Final Report

International Wheat Royalty Systems and Revenue Generation: An International Comparison

By

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February, 2015
RESEARCH ABSTRACT

The majority of wheat research in the world and in Canada is conducted by the public sector. The Government of Canada has introduced legislation to update its plant breeder’s rights (PBR) legislation, making Canada compliant with the International Union for the Protection of New Varieties of Plants (UPOV) 91 Convention, with the goal to stimulate private investment in wheat variety research. International experience with UPOV 91 reveals a wide range of outcomes depending on the specific royalty setting mechanisms allowed within their domestic legislation.

This thesis compares Canada’s existing policy to three very different international examples (France, United Kingdom, and Australia) of UPOV 91 compliant royalty collection systems for wheat. The model presented is one of a monopolistic competitive wheat-breeding industry with the introduction of a new certified seed variety. Farmers have the option to use farm saved seed (FSS) or certified seed on their farm. The benefit spillovers from the innovation are analyzed and interpreted for both, farmers (social benefit) and breeders (private benefit).

The results of the analysis show that while each UPOV 91 compliant model generates more revenue for farmers and breeders than Canada’s current policy, they tend generate less than expected revenue in the short-run. If a country has strong intellectual property rights (IPRs), it will attract some domestic and foreign investment and possibly a beneficial collaboration between the public, private, and producer sector, also known as 4-P (public-private-producer-partnerships).

Key words: UPOV, TRIPS, Intellectual Property (IP), monopolistic competition, public and private research, wheat research, research spillovers, welfare analysis, Australia, France, United Kingdom, Canada
BACKGROUND

Plant breeding is the single most important tool that delivers solutions to the challenges of food security, climate change and the more efficient use of resources as well as making a major contribution to economic growth (Alston et al., 1995). Public breeding institutions generally have limited funding available for projects and have to allocate their resources accordingly. Private breeding companies only invest where they see a potential for profits or where they know they can at least recover their high investment costs. According to Alfranca (2005) profitability depends on a country’s contract enforcement regulations or patent property right protection. As an incentive to attract private investment to a country, newly developed plant varieties need to be protected through intellectual property rights (IPRs) if technical IP protection isn’t possible (Lence and Hayes, 2008).

![Figure 1: Methods of IP Protection Summary for Crops (Giovanoli 2014)](image)

**Bill C-18- A General Overview**

Currently Canada is a signatory of the International Union for the Protection of New Varieties of Plants, known as UPOV, which is was created in 1961 and updated in 1978 and again 1991 to strengthen IPRs. Today most countries that are part of UPOV are signatories of UPOV 91. Canada signed UPOV 91 in 1994 but it has never passed UPOV 91 consistent legislation. In December 2013, the Government of Canada introduced Bill C-18, also known as “The Agricultural Growth Act”. “Bill C-18 is designed to modernize and strengthen federal agriculture legislation, support innovation in the Canadian agriculture industry and enhance global market opportunities (CFIA, 2013)”.
The main purpose of the revisions to Plant Breeders Right (PBR) Act included in the bill is to (1) encourage investment in plant breeding in Canada, (2) attract foreign varieties to Canada, (3) align the current statute with the UPOV 91 Convention, and (4) allow farmers access to the best varieties available in any country that is party of UPOV 91. The Bill is particularly important for crops without technical IP protection or patent protection.

This thesis will focus on the implications of UPOV 91 protection for wheat, which is the largest crop in Canada without technical IP or patent protection.

RESEARCH OBJECTIVES

As Canada moves forward with the introduction of UPOV 91, this thesis analyzes the royalty collection systems of France, UK, and Australia, which are compliant with UPOV 91 but have implemented PBRs in a different way. The thesis will examine the ability of these to systems to create private incentives for research, discuss the strengths and the weaknesses of each system, and identify what Canada could learn or adapt from such a system.

