Is Company Support for Public Variety Trials Eroding for Illinois Soybeans?

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1 Introduction

The State Agricultural Experiment Stations (SAES) have played a significant role in the development of US agriculture. Established in 1887 by the Hatch Act, The SAES are research institutes established at every Land Grant University (LGU) in the country to conduct research into new agricultural practices and technologies. A major contribution of the SAES has been investment in biological innovation, specifically the research and development of new seed varieties (Olmstead and Rhode 2002). Farmers have directly benefitted from the presence of the SAES, as recent studies show that counties close to Land Grant Universities and SAES historically have had higher agricultural output, productivity growth, and a higher rate of innovation (Kantor and Whalley 2019; Andrews 2021).

In addition to developing new varieties, the SAES have provided a valuable service to seed markets for close to a century: conducting independent variety testing programs. Variety testing programs are public variety trials which test the performance of both university-developed seed varieties and varieties available on the market. In the variety testing program, private seed breeders can, for a fee, have their seed variety grown in several experimental plots throughout the state alongside university-developed varieties. The results of these experiments are published and disseminated to farmers in order to provide "objective third party information" for both farmers and seed companies (University of Illinois 2022). In Illinois, the SAES at the University of Illinois has been running public variety trials since 1934.

When seed companies participate in the trials, the public variety trials publications become a valuable source of objective information about seed genetics. However, private companies now have fewer reasons to continue participating than when these trials began almost a century ago. First, seed companies can now fully afford to conduct their own internal yield trials. The SAES provided an important service to breeders and seed companies when they were small and regional, but today multinational seed companies can fully afford to conduct yield trials of their own products. Second, companies may no longer need the SAES's third-party verification to sell their products to farmers. In the 1960s, a survey of farmers found that county extension agents and extension publications were among the most important information sources for farmers (Mawby and Haver 1961). Today, these same surveys find that private consultants and industry publications are far more important to farmers than county extension agents or extension publications (Schnitkey et al. 1992; Wang 2014; Ford and Babb 1989; Prokopy et al. 2015).

In Illinois, company support for public variety trials appears to be eroding. Examining the University of Illinois soybean yield trials from the past 25 years, we see that company participation has been dropping even as the private sector continues to release new soybean varieties. The number of new soybean varieties, measured using patent data, has increased by 50% since 2004. Company participation in the Illinois public variety trials has dropped 50% in the same period. Yet, since the entrance of a competing variety testing program in 2008, the SAES at Illinois appears to have found a new, more specialized role. The SAES in Illinois now tests a greater number of conventional seed varieties and serves more smaller companies than its competitor, Farmers Independent Research of Seed Technologies (FIRST).

2 Soybean Variety Testing in Illinois

Illinois is a state traditionally dominated by soybean and corn growers, which makes the soybean yield trials all the more important to the state's farmers. To provide farmers with objective information to choose seeds each year, the Illinois SAES accepts submissions from seed companies and grows them on experimental plots throughout the state. All varieties are grown at each site under experimental conditions, allowing for a clean comparison of the yields across varieties. The variety trial results are made publicly available and free of charge to all farmers, historically though the mail and now online. Farmers benefit by receiving objective information to inform their seed purchases (Lee and Moschini 2022) while companies benefit by receiving an objective, third-party verification of their product from an institution historically trusted by farmers.

Unlike corn, the private sector is a recent entry into the soybean seed market. Using information from a variety of studies, Heisey, Srinivasan, and Thirtle (2001) estimate that in 1980 only about 8% of area were planted with soybean varieties developed by the private sector (compared to nearly 100% for corn in the same year). The private sector's slow entry into soybeans can be explained by the fact that soybeans, unlike corn, cannot be hybridized. The ability to hybridize a plant was critical to the private seed industry since hybridizing a plant prevented a farmer from saving seed, thus providing the company with a type of biological patent protection. Since seed varieties had very limited patent protection, the private sector did not often produce varieties of crops that could not be hybridized (Moscona 2021).

This all changed with *Ex Parte Hibbard*, a decision by the US Patent Office in 1985 which made biological organisms, including plant varieties, intellectual property which can be protected by patent (Howard 2015). For the first time, the private sector now had a way to enforce intellectual property rights on new soybean varieties. By 1997, the amount of area planted to private sector soybean varieties had jumped from 8% in 1980 to 70% (Heisey, Srinivasan, and Thirtle 2001).

