plants "opened the floodgates to the whole thing, and people are testing the waters: What can we claim? Patent lawyers are very aggressive."

Goldman sees plant breeding as a cumulative matter, since farmers and eaters alike benefit from the work of the farmers who altered wild plants by replanting those with the best yield and growth. "These plants have been domesticated for 8,000 years, and I touch them for a few years, and am then claiming ownership?" he says. "How realistic is it to patent the genes and the changes that have taken place for millennia?"

Moschini, however does not buy that argument. "A patent does not take away from the existing state of knowledge. I cannot assert ownership of something that was already known before I got the patent. It's true that germplasm has evolved, refined, been bred for many many generations, but when a company patents a particular line," that does not restrict others from using the pre-existing varieties.

While that may apply to utility patents, PVP protects plant varieties that are "uniform, stable, and distinct from all other varieties," which sounds a lot more expansive to us.

Can't plant and replant?

Corn productivity per acre has risen six-fold since before World War II, Moschini notes, and although the do-not-replant restrictions imposed by Monsanto and others arose with GM seeds in the 1990s, farmers long ago lost the incentive to replant top strains of maize.



Why? Because the most productive corn varieties are grown from plants made by crossing two inbred strains, giving their seeds “hybrid vigor. The next-generation seeds grown from hybrid seeds, however, are far less productive. “If you buy a hybrid, you get a great first-generation harvest, but if you replant ... the yield suffers a lot,” Moschini says.



Hand harvesting of milo, a cultivar of maize (corn) in Tulare County, Calif., in 1938. **Roll over photo** to see a modern John Deere corn harvester in Idaho.

Photos: 1.) California: [Library of Congress](#); 2.) Idaho: [Idaho National Laboratory](#)

And so, farmers, being logical, responded to the incentive by starting to buy new seed every year. And, Moschini observes, the resulting income was used by the seed companies to breed better genetics – better seeds. “Research and development in the seed industry, starting in the late 1930s, is what transformed the U.S. corn industry, and that has all taken place because there was an investment by industry, made possible by the fact that the possibility of replanting was not there.”

Plant-and-buy, therefore, has long been a fact of life in the corn belt, Moschini says. “It was done that way before patents or GM seeds. That was a technological reason [hybrid seeds], and it is not something we regret.”

A teachable moment

Enforcing patents requires a commodity – lawyers — that is scarce in the open-source movement. Leaders of the movement have given up any thought that open-source seeds can obtain ironclad intellectual property protection against being taken private. At first, to guarantee that nobody would file patents on its open-source seeds, members of OSSI, the open-source institute, considered writing their own version of Monsanto’s multi-page “technology use agreement.”

Soon, irony twined upon irony:

To prevent others from patenting its varieties, OSSI have to obtain its own patents, and/or

To prevent farmers from having to sign a biotech firm’s onerous contract, OSSI would have them sign its



own paper, rich with fine print.

ENLARGE

A vendor sells her harvest at Dane County Farmers' Market, Madison, Wisconsin. Could “open-source” vendors at farmers markets raise awareness about the ownership of seed?

Photo: [Emily Mills](#)

That onerous contract could not be simplified, Kloppenburg says. “Our attorney said every time I boil it down, I give the opposing attorney a wrench to take it apart — and with a contract like that, we look like Dow, so we gave up on that and that freed us up. We were never going to police the contract anyway.”

Instead, the [Open Source Seed Initiative](#) is trying “to get into people’s heads,” Kloppenburg says. “Rather than make a legalistic tool that would allow us to play with Monsanto in the courts, we need something that we can talk to journalists about, talk with the people who go to farmers markets and to farmers, to help them to understand that there are new possibilities. We have moved from a legal to an ethical approach, from policing to normative.”

Breeder’s sack of woe

Even as productivity of major crops creeps upward, classic plant breeding at universities is on a downslope in favor of plant molecular biology and basic genetics, says Goldman. A founder of OSSI, he breeds carrots, beets and onions at UW-Madison, and has released two carrots through OSSI, but has patented other varieties.

And even as seed companies thirst for graduates who know breeding, Goldman says corporate decisions make it harder for universities to operate breeding programs for plants that are vital to their state’s agriculture and industry. “With all this germplasm being held privately, patented, licensed, controlled, it’s hard to start a breeding program from scratch. That’s part of our justification for setting aside material through open source. In corn, I don’t think you could do it at all.”

Goldman recognizes that all crop seeds can’t be handled as open source. “It’s not remunerative, but if we can carve out some space, that would be really positive. It’s an appeal to moral economics: Let’s have the conversation about seeds, and the social contract” that governs them.

ENLARGE



Like OSSl, Seed Savers Exchange is a non-profit organization dedicated to sharing seeds, in this case, of heirloom varieties. Members have preserved diverse lineages of vegetables and herbs at home, and at exchange's Heritage Farm in Iowa since 1975.

