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IP Protection in Canadian Agriculture: A Shift to "Tragedy of Anticommons"?

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The Issue

Technological change in the early 1980s inspired major changes in intellectual property protection for Canadian agriculture. By allowing the patenting of single-celled organisms and within-cell events, in 1982 the Canadian Intellectual Property Office opened a window for biotech industry and spurred private sector investment. Increasing private sector involvement in agricultural R&D was accompanied by greater application of intellectual property rights (IPRs) over germplasm, cultivars, gene sequences, markers, and other tools necessary for further research. Given the cumulative nature of agricultural research, there are growing concerns that assignment of IPRs may restrict access to upstream innovations, thus altering, postponing, or abandoning current research initiatives.

The objective of this study is to provide a quantitative assessment of the current IP protection system with regards to access to research tools/germplasm and dissemination of knowledge among scientists.

Implications and Conclusions

This study employs survey results from the wheat and canola breeding sectors. There is strong evidence that strengthened IP protection in agriculture is taking the Canadian breeding sector down a road where there are more legal arrangements to access materials, where access to tools/germplasm gets restricted and sometimes blocked, and the flow of knowledge is reduced. Unwillingness to share ideas about current research and the latest advances is becoming prevalent and is more distinct in the canola industry.

Background

For more than a century, the federal and provincial governments in Canada were the major players in agricultural research industry. By the early 1980s, the public sector accounted for over ninety-five percent of formal plant breeding in Canada and one hundred percent of cereals and oilseeds (Kuyek (2004)). The latest achievements in the breeding industry were openly discussed among scientists and breeders, and new cultivars were freely distributed to farmers.

Marketplace changes in the 1970s and 1980s, including rapid development of a biotechnology industry and significant budget cuts for agricultural R&D, led government to seek greater private sector investment. A general belief among policy makers was that biotechnological advances would allow introduction of desired traits and development of new cultivars at a faster pace and lower cost than what could be achieved via traditional breeding methods. Given the opportunities that biotechnology had to offer, private industry gained prominence in public discussions. The technological breakthroughs in the biotech industry made it possible to identify the seeds, which made feasible the protection of intellectual property in plant breeding. Some innovators suddenly found enormous commercial value in the seeds developed

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through genetic engineering and began lobbying for stronger intellectual property protection in agriculture

In 1982, in the *Abitibi Co*. and *Connaught Lab* cases, the Canadian Intellectual Property office allowed the patenting of single-celled organisms or events within cells, initiating a new era for protection of plants developed through genetic engineering because patenting of genes *de facto* extended protection to the whole plant. In 1990, new plant varieties were also granted protection in the form of plant breeder's rights.

Thus, an IP protection system in Canadian agriculture has undergone a major change over the last few years by moving from a system where information and new technologies were freely available to one where some form of IP protection is assigned to most technological advances. Expanding IPRs has given rise to heated debates between industry participants. On the one hand, IPRs are thought to encourage research activity by giving innovators temporary monopoly power over their inventions and allowing them to recoup R&D expenditures. On the other hand, IPRs are perceived to stifle innovation by limiting access to valuable information. So, the innovation inducing and innovation stifling effects are inherent to the current IP protection system, which raises the question as to where a more ideal balance between the two is located.

There have been growing concerns that stronger IPRs are leading the Canadian breeding sector to "the tragedy of anticommons," a concept first introduced by Heller and Eisenberg (1998). "The tragedy of anticommons" refers to a situation where competing patent rights could prevent the use of valuable resources. Because agricultural research is cumulative in nature and builds extensively on past advances, assigning property rights to germplasm, cultivars, gene sequences, and markers separates building blocks for a product or line of research. When these property rights are diffuse among multiple owners, the negotiation process to put the required pieces of IP together may fail, thus leading to an exclusion of plant breeders from certain areas of research, quashing promising research initiatives, and delaying breakthroughs in research industry. The possibility of protecting the final product makes a tragedy of anticommons more likely to emerge because it creates incentives for innovators to keep research inputs to themselves, at least before property rights over a product are obtained. Restricted access to research tools/germplasm and limited information exchange may lead to underutilization of resources that might otherwise be put to valuable use.