As the seed industry has expanded, so have public variety trials. At the Illinois SAES, the variety testing program gradually increased the number of plots, making it possible to test a wider cross-section of soybeans with different maturity dates. In 1969, the first year of the soybean variety trials, the program had only two test sites growing 12 seed entries. At its peak in 2004, the program had 13 test sites testing over 800 soybean varieties from more than 80 companies.

As of 2008, The Illinois SAES is no longer the only public variety trial operating in Illinois. Farmers Independent Research of Seed Technologies (FIRST) began in 1997 in Illinois with the same mission and basic model as the SAES variety trials: FIRST enlists farm volunteers to host their trials and grows different seed company submissions to benchmark their yields. When the trials are finished, FIRST publishes the top 30 varieties in terms of yield in reports that are made publicly available on their website. FIRST conducts trials in 15 different states, mostly in the Midwest and Great Plains. In their first trial in 1997, FIRST grew 64 hybrid corn varieties in 12 sites in Illinois. In 2020, FIRST grew over 200 varieties from a little over 20 companies at 18 different test sites in Illinois.

3 Trends in Variety Trial Participation

To examine trends in participation, I use the Illinois SAES soybean variety trial results which are publicly available from 1995 to 2020 (University of Illinois 2021). Each report contains a list of the submissions made by each company in addition to the results of the experiments. I also use publicly available FIRST reports beginning in 2008, the first year that FIRST published results for soybeans in Illinois (FIRST 2022).

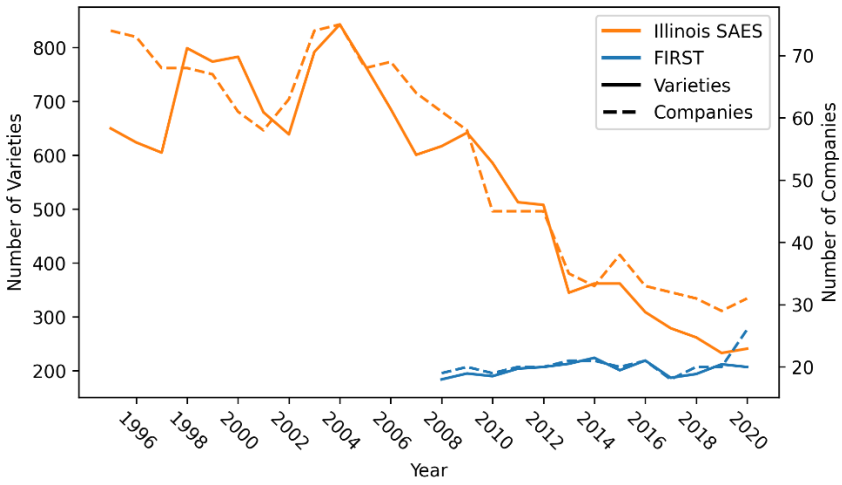

Figure 1: Participation in Illinois SAES and FIRST

Figure 1 shows trends in the number of companies participating in Illinois SAES and FIRST and the number of varieties being submitted. At the Illinois SAES, the number of varieties peaked in the year 2004 at over 800 varieties. Since then, the number of varieties and companies has been reduced by almost 50%. Since FIRST published its first report in 2008, the number of varieties and companies has stayed constant: about 20 companies have submitted about 200 varieties to FIRST each year since their first public report in 2008.