The specific objectives of this thesis are to:

1. Identify the incentives created by intellectual property rights (IPRs). Given the current royalty rates for FSS and certified seed within each country, calculate the benefit of breeders (private benefit) and farmers (social benefit) receive, which they are not paying for. This will address the question of: is there enough private benefit occurring given the current royalty rates to support a viable private wheat-breeding industry?
2. Learn something about the competitiveness of the wheat-breeding industry. How is the pricing of certified seed impacted by the existence of farm saved seed (FSS)?
3. Identify which of these three systems would best be adapted for Canada.

METHODOLOGY

Two methods are used to analyze how efficiently the countries collect royalties and how the parties (breeder or farmer) are benefitting from the current royalty rates charged.

First, I apply a six panel monopolistically competitive model to the wheat-breeding industry. This model aids to see how the willingness to pay for certified seed royalty is a function of the FSS royalty charged in the country.

Secondly, I calculate the social and private benefits created by the introduction of a new wheat variety. I calculate the benefit spillover from the introduction of the new variety to the farmer, given the current royalty rate. Calculating this spillover provides an indication of the ability of royalty system in each country to address market failure and create optimal private incentives for research.
Theoretical Model – The relationship between FSS and Certified Seed Royalties

A key output of the thesis is an economic model that derives the relationship between any royalties on farm seed (FSS) and the demand for certified seed. Figure 2 shows how the exogenously set FSS royalties impact what a breeder can charge for certified seed. This model can be applied for France and the UK. In France, the farmers’ and breeders’ unions mutually agree upon FSS royalties. In the UK, FSS royalties are predetermined and based on historical rates.

Beginning with the upper right hand panel, farmers have a downward sloping demand curve for the variety \( i \) equal to the value marginal product (VMP). This VMP reflects the additional revenue variety \( i \) will generate on each parcel of land. I assume that each farmer holds an identical portfolio of land\(^1\). Farmers wishing to adopt a new wheat variety are faced with a decision; they have the choice between purchasing certified seed or using FSS. If they choose certified seed they must purchase the seed from a certified seed grower. If they wish to use their own FSS they must purchase a small quantity of certified seed and incur the costs to grow it on their farm, test it, clean it, treated for use plus any FSS royalty due. With this latter option, the farmer must forego the additional rents earned from the variety for one year while they grow the FSS. The cost of using FSS rather than certified seed is included as an opportunity cost in the model, which is added to the marginal cost (MC) to make up the total marginal cost (TMC). Once incurring these additional costs, the will have access to the variety \( i \). The total farmer demand for variety \( i \) will be made up of either FSS or certified seed.

Figure 2: Relationship between the Farm Saved Seed (FSS) royalties and the derived demand for Certified Seed
The supply curve on the top right panel is the sum of the TMC and the FSS royalty. The TMC of producing FSS is the vertical sum of the opportunity cost plus the MC curve (both shown in the middle right panel). The TMC includes the cost of growing the FSS, seed testing, seed cleaning and treatment, and the opportunity cost of postponing yield gain for one year. The MC curve is upward sloping as different farmers have different costs of producing FSS and are ordered from those with the lowest to highest MC of FSS. Producing FSS might be quite cheap for a large farmer but can be expensive (i.e. due to cleaning and storage costs) for smaller farmers. This increasing MC curve helps us differentiate the farmers in the model.

Given supply curve of FSS and the total demand for the new variety \(i\), the demand for certified seed can be derived as a residual demand. As shown in the upper left panel of Figure 2, the price intercept of the residual demand for certified seed is at price of intersection of supply of FSS and total demand. At prices below this level, farmers have a willingness to pay (WTP) for certified seed, which includes the certified seed royalty.

The derived demand for certified seed royalty, shown in the bottom left panel is the farmers’ demand for certified seed minus price charged by seed growers for certified seed services. For example, if a farmer is willing to pay $5 per unit for certified seed and the seed growers charge $3 for certified seed services, the breeder can charge $2 royalty. The breeder, facing this demand curve must set the certified seed royalty. If breeders wish to maximize royalty revenue they will set MR = MC as the wheat-breeding industry is monopolistically competitive. MC of certified seed for breeders is zero. The intersection of MR = MC shows the quantity of certified seed produced (shown in the left panels).

