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Assessing Impacts of the 2015 Legislative Amendments to Canada's Plant Breeders' Rights Act and UPOV'91 Ratification

Canada

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INTRODUCTION

Plant breeders' rights (PBRs) are a form of intellectual property (IP) protection granted by national governments. Similar to other forms of IP such as patents, the public policy objective of PBR is to provide incentives and rewards, stimulating investment and innovation in plant breeding. If the PBR IP regime is fair and functions effectively, it should encourage greater investment in plant breeding (private, public, or partnerships) increase productivity and create new end markets, facilitating farmers access to new plant varieties. Unlike patents, PBR is a form of IP solely reserved for new plant varieties only, containing many benefit sharing provisions that strike a balance between plant breeders and farmers. Governed by Canada's *Plant Breeders' Rights Act* (PBR Act), which came into force in 1990, PBRs are obtained through the Canadian Food Inspection Agency's (CFIA) Plant Breeders' Rights Office (PBRO). All plant species are eligible for protection.

In 2015, with the support of farmers and plant breeders, Canada amended its PBR Act to conform to the most recent international agreement, the *1991 Act of the International Convention for the Protection of New Varieties of Plants* (UPOV 91). A summary of the changes made can be found in Table 1. Although anecdotal information suggests that the horticultural and other crop production sectors have benefited the most from these legislative amendments, overall, there has been an absence of clear qualitative and quantitative data to support these assertions. Furthermore, there has been a lack of information and evidence on which sectors have benefited the most and to what extent.

The purpose of this report is to investigate the impact of strengthened IP protection since the 2015 amendments to the PBR Act, and to ascertain if those changes have benefited plant breeders, farmers, and the sectors overall. This report is a successor to the initial "10-Year Review of Canada's PBR Act (UPOV'78-based)" report published in 2002. It is anticipated that the indicators and lessons learned from this project, can be built upon on an ongoing basis, providing feedback on how breeding entities are leveraging strengthened PBR IP protection. Furthermore, it is anticipated that the results of this report may provide evidence to substantiate advancing further changes to Canada's PBR framework through future regulatory amendments.

The report is comprised of three sections: A) an economic analysis of the impacts of the 2015 PBR Act amendments; B) results of a PBR-user survey; and C) a number of case studies from national and international firms that use Canadian-granted PBRs.

TABLE 1: COMPARISON OF SOME PROVISIONS OF PBR ACTS: 1990 VS 2015

Dimension	PBR Act 1990 (UPOV 78)	PBR Act 2015 (UPOV 91)
Duration of exclusive monopoly rights on the registered variety	18 years for all trees and vines and all other crops (e.g., cereals, shrubs).	25 years for all trees and grape vines and 20 years for all other plant species. Option to extend PBR for up to 25 years for these other species if prescribed through regulations.
Provisional protection	Protective direction, allowed for interim protection (after filing the application) but did not allow for any commercial sales during this period.	The provisional protection after filing the application provides the same rights as those after granting PBR and could obtain remuneration during the provisional period.
Annulment of PBR (disputes based on the features of distinct, uniform, and stable)	Allowed for annulment of rights if evidence suggests that the variety is not distinct.	Also allows for annulment based on evidence that the variety was not uniform or stable (in addition to the variety is not distinct).
Revocation of PBR	Allowed for rights to be cancelled if holder was not able to supply propagating material, or if the holder cannot prove the variety is being maintained or fails to make annual payments.	In addition to such reasons, the revocation can occur if the variety is no longer uniform or stable.
Sales of new variety prior to filing PBR application	Did not allow any sales in Canada prior to filing a PBR application.	A variety can be sold for up to one year in Canada (testing the market) prior to application for PBR seeking variety protection through PBR.
Scope of breeder's rights	Scope of PBR only provided exclusive rights to sell propagating material of the protected variety and to produce such material.	Scope of exclusive rights are expanded (beyond sale and production), to include reproduction, exportation, importation, conditioning, and stocking of propagating material of the plant variety.
Rights on harvested materials	Rights were limited to only the sale of the propagating material and not any rights on the harvested material (e.g., seed).	Rights on the harvested material (e.g., grain), if obtained through the unauthorized use of propagating material (e.g., seed).
Essentially derived varieties	Did not extend protection to another variety that is "essentially derived" from an existing protected variety. No authorization of the original protected variety is needed for market introduction of such "essentially derived" variety.	Rights are extend to varieties which are essentially derived from a protected variety. Authorization of the breeder of the initial variety is needed for commercialization of the new "essentially derived" variety.
Rights over other varieties	Did not allow any rights over an identical variety or over hybrids that require use of PBR protected inbred lines used in hybridization.	Rights extend to varieties that are not clearly distinguishable from the protected variety.
Farmer's privilege	Did not explicitly prohibit farmer saved seed or saving of other propagating material for replanting.	Allows for farmers to use "saved seed (e.g. propagating material). However, authority exists to limit or restrict through regulations, for situations where this is no longer a customary practice (e.g. asexually propagated horticulture species) and to support equitable remuneration back to breeders when farm saved seed is used.