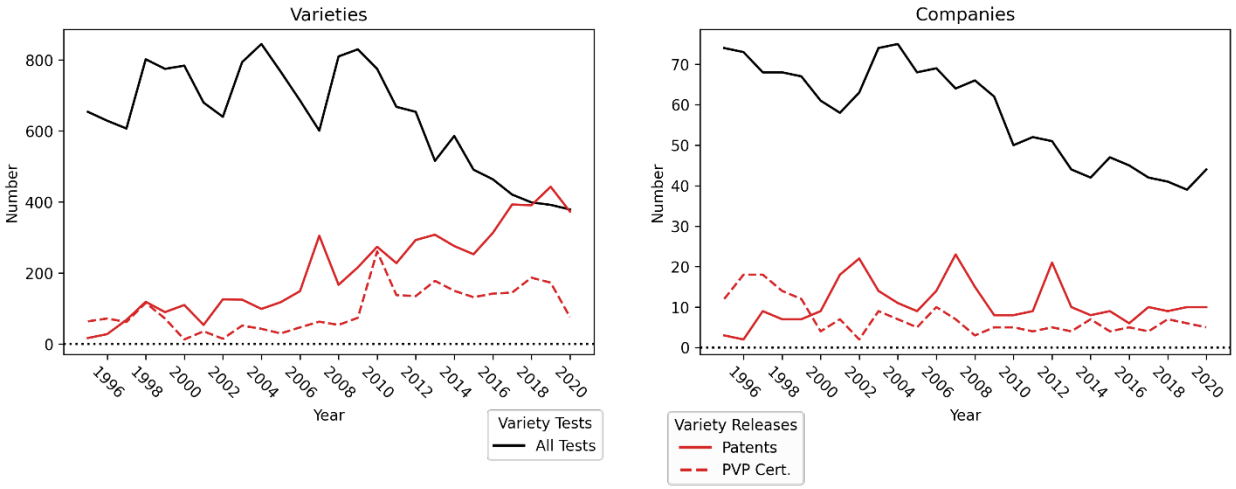

Figure 2: Total Variety Tests and Patent Application

Figure 2 shows that the precipitous decline in both seed varieties and companies in Illinois SAES has not been reflected in patent applications. In addition to FIRST and Illinois SAES tests, the graph shows the number of soybean variety patent applications and the number of Plant Variety Protection (PVP) certificates, a lesser form of patent protection available since 1970. While less and less varieties were being tested at Illinois and FIRST, more and more varieties were being patented. There was a modest increase in the number of PVP certificates since 2004 but a much larger increase in the number of patent applications every year. In 2004, there were around 150 patent applications for new soybean varieties. In 2020, this number grew to more than 400. While variety test submissions have diminished by 50%, patent applications for soybean varieties have grown by more than 50%. The number of companies also held steady in both PVP and patent applications while the number of companies participating in public variety trials has declined.

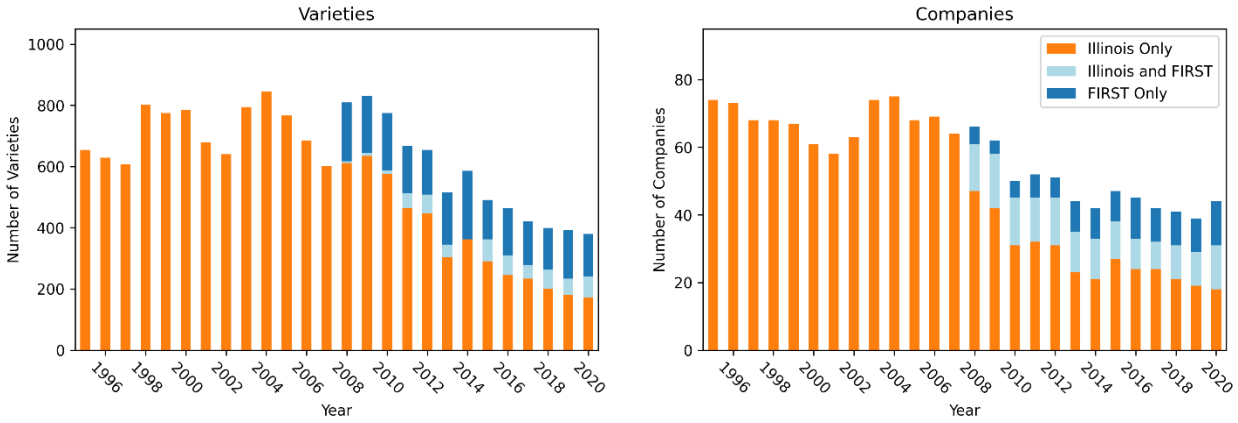

Figure 3: Company Participation in Illinois SAES and FIRST

How has the entrance of FIRST impacted the Illinois SAES program? Figure 3 examines the overlap between FIRST and Illinois by breaking down the trends in testing program participation into three groups: companies only submitting to Illinois SAES, companies submitting only to FIRST, and companies submitting to both. While FIRST boosted total variety submissions by entering in 2008, FIRST has not grown its number of submissions in Illinois and so the trend continues downward. Even as FIRST entered in 2008, the number companies and varieties participating declined by almost 50%. Interestingly, only a small number of varieties are submitted to both Illinois and FIRST but a larger number of companies participate in both trials. This suggests that while companies use both testing services they test different varieties in different programs.