The extent to which a tragedy of anticommons is present depends on how easy it is to obtain IPRs, who owns the IP, and the IP enforcement costs. The innovation blocking effect of IPRs depends on an ability to apply patents, which in turn originates from the ability to employ DNA modification techniques in breeding. Because the latter point varies substantially from crop to crop, the introduction of IPRs is unlikely to have a uniform impact across crops. The two best examples of this are the canola and wheat sectors. These crops followed divergent paths since the early 1990s. Prior to 1989, breeding in the canola industry was performed primarily by the public sector, with private investment accounting for no more than two percent. Genetic transformation for this crop was relatively easy, and this, combined with health research and a subsequent expansion of the canola market, attracted significant private industry research. Substantial gains accrued from assigning property rights to developed DNA modification technologies and transgenic seeds. IPRs allowed for appropriation of benefits from innovations, which in turn spurred private investment. By 2000, eighty-five percent of breeding in the canola sector was performed by the private sector (Kuyek 2004). Expansion of the private sector in this field has led to more property rights being assigned to research tools.

Application of biological advances in the wheat sector was not that easy as in canola, and that, to some extent, undermined the applicability of patenting for wheat breeding. Even though new wheat varieties were protected under the Plant Breeder's Rights Act, the self-reproducing nature of wheat and certain farmers' exemption contained in the act prevented seed companies from appropriating benefits from wheat research. Accordingly, wheat did not gain the interest of the private sector and wheat breeding has remained a predominantly public concern.

In this paper, we examine the impact of IPRs on access to research tools/germplasm and information flows in the wheat and canola sectors. This will provide us with a qualitative assessment of the tragedy of anticommons problem in the Canadian breeding sector.

Canadian Breeding Sector and IPRs: Empirical Study

Method and data

Case studies have been launched to identify the effect of IPRs in the Canadian breeding sector on the ability to conduct subsequent research. Two sectors have been chosen, wheat and canola. The choice of these sectors was not arbitrary and the findings should allow for a useful comparison between the effects of IPRs in an industry dominated by private firms (canola) and one consisting mostly of public institutions (wheat).

The authors conducted twelve personal interviews with wheat breeders and nine with canola breeders. Interviews were recorded and transcribed to ensure accuracy. The major findings are reported in the following sections.

Access to research inputs and genetic materials

1. Assignment of IP rights has altered the way that genetic materials/research inputs are accessed. In the past, any germplasm/material exchange among plant breeders was fulfilled under agreement that a code of ethics would be followed. Now, however, in most cases Material Transfer Agreements (MTAs), licenses, or other forms of formal agreements accompany any exchange of research material, reducing the quantity of research inputs freely available to the breeding community. To gain insight into this issue, the breeders were asked to estimate the proportion of research tools/germplasm freely accessible to them. A summary of responses is presented in Figure In comparing the wheat and canola sectors, it becomes evident that the canola sector's access to research tools/germplasm is more restrictive (formal), with private industry in both sectors being least likely to provide research material without some kind of agreement or licensing scheme. In the wheat industry, roughly seventy-five to one hundred percent of research tools/germplasm is freely accessible; in the canola industry it falls in the zero to fifty percent range. In the canola sector, for example, one interviewee argued that "almost everybody in our industry can see the fact the freely available material for release without any burdens has dried out. So, we are really locked in a point where 1995, 1998, and 2000 was the last time where you could freely access material or germplasm." Another canola breeder from the Agriculture and Agri-Food Canada (AAFC) shared the same thought, asserting that "we will come to a point where knowledge, germplasm that is available from here, would be exhausted to the extent that companies have more."