**THE WHEAT ROYALTY SYSTEM IN FRANCE**

*Farm Saved Seed (CVO) Royalty Flow:*

The royalties on FSS are collected via end point royalty (EPR), known as Contribution Volontaire Obligatoire (CVO) in France, which is applied at the point of sale of all bread wheat varieties. The 0.50€ ($0.69) per ton EPR applies on all bread wheat varieties and is collected through the seed marketers.\(^2\) This CVO facilitates and reduces the cost of collection for GNIS and SICASOV (Alston et al. 2012, p. 32).

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\(^1\) The need for this assumption will become apparent later when we differentiate farmers by their seed reproduction costs.

\(^2\) The CVO is increased to 0.70 Euros per ton starting in the growing season of 2014 (SICASOV, 2013).
As shown in Figure 3, the marketers charge the farmer the CVO at the time of delivery. GNIS is responsible for the collection of the FSS royalty from the marketers and then redistributes the money (1) back to farmers, which fall under the small farmer exemption (producing less than 92 tons per year), (2) back to breeders, in direct proportion of certified seed sales, and (3) forward the rest of the money to SICASOV. Breeders get reimbursed 85 percent of the FSS royalties and SICASOV forwards the remaining 15 percent to Fonds de Soutien à l’Obtention Végétale en blé tendre (FSOV), which is the French wheat research fund (Alston et al. 2012 p. 32).

Figure 3: CVO Royalty Flow in France

Figure 4 shows the money and information flow for certified seed. Breeders get paid a royalty from the sale of certified seed for their variety. The certified seed royalty rate is identical across all bread wheat varieties at 75€ ($103.50) per ton, and is paid for when farmers purchase their seed from a seed grower (SICASOV, 2013). The seed growers declare certified seed sales and remit payment to SICASOV. SICASOV invoices and receives payment for declared certified seed sales, verifies the amount paid and reimburses the breeders. SICASOV and GNIS exchange information for verification purposes. GNIS inspects fields and seeds of seed growers.

Figure 4: Certified seed Royalties in France
Certified Seed Royalty Flow:

The CVO of 0.50€ ($0.69) per ton is also charged to the farmers that use certified seed at the time of delivery to a marketer. However, as opposed to FSS, farmers that provide receipts of certified seed purchases receive a refund of 20€ ($27.60) per ton of seed purchased, whereas FSS users do not get any refund at all.

According to the International Seed Federation (ISF) the French royalty collection system allows SICASOV to collect almost 100 percent of the royalties due on certified seed in addition to 90 percent of the FSS royalties (ISF, 2011). The other ten percent fall under the small farmers’ exemption or is consumed on the farm. The French royalty collection system is efficient at about 92 percent but currently applies only to bread wheat (ISF, 2011). However, efficiency can be interpreted in different ways. The system efficiency is different if looked at the perspective of the breeder or the farmer. The efficiency measured in the ISF report looks at the system as a whole with the given prices and royalty rates. It does not consider efficiency with optimal prices or royalty rates. The bottom line is that the system is well enforced and most farmers pay the royalties due.

Annual Royalty Revenue in France

Approximately 50 percent of wheat seed is farm saved. The collection and contributions to breeders works as follows. On sales of 36 million tons the grain marketers remit $24.84 million of royalties to GNIS (Gray and Galushko, 2013 p. 16). The sector is funded from $41.4 million in certified wheat seed royalty plus about $12.42 million in FSS royalties, $53.82 million in total (Gray and Galushko, 2013, pp.). The CVO increases the royalty incomes paid to breeders by 20 to 25 percent depending on the amount of grain collected each year (Interview 4, 2012).