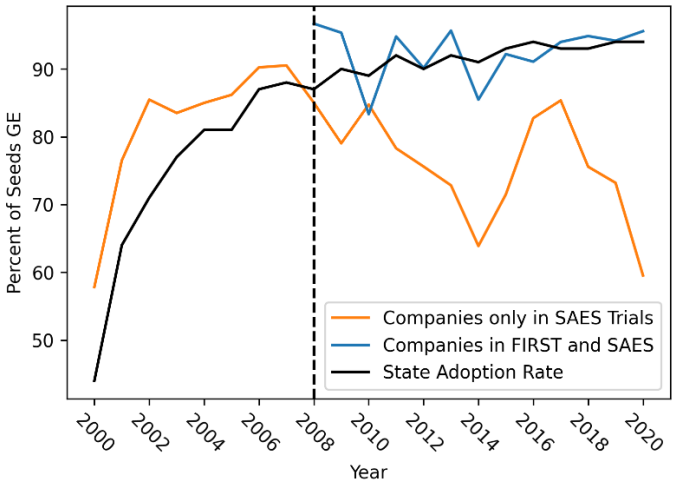

Figure 4: GE Adoption in Variety Testing and Illinois

What sorts of varieties are tested in each program? One of the biggest changes in soybean genetics in the past two decades is the growth of genetically engineered (GE) varieties which are resistant to herbicide. Figure 3 breaks down the trend of GE use in Illinois by companies which only submit to SAES trials versus those that submit to both SAES and FIRST. Every variety tested at FIRST is GE, making their adoption rate 100% in every year. The black line is the percentage of soybean acres in Illinois planted to GE seeds (USDA ERS 2021).

Up until 2008, the percentage of seeds that are GE is higher in the trials than in the state. In the year 2000, only a little over 40% of acres were planted to GE soybeans whereas nearly 60% of SAES submissions were GE seeds. The increases in GE adoption in SAES mirror what is happening in the state.

Once FIRST enters, the testing portfolio at Illinois begins to change. After 2008, the companies submitting to both FIRST and Illinois still follow the state adoption rate which increases to just over 90%. Companies not participating in FIRST, however, test fewer and fewer GE seeds. In 2020, about 40% of submissions from these companies were conventional seeds. Even though more than 90% of Illinois acres were planted to GE seeds, only 60% of submissions from companies only submitting to SAES were GE seeds. Not only has participation dropped at Illinois SAES but the trials appear to be testing for a whole different audience than the average Illinois farmer.

4 Implications for Seed Markets and Extension Services

The growth of the seed industry has significantly changed the purpose of the public variety yield trials. Unlike before, companies can and do conduct their own internal variety trials to advertise the yield of their products. Since companies can now afford to test the yields of their products internally, the primary reason for a company to submit their variety to FIRST or Illinois SAES is to provide third-party validation for their product.

If companies are participating less in public variety trials, it may be because the extension audience is shrinking. The number of farmers that depend on extension publications, like the seed variety trials, continues to diminish. Seed companies will cease to value the public trials as

a source of independent verification if farmers no longer look to extension as their primary information source. This trend breaks precedent with the historical role that the public variety trials have played in being an objective source of information for farmers about seed genetics. It also indicates that farmers are much more comfortable trusting yield trial results from seed companies, even without independent verification from the Land Grant University.

Yet, the Illinois SAES may be gaining an audience with a new kind of farmer. Since FIRST's first soybean report in 2008, the Illinois SAES has increased the number of conventional seeds it tests every year. In 2020, less than 10% of acres were planted to GE soybean seeds while 40% of the Illinois SAES submissions were conventional seeds. If the types of seeds that Illinois SAES are testing reflects the audience of its reports, Illinois SAES is now providing information for a more specific audience, possibly organic producers or farmers growing under the GMO free label. Since private consulting for organic farming is less common, Illinois SAES may be filling a niche by providing information for this specific producer group (Sapbamrer and Thammachai 2021).

The shift to conventional may also be explained by the type of company that Illinois SAES now serves. Of the companies submitting to FIRST, nearly all of them are subsidiaries of major multinational corporations. In contrast, Illinois SAES still serves smaller and more local seed companies that are primarily based in the Corn Belt. Unlike the multinational corporations, these smaller companies cannot necessarily afford to conduct their own variety trials and may still find value in paying the Illinois SAES to grow their new varieties. If these companies happen to also supply more conventional seeds, this may cause the audience of the public variety trials to gradually shift.

As the seed industry continues to consolidate, the SAES variety trials may start to lose their traditional role as an objective source of information for the whole seed market. Instead, the SAES may become an objective source of information for a group of farmers which lacks private consulting services. Rather than letting its influence fade in the seed markets, SAES and extension agents may have the opportunity to provide public services for an entirely different kind of farmer which may be underserved by the greater seed industry.

For More Information

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