ECONOMIC IMPACTS OF 2015 PBR ACT AMENDMENTS

The purpose of the economic analysis is to examine the potential economic impacts of the strengthened PBR Act during the six years after the new PBR Act regime came into force (January 2015 to December 2020), relative to a comparable earlier period before those changes enacted (January 2009 to December 2014). The analysis first explores the changes between the two periods in the number of PBR Act applications accepted by the CFIA's PBR Office for all the crop kinds included in the PBRO database. Based on the changes in number of applications accepted between these two periods, 11 crops kinds were specifically selected to compare the growth rates in the production, yield, farm cash receipts, exports value and volumes for these two periods. These crops were chosen as they represent a diverse group of plant species that are economically significant to Canada. They are: canola, strawberries, field tomatoes, greenhouse tomatoes, wheat, dry peas, field peppers, greenhouse peppers, sweet cherries, apples and potatoes.

DISCUSSION

The strengthened PBR Act was intended to foster greater private and public investments in plant breeding in Canada, in addition to providing greater access to improved foreign varieties for Canadian farmers. Both these outcomes would, in theory lead to better and more profitable varieties available to Canadian farmers. Collectively, such improved plant varieties would lead to better economic outcomes for Canadian farmers and others in the crop production value chain, such as growth in production, yield, farm cash receipts, and exports.

However, when examining the economic changes that occurred after the PBR Act was modernized, there are two types of contributory factors to consider. The first type of contributory factors is the collective impacts of "plant breeders' rights" as affected by the PBR Acts. For instance, strengthened plant breeders' rights would stimulate more investments into better varieties that will enhance production, yield and open up new export opportunities. The second type of contributory factors that could influence economic outcomes are all the "other factors" other than "plant breeders' rights". These second types of contributory factors are many, including technological improvements such as better agronomical practices, better fertilizer and other inputs, better equipment, farmers' managerial skills and knowledge, etc., and other potential exogenous factors such as climate and weather variables, changes in consumer preferences in domestic and export markets, and other global economic changes.

During the reference periods, there were a number of the "other" contributory factors that would have had an impact on the economic variables considered. For instance, dismantling of the Canadian Wheat Board in August 2012 would have immediate economic impact during the 2009-2014 period relative to such impacts in the latter period (2015 to 2020). Similarly, the government of China's ban on Canadian canola exports in March 2019 was only relevant for the latter period (2015 to 2020) and no

similar incident occurred during the earlier period (2009 to 2014). There may be many such isolated events unique to each period. and these two periods are not strictly comparable in terms of "all other" factors.

Additionally, uptake of new varieties generally follows an "S" shape adoption curve (a few early adopters and, with a time lag, many late adopters). It is very likely that the enhanced rights for plant breeders with the new PBR Act may take a period longer than six years to bring about demonstrable and significant economic impacts.

CHANGES IN ECONOMIC OUTCOMES PRE AND POST 2015 PBR REGIME

The economic outcomes capture the physical output (production as a volume), pecuniary output (farm cash receipts), efficiency measure (yield) and competition in the global markets (export value and volume). Each number represents the percentage change from the 2009-2014 period compared to the 2015-2020 period. Table 3 summarizes the results.

TABLE 2: ECONOMIC IMPACTS OF PBR ACT AMENDMENTS (% CHANGE IN 2009-2014 PERIOD COMPARED TO 2015-2020 PERIOD)

	Production	Yield	Farm Cash Receipts	Export Value	Export Volume
Strawberry	23.59%	29.53%	54.70%	412.69%	281.59%
Canola	34.14%	18.49%	34.11%	28.18%	28.55%
Tomato (field)	0.73%	2.16%	36.43%	119.23%	46.66%
Tomato (greenhouse)	1.03%	12.91%	19.25%	31.26%	6.20%
Wheat (all)	12.10%	10.18%	37.81%	17.27%	17.49%
Pea (Dry)	22.73%	4.28%	30.00%	36.68%	23.56%
Cherry (sweet)	57.36%	33.17%	86.74%	97.69%	45.91%
Pepper (field)	26.00%	12.40%	72.95%	82.56%	37.90%
Peppers (greenhouse)	32.18%	2.38%	41.07%	74.45%	39.33%
Apple	-2.05%	2.47%	26.47%	61.14%	24.89%

Potato (Total)	5.83%	8.25%	20.08%	46.37%	8.48%

The desired impact of the new PBR regime is to have greater number of PBR applications, leading to a greater growth in yield. Other than apples and potatoes, all other crops had more applications granted for PBR protection under the new PBR regime relative to the earlier period. Yield, along with the other economic indicators, increased for all crops analyzed.

A significant increase in the number of accepted PBR applications is notable during the latter six-year period (2015 to 2020) relative to the earlier period as can be seen in Figure 1. Perhaps more importantly, prior to 2015 the number of PBR applications was falling, suggesting that the 2015 amendments resulted in a turnaround for PBR applications.