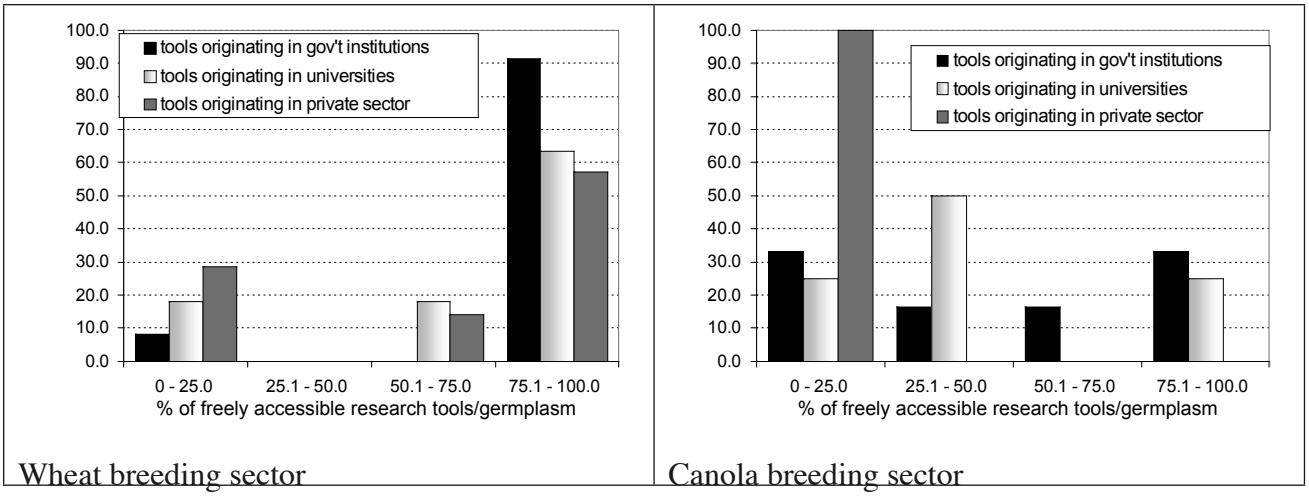

Figure 1. Accessibility of research tools/germplasm by crop and breeding institutions.

As was mentioned in the introduction, assignment of IPRs not only restricts access to new discoveries by imposing formal agreements and licensing schemes, it also affects any willingness to share research inputs. Because IPRs allow extracting rents from innovations, researchers are encouraged to keep research inputs to themselves until the product is developed and IPRs are obtained.

To qualitatively assess the extent to which unwillingness to share with other researchers is a problem, respondents were asked, "How likely is it that the laboratories competing in the same field would provide the research tool/germplasm if they asked for it?" The results are illustrated in Figure 2.

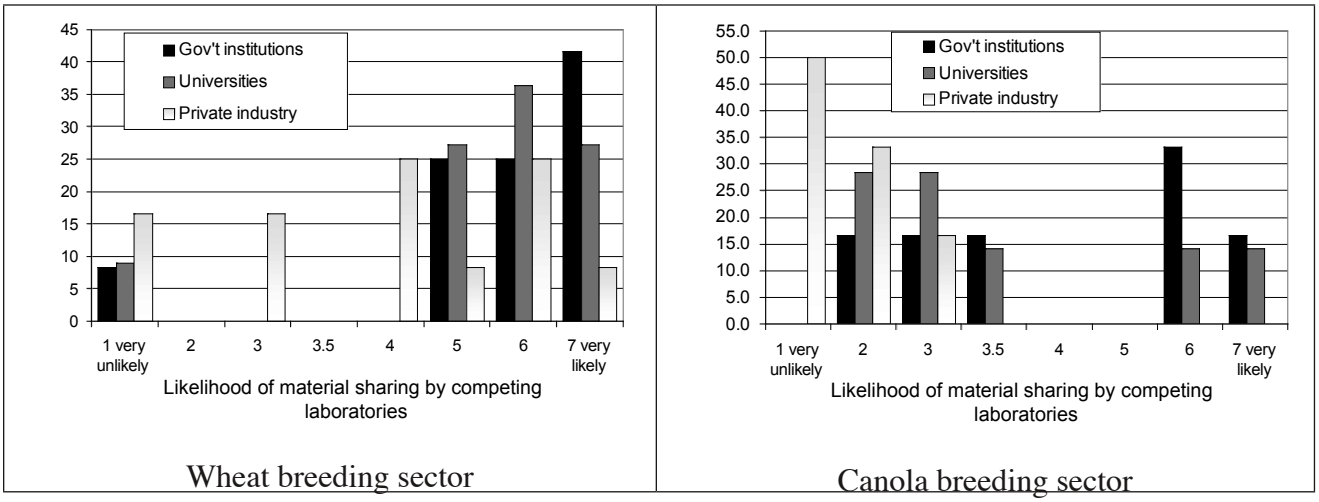

Figure 2. Sharing of research tools/germplasm by competing laboratories.