Seed Savers

As the world population grows, land is limited, fresh water is getting scarce and the climate is changing. Thus the need for smart plant breeding will only grow, Goldman observes.

But OSSl is not a seed producer, and is focused on getting liberated (but not necessarily cost-free) seed to people who want it, says Kloppenburg. "We don't have a commercial sensibility, but ... we took picture of a package with the pledge, put it on the web, advertising 15 packages for \$25, and within a month, had more than 400 orders from 16 countries. We are not going to be a seed company but we can publicize that there are varieties available under the OSSl designation that you can buy from people who have agreed to the pledge."

ENLARGE

OSSI sparkplug Kloppenburg poses with two jars designed to make a point about the ownership of seeds. "Free seeds," he says, is not meant in the sense of "free beer," but rather to parallel "free speech."

Credit: The Why Files

Few gardeners are going to save seeds or breed OSSl varieties, Kloppenburg concedes. "Where OSSl can be important is in changing behavior of the breeders. Irwin [Goldman] has gotten all kinds of interest in his carrots, but if seed companies release then under the pledge, that's where a difference is going to be made, in the seed wholesale and retail community. We are trying to get into the heads of gardeners, CSAs [community supported agriculture]. There are many people into good food, but how many know what a cultivar is? [It's a cultivated strain of a crop, such as one of the new OSSl strains, [Midnight Lightning](#) zucchini. Even fewer know what breeders do to make a cultivar. Plant breeding is under-recognized but that's where the future of food rests. We want OSSl to open heads to the value of open-source breeding."

A related development, called participatory breeding, "Melds the different capacities of farmers and breeders to participate, work with each others," says Kloppenburg. At UW-Madison, "Bill Tracy has a sweet corn line that he developed through participatory breeding that he's going to release with the [Organic Seed Alliance](#). The [Northern Vegetable Improvement Collaborative](#) has been doing participatory breeding, in cooperation with farmers."

ENLARGE



Olds Seeds has been breeding and raising veggie seeds for a long time.

[Heritage Seed](#)

More players in a market is often better, agrees Moschini. “Competition in the market, between the seed companies, is very important. If there is more competition from what you describe as the open source movement, that could potentially be good.”

However, Moschini says simple concentration among major-crop producers is not the bogeyman that the open-sourcers claim. Economists see concentration as “an indicator, but it is not particularly informative. You could have a very concentrated industry that is very competitive. That’s why anti-trust rules do not just look at concentration, but at the practices that happen in an industry.” He grants that the level of concentration is high in seeds, as it is in other high-tech industries, but says, “the question is really whether entry is possible by new firms that have better ideas, products, and whether certain practices violate anti-trust.”



[ENLARGE](#)

A tractor pulls a soybean planter. Soybeans were planted on a record 85 million acres in the United States in 2014; most were genetically modified and covered by a web of intellectual-property protections. Is that trend moving toward smaller markets for veggie seeds?

Credit: [United Soybean Board](#)

As Moschini’s 2010 article shows, prices are soaring for major-crop seeds. “Simply comparing the last available year (2008) to the pre-GM year of 1995, we see that the total seed price increase over this period is 139 percent for biotech corn, 49 percent for non-biotech corn, 199 percent for biotech soybeans, and 96 percent for nonbiotech soybeans.”²



But that does not prove profiteering, Moschini adds. “The proof of the pudding is in the eating. What really matters is whether farmers are willing to purchase these seeds.... Farmers do obtain a share of the benefit created by a more productive technology; it’s not all extracted by the seed company.”

Although there are some questions about the true profitability of biotech seeds, advocates of small-scale farming are concerned that the same aggressive pursuit of intellectual property protection will extend to the much smaller — and far less lucrative — field of vegetable production.

Locking up innovations, says Kloppenburg, can, well, lock up innovation: “To meet the challenges of the future, we are going to need an enormous amount of creativity, and it should not just be at Monsanto or DuPont. It needs to draw on Michigan State, the University of Wisconsin, Minnesota and Oregon, and all the farmers around the world, many of whom are still breeding.”

— David J. Tenenbaum

Kevin Barrett, project assistant; Terry Devitt, editor; S.V. Medaris, designer/illustrator; David J. Tenenbaum, feature writer

Related Why Files

- [Smokin' hot! Altered tobacco plants point toward race-car photosynthesis](#)
- [New food rules: How healthy?](#)
- [Patent wars!](#)
- [Farming, Native American style](#)
- [Feeding 7+ billion](#)
- [Soil: Key to solving the food crisis?](#)
- [Organic Corn & Soybeans: Competitive?](#)

©2014 University of Wisconsin Board of Regents