The increase in PBR applications provides some evidence that the changes to the PBR Act have had a positive impact on plant breeding and the agricultural sector in Canada. However, due to the other contributory factors noted above, as well as the fact that some of the investments that were made after the changes took effect will take a number of years to become apparent in the economic data. As such, the results of this analysis should not be taken as sole evidence for the growth experienced, but rather one of many possible factors that led to economic improvements for these eleven crops.

FIGURE 1: NUMBER OF ANNUAL APPLICATIONS RECEIVED BY THE PBR OFFICE UNDER THE UPOV 78 CONVENTION (2009-2015) COMPARED TO THE UPOV 91 CONVENTION (2015-2020)

Since economic analysis alone cannot be the sole attributable factor for of positive economic impact on the sector, this study also includes a survey of stakeholders and individual case studies of firms that have been impacted by the changes.

PBR ACT INVESTMENT SURVEY

This survey work was designed to identify the impacts the 2015 PBR amendments had on Canadian plant breeding investments. Two surveys were developed – one for plant breeders, agents, and licensee's and one for special interest organizations, including; producer commissions, general farmer associations, seed trade associations, seed growers, horticultural associations, etc., etc.. . Between December 2021 and March 2022, electronic survey invitations were sent to a total of 732 individual breeder organizations, agents and licensees or retailers with a presence in the Canadian market. A total of 121 responses were received for the first survey.

The second survey was sent to approximately 70 special interest organizations, domestically, and internationally, including entities whose members conduct or support crop research and plant breeding funding in Canada.

The second survey asked these organization about how their investments in plant breeding within Canada has changed since 2015. A total of 46 organizations submitted responses.

Quantifying a confidence level for the reported data is challenging as no database exists that contains 100% of potential recipients. Every effort was made to ensure as many potential recipients as possible were identified and invited to participate, but undoubtedly, some were missed. With 121 breeder institution, licensee/retailer, and agent responses and 46 special interest organization responses, we are confident the data gathered is representative of the sectors, but are not able to provide a specific confidence interval.

PLANT BREEDERS SURVEY

Respondents to the survey were asked to identify, as closely as possible, which of the following categories they fell into: a breeding organization which carries out research and development and releases varieties (45.4%), a licensee or retailer that sells seed to producers (25%), or an agent, such as a law firm specializing in IP law (16.7%).

One survey respondent reported to begin investing in plant breeding in Canada in 1878 (1.8%, n = 1). The remainder of respondents are considerably more recent, with 39.4% (n = 22) beginning their investments pre-1980, 10.8% (n = 6) began investing between 1981 and 1990, 10.8% (n = 6) began investing between 1991 and 2000, 25% (n = 14) began investing between 2001 and 2010 and 14.3% % (n = 8) began investing from 2011 onwards.

TABLE 3: CROPS CURRENTLY BRED (N = 166)

Crop Type	Number of Respondents Breeding this Crop Type
Cereal (e.g. wheat, barley, oat, corn)	30
Forage (e.g. grass, alfalfa, clover)	10
Oilseed (e.g. canola, soybean, flax)	23
Potato	24
Pulse (e.g. lentil, pea, bean)	13
Fruit (e.g. strawberry, apple, blueberry, cherries)	27
Ornamental (e.g. petunia, rose, hydrangea)	15
Vegetable (e.g. pepper, tomato, lettuce)	15
Other (e.g. cannabis, basil, hops)	9

For respondents who identified themselves as breeders, they further identified as private companies (80%), both private and public breeders (3%, n = 2), federal/national or provincial/state government institutions public breeders (3%, n = 2) and as university affiliated public breeders (13%, n = 8). Breeders worked both in Canada and abroad. About 44% of breeders reported that their activities are mostly based outside of Canada, 37% reported they work solely inside Canada and 19% have reported working both in Canada and abroad.

Most breeders identified that their breeding programs, or those of their clients, were funded mostly from (1) sales, licensing or royalties; (2) producer funding (e.g. check-offs); and (3) government funding and other sources.

About 25% of respondents self-declared as licensees or retailers. Most of these reported they are primarily based within Canada (63%). About 15% reported working solely outside of Canada and 22% have a presence both in Canada and abroad.

Agents (52%) stated that their organizations were mostly private sector (e.g. joint stock, privately held, sole proprietorship, self-employed). For agents, 11% reported being law firms specializing in intellectual property (IP), another 11% identified as general law firms, as consultants 7% (n = 2), only one respondent identified as an academic institution (4%) and four reported as being something other than the categories provided in the survey (15%).

Breeders have a suite of strategies for protecting their intellectual property (IP), including: PBRs; patents; trademarks; trade secrets; non-disclosure agreements; private contracts/licensing agreements; and hybridization. PBRs are the most frequently used form of IP with which plant varieties are protected in Canada (Table 4). Of the classes of crop types provided in this survey, respondents reported they protect cereal, pulse, vegetable and root crop plant varieties with the entire spectrum of IP options. The remaining seven crop types are protected with partial protection options.