The degree of sharing among competing institutions in the wheat sector is rather high. Government institutions and universities are most likely to share their material. This is supported by some interviewees' claims that public institutions are obliged to provide germplasm/ tools to whoever asks for it, with the exception of private companies that want to use the material to develop a proprietary product. Sharing is less likely within private industry. One respondent stressed that "the smallest private companies are like [a] one-way street: if we give them something, we won't get something like a research tool in return." Another breeder stated that "the private industry is less likely to share and it's getting worse. I think these gentlemen's agreements in the next few years are going to be very difficult and they will disappear at all."

The pattern in the canola industry is completely different. There is much less sharing in any of the three types of institutions (i.e., private, public, university). Sharing has not only shrunk in quantity, but also in quality. As one canola breeder noted, "With all the changes in the patent system we don't tend to give our best material." Sharing is extremely limited at early stages of development and the general tendency is to provide material only after IPRs have been applied. One interviewee noted that "it is in the interest of researchers as well as the institution to protect the research before you give it to anybody. Once I have protected the invention I am willing to share it with others."

There is also strong evidence that an exchange of ideas in general has suffered from stronger IPRs. As can be seen in Figure 3, secrecy has increased over the last five to ten years, particularly in the canola sector.

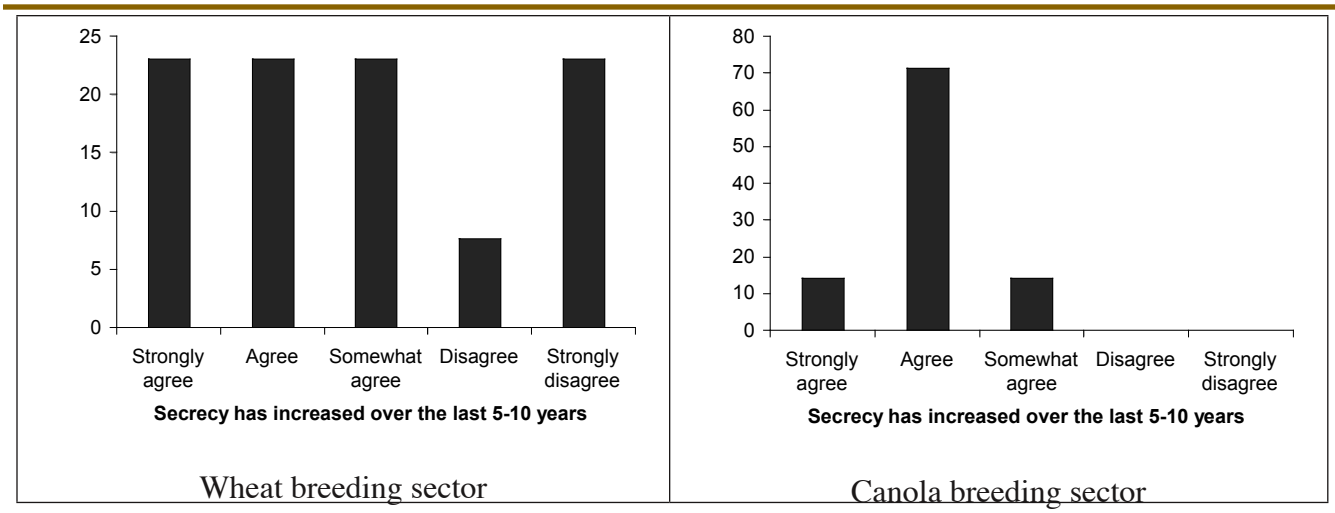

Figure 3. Views on secrecy in the wheat and canola breeding sectors.