UK ROYALTY COLLECTION SYSTEM

The UK has kept up with current forms of PBRs, based on the principles of the International Union for the Protection of New Varieties of Plants (UPOV). In 1964 the UK passed the UK Plant Variety and Seeds Act to become compliant with UPOV 1961. Ever since then, the UK has adapted its PBR to remain compliant with changing UPOV agreements and EU PBR legislation. In 1994 the EU passed legislation to become compliant with UPOV 91, allowing breeders to charge a royalty on FSS as long as it is ”sensibly lower” than the royalty on certified seed (McKee, p. 10, 2003). The 1997 UK Plant Variety Act allows the UK to be compliant with 1994 EU PBR legislation in addition to UPOV 91 (Galushko and Gray, 2013).

Farm Saved Seeds Royalty Flow:

European and UK law oblige farmers to declare their use of FSS. The FSS collection system relies heavily on the honesty of those declaring their use of protected varieties to the BSPB. Neither the BSPB nor the breeder have right to audit or verify the declaration made by the farmer and therefore have to take it on trust (BSPB, 2011, p. 5).

The UK FSS royalty collection system is the most effective in Europe and generates vital income for plant breeders with generally good cooperation from farmers; however there are some problems with enforcement. While compliance is generally very high, not all FSS is declared and paid for (BSPB, 2011).
The EU and UK legislation provide for three different ways in which FSS royalties can be collected. These are either a 1) contractual relationship between breeder and grower, 2) an agreement between a breeders’ association and a farmers’ association (McKee, pp., 2003) or 3) a default royalty rate on FSS of 52.5 percent of the weighted average royalty rate on certified seed grown the year before (Galushko and Gray, 2013). The British Society of Plant Breeders (BSPB) and the National Farming Union (NFU) negotiated a contractual arrangement and set a uniform royalty rate on FSS, which currently is 52.5 percent of the weighted average royalty rate on certified seed grown one year before (Galushko and Gray, 2013).

About 80 percent of FSS royalties are collected through mobile seed processors. When seed processors invoice the farmer for seed cleaning and treatment, they also invoice them for the FSS royalty, which is forwarded to BSPB. The processors are paid a small collection fee for this service, which is about 6.7 percent of the total FSS royalties collected. Figure 5 shows the FSS royalty Flow.

Figure 5: UK FSS Royalty Flow

**UK Certified Seed Royalty Flow:**

The collection of certified seed royalty is an easy and transparent system in the UK. Every seed lot sold by seed growers is inspected and certified. BSPB can so double check royalty collection because they receive a declaration from each seed grower, which specifies how many tons of each variety they have sold and royalty owed (Galushko and Gray, 2013). BSPB has about 160 sub-licenses with seed growers for production and sales that pay seed royalties to the BSPB. Seed growers are compensated about 1.2 percent on average from the total certified seed royalties collected for their collection efforts. Figure 6 shows the certified seed royalty flow.

![Diagram of FSS Royalty Flow](image-url)
According to the ISF, the overall ability of breeders to collect royalty on certified seed is 100 percent and about at 90 percent on FSS. BSPB retains about one to two percent of the royalties collected for the cost of certified seed collection and about 10 percent for FSS royalty collection.

Despite the apparent efficiency of collection annual royalty revenue in the UK is quite low, amounting to $28.4 million for the 2010/2011 production year, which is about $1.67 per ton produced. About $9 million is reinvested into wheat breeding each year (Galushko and Gray, 2013), the other $19.6 million are likely accounted for profit or paid to shareholders. The royalty rate for FSS was £36.1 ($60.28) per ton of seed in 2011, which is equivalent to £0.56 ($0.94) per ton of harvested grain. This implies that in 2010 the weighted average royalty was about £68 ($113.56) per ton of seed (Galushko and Gray, 2013).

THE AUSTRALIAN WHEAT ROYALTY SYSTEM

To conform with UPOV 91 the Australian Parliament passed the new legislation the Plant Breeder’s Rights Act 1994 (IP Australia, 2014). The Act owners to apply an end point royalty (EPR) to the grain produced from nominated PBR-protected varieties to collect revenue for further research. The duration of registration is 20 years from the date of issue of the certificate, depending on the variety requiring longer duration of protection (GRDC, 2011).