TABLE 4: FORMS OF IP USED TO PROTECT NEW PLANT VARIETIES

	PBRs	*Patents*	*Trademarks*	*Trade secrets*	*Non-disclosure agreements*	*Private contracts/ licensing agreements*	*Hybridization (biological protection)*	*None*
Cereal	102	37	18	4	3	2	1	
Oilseed	40	28	11	2	3	1		
Tree	4		3		1			
Pulse	37	17	17	3	3	2	1	
Forage/grass	17	12	11	11	5	2		
Fruit	49	17		12	4	3	1	1
Vegetables	71	29	23	5	4	3	2	1
Root crops	24	14	4	1	1	2	2	
Spice	3	1	2					
Cannabis	4	4	1	1			1	
Ornamental	8		2	1		1		1

SURVEY RESPONSES

In evaluating the survey response, most stakeholders held positive views on the 2015 amendments.

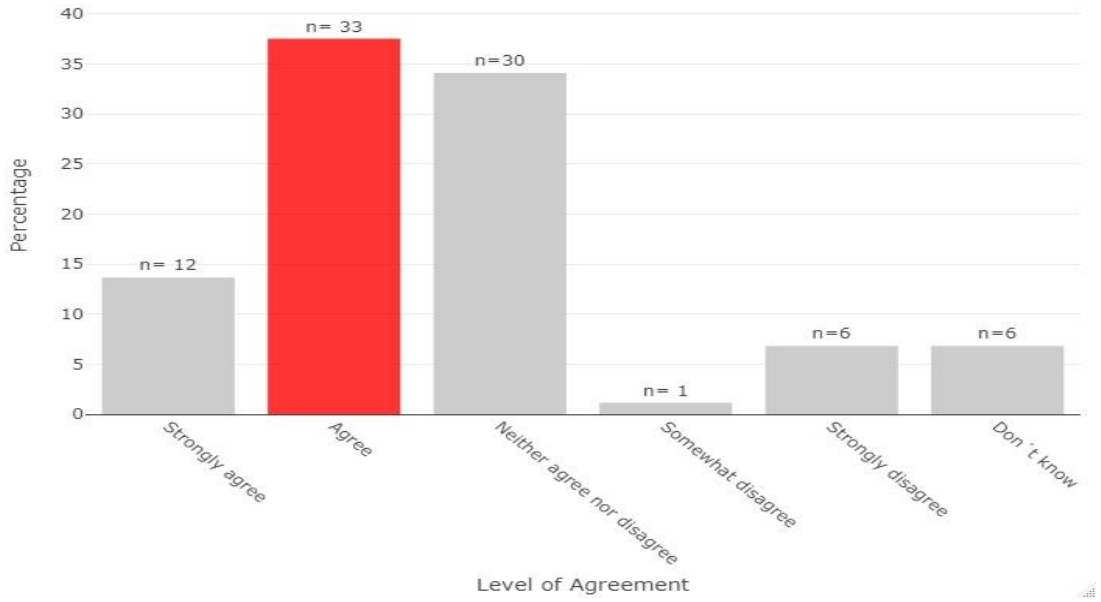
Asked whether the current PBR system provides a sufficient level of protection for their plant varieties, 52% either strongly agreed or agreed, and only 8% disagreed or strongly disagreed, with 7% indicating they didn't know and 34% neither agreeing or disagreeing.

The new PBR regime expands the scope of "novelty" allowing breeders to sell their new variety for up to one year in the Canadian marketplace, prior to filing a PBR application. The purpose of this provision is to afford breeders an opportunity to test the market before deciding whether to file. Respondents were asked whether they had taken advantage of this opportunity since 2015, with 59% said they had, while 41% stated they had not.

The duration of PBR was extended from 18 years to 20 years (25 years for trees and vines). 51% of respondents agree that the period for which PBRs are granted is appropriate, 18% identified these periods are not appropriate, with 31% indicating that the period for which PBRs are granted should be longer. Several respondents indicated that the length of duration should be tailored to the crop type, depending on the timeframe for breeding and marketplace adoption.

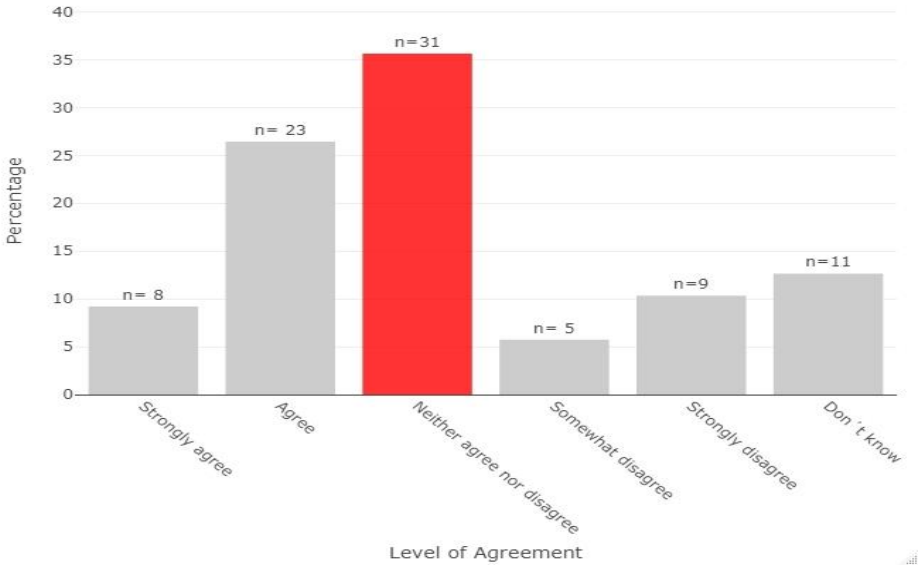
Respondents were asked about whether or not PBR amendments have encouraged them, or their clients, to invest more into their plant breeding program (Figure 2). While the majority of respondents agree (51%) that the PBR amendments have encouraged investment, 34% neither agree nor disagree, with 7% strongly disagreeing. About 7% reported they do not know.