In the wheat sector, sixty-nine percent of respondents believed that the research environment has become more secretive, while thirty-one percent of breeders reported no increase in secrecy. While a majority of breeders believed that their colleagues hold discussions about their projects, a number of wheat breeders reported that the public nature of research in wheat breeding contributes to information disclosure.

In the canola sector, there is a strong consensus that secrecy has increased. Responses from canola breeders leave little doubt: "When you go to conferences now a lot of people are tough about research that they publish, it's very rare that somebody talks about what he is doing in the lab so I think there's a lot of secrecy"; and "Everybody knows what everyone else is doing but nobody talks about it. Secrecy has increased to ridiculous levels." Although it is quite clear that a vast majority of breeders do not approve of the poor level of information sharing, it seems that they are left with no choice. Many research institutions' policies prevent disclosure of information related to research. As one canola breeder pointed out, "A number of years ago we had canola meetings where the breeders would describe what they were working on. Now we don't say anything. We have prior knowledge here and we can't go and discuss it elsewhere because the business offices are concerned about patents and freedom to operate (FTO) issues."

Evidence of the Tragedy of Anticommons in the Breeding Industry

The results above provide strong evidence that Canada is following a formalizing route in the area of material exchange that reduces information flows/sharing. The use of formal agreements slows down the process and makes technology exchange more cumbersome. One canola breeder asserted that "in some cases we don't use the material or tool because the negotiation process can be painful and it takes a lot of time." One wheat breeder indicated that MTAs make breeders forego a number of opportunities in the sense that if a researcher is unsure that use of the material will yield valuable results, then he would not even bother to go through the legal requirements to obtain the material. Thus, legal arrangements prevent researchers from using material that could otherwise be put into a good use.

In some cases, breeders cannot obtain the materials they need and are forced to abandon otherwise promising research initiatives. In the canola industry, for example, three out of seven breeders responded that they had to cease their research projects because they could not get material from another party. One canola breeder alleged that "the owners of the tools were unwilling to share because as a public company we didn't have a commercial arm. We talked to them for 2 years but they just wouldn't make it available." The problem seems less prevalent in the wheat breeding industry, where only four out of twelve breeders reported incidences of negotiations over materials breaking down, resulting in the cessation of projects.

In many cases, negotiations last for months, even years, inflicting significant delays and consequent costs on research programs. In the canola sector, three breeders indicated that they had experienced research delays; one reported that his negotiations had been going on for five years. Another noted that "in terms of negotiating

licenses there are a lot of delays and there was one actually that took three or four years just because of the inability to negotiate with the competitor." On the wheat side, four out of twelve breeders reported delays, with the maximum delay experienced being three months.

Conclusions

In this study, we have endeavoured to assess whether protecting IP poses a serious threat to the breeding community in the form of restricted or blocked access to upstream innovations. The interviews confirm that freely accessible materials have shrunk over the last few years and that the number of cases where legal arrangements are required to obtain research tools/germplasm has grown. Even though negotiating and licensing imposes additional costs, as well as determines the areas of research, there is no evidence that blocked access to upstream discoveries has been a serious problem.

The canola and wheat sectors show different patterns in terms of information/material exchange. In the wheat sector, where participants are primarily public entities, the degree of sharing of genetic materials is rather high and a majority of breeders agreed that about seventy-five to one hundred percent of materials are still freely accessible. The canola sector, dominated by the private sector, is marked by increasing secrecy and a general unwillingness of researchers to share research tools/germplasm. In many cases, the unwillingness to disclose research-related information is dictated by the patent (business) offices rather than a choice of the breeding society.

Reduced information flows and tools/germplasm exchange is, in part, a result of the protection system under which the biotech companies and breeders are operating. The Canadian patent system needs more integrity and clarity as to what is patentable and what is not. The uncertainty about eligibility for patenting encourages companies to keep information/materials secret rather than assign property rights and make the invention available via a licensing fee. This in turn stifles subsequent innovation and results in costly duplicative efforts.

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