EPRs differ from seed royalties in at least four ways: (1) with an EPR the breeder is able to collect a royalty even if the farmer used FSS or does not buy new genetic material, which usually represents a significant loss in revenue to breeders (Perrin and Fuliginiti, 2008); (2) the breeder and farmer share the production risk; (3) by eliminating a seed royalty the farmer is encouraged to use the best variety and seeding rate; and (4) breeders can rely on crop marketers to enforce the collection of royalties (Alston and Gray, 2013). In the EPR system, royalties are collected at the point of sale of the harvested product, rather than the seed. As EPR return is linked to the production level, this provides breeders with an incentive to develop the most productive and highest value varieties (Variety Central 2014). For any particular variety, EPR rates are set at time of variety release and are maintained for the life of the variety.
Over the past 25 years Australia switched from a predominantly publicly funded and managed system with free wheat varieties to a levy-based system and more recently to a predominantly royalty-based funding system (Alston and Gray, 2013). This transformation has led to an increased total funding for wheat but has changed the distribution of cost and benefits between farmers, consumers, and the private industry. Australia has undergone three major changes in the past which are (1) the creation of the Grains Research and Development Corporation (GRDC) and levy-based grain research funding; (2) the PBRs Act and the creation of EPRs; and (3) the development of three for-profit public corporations that undertake wheat-breeding research (Alston and Gray, 2013). In addition to GRDC there are several federal agencies, state governments and private institutions that fund different aspects of agricultural research (Alston and Gray, 2013).

**Australia’s Wheat Royalty Collection System**

Australia’s royalty collection system is a very transparent and efficient system compared to many other countries. SeedVise negotiates and coordinates the EPR collection system (Alston et al. p. 24) and Grain Trade Australia (GTA) supports this approach. Many major grain buyers in Australia entered contracts with SeedVise and agreed to automatically deduct the required EPR from the farmer’s grain payment on behalf of Seedvise. The grain buyers are paid a small collection fee for this service (Grain Trade Australia, 2014).

Farmers have the choice to either use certified seed or to use FSS on their farm. Once they have grown and harvested any variety they must declare the variety at the time of delivery and/or fill out an annual Harvest Declaration Form (GRDC, 2011). On this form farmers declare quantity of seed sown, quantity of harvest grain sold, used on farm, stored, retained for planting and name of company that purchased the grain (GRDC, 2011). Grain traders then either deduct the royalty amount from the farmer’s grain payment and remit the royalty directly to the variety owner or make reports on grain purchases, which can be used by the variety owner to invoice the farmers directly. This mechanism allows for a simple and efficient royalty collection mechanism (Variety Central, 2014). Royalty Managers Directly Invoice Growers for EPR Payments (GRDC, 2011).

**Annual Royalty Revenue**

Australia typically harvests 25 million tonnes of wheat. Assuming the average EPR was AUD 2.00 per ton, this would amount to a total of AUD 50 million in royalty revenue (Alston and Gray, 2013). This large royalty stream occurs despite a very limited use of certified seed, indicating that royalty income does not need to be tied to the use of certified seed.

It is also very important to note that statutory levy-funded Research and Development Corporations (RDCs) have a profound effect on the Australian agricultural research system. The GRDC is the largest RDC and is funded by a mandatory levy of 1.02 per cent on the value of farm sales. The Australian Government matches up to 0.5 percent of the farm sale value (GRDC, 2011). Levy revenue with typically exceeds $100 million per year is now predominantly focused on agronomy, crop management practices and pre-breeding activities that EPRs don’t cover (GRDC, 2011). This levy is collected through the Department of Agriculture, Fisheries and Forestry (Variety Central, 2014). The GRDC manages levies and government funds (Coles, 2007).
LESSONS FOR CANADA

Looking at the history and current situations of France, UK, and Australia, Canada can learn the following lessons:

Lessons from France

• France has a great working system with a mid-sized private wheat-breeding sector that has a long history of partnership.
• France uses a uniform FSS royalty rate of .7 Euro per tonne, which is set through negotiation of seed industry and farmer unions. This allows farmers and breeders to plan forward and know the future royalty rates. While this system allowed FSS royal rates to set to commercially viable rates the process also reduces the risk of excessive royalty rates observed in some hybrid crops.
• GNIS and SICASOV have a successful working relationship, ensuring a good compliance in royalty collection. Collaboration between farmers’ and breeders’ unions and government is important in the creation of a royalty mechanism to ensure both parties benefit from the new legislation. This also reduces the risk of too much market power.
• It took France 12 years to implement the wheat-breeding industry they have today.