FIGURE 2: PBR AMENDMENTS ENCOURAGED MORE INVESTMENT INTO PLANT BREEDING PROGRAMS (N = 88)



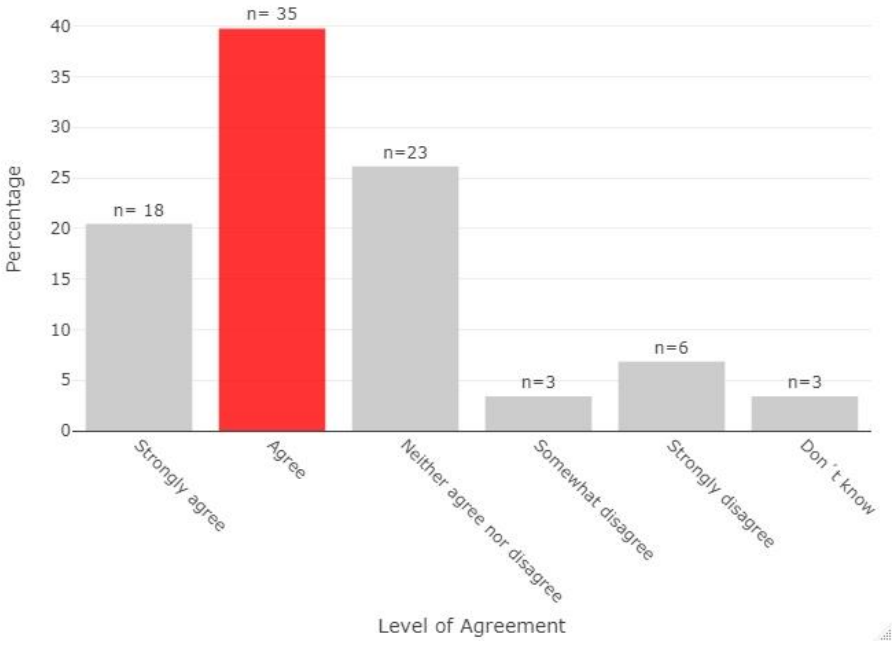
Some 36% of respondents (Figure 3) believed that the PBR amendments have encouraged greater diversity in plant varieties introduced; an identical number were uncertain whether they helped or not; about 16% thought the changes in the rules reduced the diversity of plant varieties. The remaining 13% reported they did not know.

FIGURE 3: PBR AMENDMENTS ENCOURAGED GREATER DIVERSITY OF PLANT VARIETIES RELEASED INTO THE CANADIAN MARKETPLACE? (N = 87)



When asked whether the 2015 PBR amendments facilitated greater economic opportunities in the Canadian marketplace for respondents or their clients (e.g., new partnerships, greater licensing opportunities, etc.), 60% of respondents indicated that economic opportunities have increased because of PBR amendments (Figure 4).

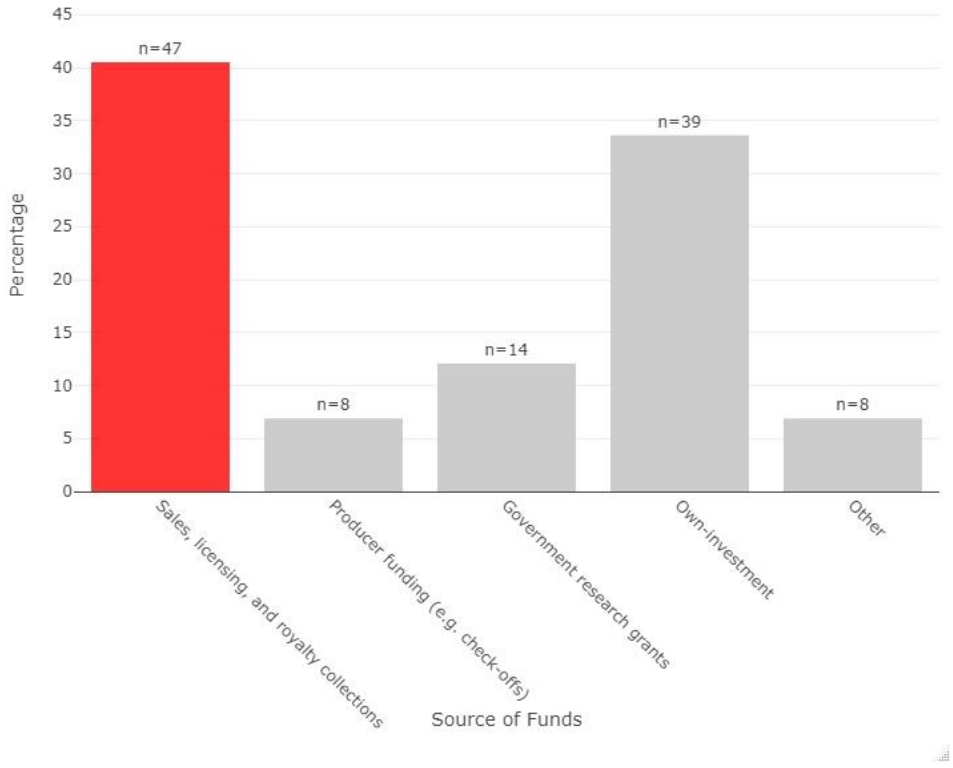
FIGURE 4: HAVE PBR AMENDMENTS FACILITATED GREATER ECONOMIC OPPORTUNITIES? (N = 88)