Lessons from Australia

• EPRs provide a strong protection for new plant varieties, close to the one provided by hybrids and patents. EPRs as a mechanism enforce intellectual property rights (IPRs), which over time would attract private investment for additional wheat breeding and research.
• The Australian breeders generate the most revenue if compared with the France and UK. Both royalties are exogenous, which means the private breeders themselves set them.
• During the initial periods of establishing EPRs, the ability to charge a royalty was highly dependent on the availability of free varieties in the market. The private wheat-breeding industry took 16 years years to reach commercial viable EPR rates but is profitable and successful today.
• In Australia, EPRs are variable and tend to increase over time, which can develop to a problem for farmers if firms gain market power and increase royalties dramatically. Today, barriers of entry to other breeding companies are high, which implies that the wheat breeders will market power increase their royalty rates over time.
• During the initial periods of establishing EPRs, the ability to charge a royalty was highly dependent on the availability of free varieties in the market. The private wheat-breeding industry took five years to implement, but is profitable and successful today.
• Australia implemented a private wheat-breeding industry successfully using EPRs.

Lessons from the UK

• The UK wheat breeding industry is very small, consisting of 6 small private firms. Together they generate very little royalty and invest $9 million per year in breeding activities.
• Placing undue confidence in the establishment of a viable private breeding sector, the UK stopped public investment in wheat in 1987 and left the private industry on its own without transitioning period. The result was a decade of lost genetic gain before upstream public research investment was restored. This outcome suggests that public withdrawal alone does not guarantee the development of a successful breeding sector.
CONCLUSION

With the implementation of UPOV 91, Canada has the ability to develop royalty collection mechanisms found in other countries. By implementing UPOV 91, France, UK, and Australia have all increased private and total investment in wheat research and breeding. Similar results are expected for Canada.

These case studies also show that efficient royalty collection, does not guarantee the establishment of a viable private sector. In Australia, it took 16 years for EPRs to reach a level to support a viable private breeding program. In the UK, the royalty revenue has only been able to support 6 small breeding programs. The establishment of negotiated uniform EPRs may be a more effective tool to fund private breeding in the near future.

A combination of public and private funding in addition to non-refundable levies is illustrated in via the Australian case to best in achieving enough funding for a viable wheat-breeding industry. Public private producer partnerships (4P) approaches show many benefits, regarding funding, regulation and management, even beyond wheat breeding. A combination of royalties, levy and government matching would be an optimum funding mechanism for future wheat breeding. Matching government grants for levies, such as done in Australia also successfully increase total funding for R&D while compensating spillover benefits beyond farmers.

RESEARCH OUTPUT

Publications:

Presentations (shared content):
Richard Gray “IPRs and Levies for Financing R&D in Agriculture” Presentation to the Senate Standing Committee on Agriculture and Forestry, October 18, 2012


REFERENCES


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<th>Abbreviation</th>
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<td>BSPB</td>
<td>British Society of Plant Breeders</td>
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<td>CVO</td>
<td>Contribution Volontaire Obligatoire</td>
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<td>EPR</td>
<td>End Point Royalty</td>
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<td>FSOV</td>
<td>Fonds de Soutien a l’Obtention Végétale en blé tendre</td>
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<td>FSS</td>
<td>Farm Saved Seed</td>
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<td>GNIS</td>
<td>Groupement National Interprofessionnel des Semences et plants</td>
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<td>GRDC</td>
<td>Grains Research and Development Corporation</td>
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<td>IP</td>
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<td>SICASOV</td>
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