When respondents were asked whether the 2015 amendments provide sufficient IP protection to incentivize investments in plant breeding and the release of new varieties into the Canadian marketplace, 72% indicated they did. The remaining 28% responded they did not.

Respondents were also asked about the source of the investments into their breeding programs. Most investment comes from the revenue stream generated from licensing, sales and royalties from their collections, with the second leading source being their own investment (Figure 5). Most respondents (54%) stated that the investments they have made have been successful.

FIGURE 5: SOURCE OF THE FUNDS FOR INVESTMENT INTO PLANT BREEDING PROGRAMS (N = 116)



Respondents were asked to rank what plant breeding program component, from most to least, they had directed their investments towards (Table 4). Most respondents invested differentially in the marketing of their varieties, closely followed by permanent workers for their breeding programs.

TABLE 5: WHAT HAVE RESPONDENTS INVESTED IN?

Rank	Plant Breeding Investment Component	No. of Responses
1	Marketing for my variety(ies)	46
2	Permanent workers	39
3	Instruments/equipment necessary for my breeding program	38
4	Computers, software or other business equipment	34
5	Physical infrastructure/greenhouse improvement/expansion	33
6	Land area for your breeding program	32
7	Temporary workers	32
8	Workshops to improve my skills	15
9	Other	9

The 2015 PBR amendments in Canada sought to make Canadian plant breeders more competitive internationally. The survey asked respondents to state whether any aspects of their international research partnerships or collaborations had changed since the amendments had come into force. Only 20% of respondents reported these relationships had changed for them, with 71% stating that nothing had changed.

Respondents were asked whether they ever commercialize plant varieties without PBR protection. Most respondents (45%) stated that they had not, while 39% stated that they had.

Respondents were asked to provide additional comments they deemed important, but which might not have been explicitly asked in the survey. Table 6 contains their comments, corrected only for grammar and not for content. Twenty respondents offered additional comments. A handful suggested changes to the administration of the rules (make name changes easier, tweak variety use agreements (a contract-based form of IP protection) , facilitate recertification, simplify), a number commented on farmers' rights, breeders' exemptions, and related enforcement. A handful addressed the current period or protection and royalties (some wanted up to 30- or 35-years protection, while others wanted to end royalties) and a few noted issues outside the scope of PBRs (e.g., plants with novel traits, and phytosanitary quarantine rules).

TABLE 6: COMMENTS REGARDING PAST OR FUTURE CHANGES TO CANADA'S PBRS

	Comments
1	Ability to change the name of the variety when PBR has been granted - relates to out-licensing and reduces flexibility on deployment, CFIA variety registration allows change, but PBR does not; 1) Use variety description based on genotype info vs. phenotype - e.g. ear height on corn, cob width, etc....all irrelevant and would not be valuable to defend the line; and 2) removal of the farm saved and breeder exemptions
2	Eliminate the annual renewal fees.
3	I feel royalty collection needs to be removed from the sale and pricing of seed. This current method creates a lot of customer resistance. Many customers feel if they go to common seed it is a smart pricing decision to obtain seed more cheaply. We need a system removed from the price of the seed where farmers can see they are investing in their future. Now when they bypass the current system, they see it as a smart economic decision.
4	In conjunction with the PBR, we require the collaboration with the CFIA to provide restrictions on recertification
5	I wish the US had this.
6	Increase the duration of PBR to a minimum of 30 years. 35 years would be more appropriate
7	It's all about how we put the framework into action. If a Variety Use Agreement concept is successful we will be on our way to new levels of success in many of Canada's key crops which have suffered from under-investment
8	le plus gros frein pour le développement de nouvelles variétés au CANADA est à ce stade le goulet d'étranglement au sein de la station de quarantaine pour introduire de la génétique depuis l'Europe (très longue attente). *English Translation: The biggest obstacle to the development of new varieties in Canada at this stage is the bottleneck within the quarantine station to introduce genetics from Europe (very long wait).*
9	Not directly, but we are strongly hindered in our work by the problems with the quarantine authorities. We need to be able to import new varieties on a larger scale and with shorter delay.
10	Permanence of commercial names in PBR limits partnership opportunities/flexibilities. One name/one variety rule adds limitations. Ability to use genotype information rather than phenotype variety description would help modernize PBR. Removal of farm saved seed and breeder exemptions.
11	Please extend the period of PBR to 30 years
12	Plant with Novel Traits (PNT) issues will eventually force our company to move all of our research into areas such as Montana and North Dakota where innovation is not discouraged with PNT concerns

13	Simplification des processus *English Translation: Streamline processes*
14	The biggest issue we have as a licensee, is the ability (or lack thereof) to find reasonable settlements for PBR violations. Protection is only as good as your ability to enforce it and implement financial consequences as a future deterrent.
15	The changes may not have led to extra investments as such, but they did allow for reduction in costs and stronger license agreements, since we can now rely on a stronger PBR and do not need to take as much extra measures to cover the previous holes in the PBR law (by for instance contracts or TM's).
16	The cost to building up seed to get it to a level of commercialization is a financial risk, PBR offers protection for 20 years, but it would be a better incentive for breeders to have a longer time to protect their inventions that are so costly.
17	The people who do brown bag should not be allowed to remain unnamed when a settlement is made. Everyone knows the rules and still lots of brown bagging, i.e. illegal seed being sold, mobile cleaners are an issue also.
18	There may be an opportunity to do genetic fingerprinting, however that is in the distance as some UPOV countries may not agree on this methodology.
19	We have only started evaluating the impact of UPOV91 on our institution over the last year. UPOV91 has had both a positive and negative impact on us. Although the changes have led to an increase in industry interest and R&D sponsorship for specific crops, it has also led to increasing pressures from industry partners to allow the use of Variety Use Agreements (VUA's). The pressure to use VUAs has led to challenging questions around whether VUAs align with the intent of public breeding programs. There also seems to be a correlation between UPOV 91 and a trend toward decreased partnership diversity as pre-existing industry partners find ways to shut-out new industry partners from participating in our breeding programs in order to protect what they feel is "their" investment.
20	We live in heated homes, ideal for growing LLT fruits and vegetables. Light is the limiting factor in the north. In my opinion, plants that can survive and flourish with 20% of the direct sunlight is the answer for the future which I have been looking at for the last 41 years. With global climate changes, this will be crucial for our survival.

In conclusion, although most respondents agreed that PBR amendments have encouraged more investment into plant breeding in Canada, a significant number of respondents were not convinced.

SPECIAL INTEREST ORGANIZATION SURVEY

After the survey of plant breeders, an additional survey was undertaken with special interest organizations, such as; producer commissions that direct check-off dollars towards research and development, general farm organizations, seed growers

associations, seed industry, breeder associations, and organizations representing horticulturists and nurseries.

Most of these survey respondents (95%) think that the IP protection of new crop varieties is important; only 5% think that it is neither important nor unimportant. When asked to rank their organization's use of IP to protect their plant varieties, respondents provided the order listed in Table 5.

TABLE 7: FORM OF INTELLECTUAL PROPERTY FOR NEW PLANT VARIETY PROTECTION

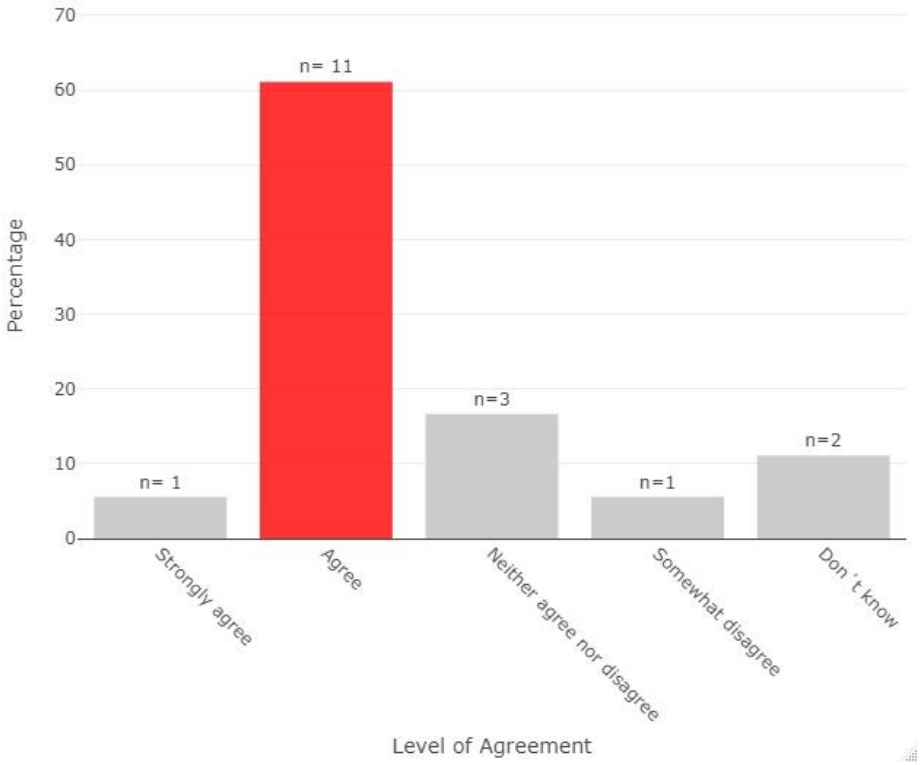
Rank	Form of Intellectual Property	Number of Respondents who selected this option
1	PBRs	17
2	Private contracts/licensing	15
3	Patents	14
4	Trademarks	13
5	Hybridization	13
6	Non-disclosure	12
7	Trade secrets	11

Some respondents used the opportunity to provide comments on this question. One respondent reported that in addition to the forms of IP in Table 7, they used 'consent forms.' A respondent involved in ornamental plant variety development reported that their IP strategy consists of layering; applying PBRs on foreign genetics, using patents in the US, trademarking or private contracts on most new varieties in Canada and when appropriate, licensing agreements as well.

Most respondents either strongly agreed (31.6%) or agreed (42%) that the current Canadian PBR system provides a sufficient level of protection for plant varieties. Only one respondent somewhat disagreed that the current system provides sufficient protection. Two-thirds of respondents think that the current period for which PBRs are granted is appropriate (25 years for trees and vines and 20 years for all other crops) while 14% (n = 3) of respondents would like to see these time periods extended, but only for specific crop types.

Some 61% of respondents indicated that current Canadian PBRs make them internationally competitive; no respondents strongly disagreed with this statement (Figure 6). However, 11% of respondents do not know whether current PBRs make them competitive and 6% somewhat disagree that they do.

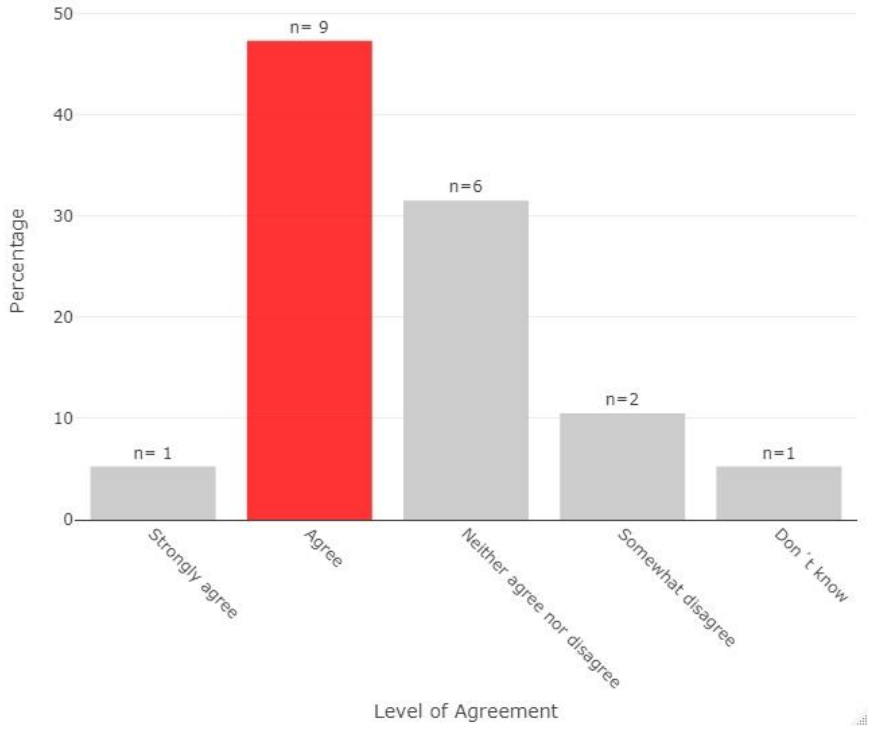
FIGURE 6: DO CURRENT PBRS ALLOW CANADA TO BE MORE COMPETITIVE (N = 18)



Asked whether the 2015 PBR amendments provide sufficient IP protection to incentivize investment in plant breeding and the release of new varieties into the Canadian marketplace, respondents were more divided (Figure 7). Most respondents agree (5% strongly agree, 47% agree) that the 2015 amendments incentivize them to invest in plant breeding, but 11% somewhat disagree and 5% do not know.

Nearly half of the respondents were uncertain about whether the 2015 PBR amendments had led to increased investment into new plant variety development. No respondents strongly agreed, 47% had no opinion on the matter and 37% agreed that the amendments had led to increased investment. If respondents agreed, they were asked to elaborate on what had changed as a result of the amendments. One respondent stated that because the Canadian market is very small, if there have been increased investments into the development of new horticultural varieties, it was a result of need, rather than changes in the PBR Act. According to the same respondent, financial gain for new horticultural plants developed in Canada is low; they indicated that foreign companies have developed a great number of new varieties, but very few are specifically adapted for the small Canadian market. Another respondent stated that while a renewed interest has arisen from private breeders, overall public investment is declining.

FIGURE 7: DID THE PBR AMENDMENTS PROVIDE INNOVATION INCENTIVES (N = 19)

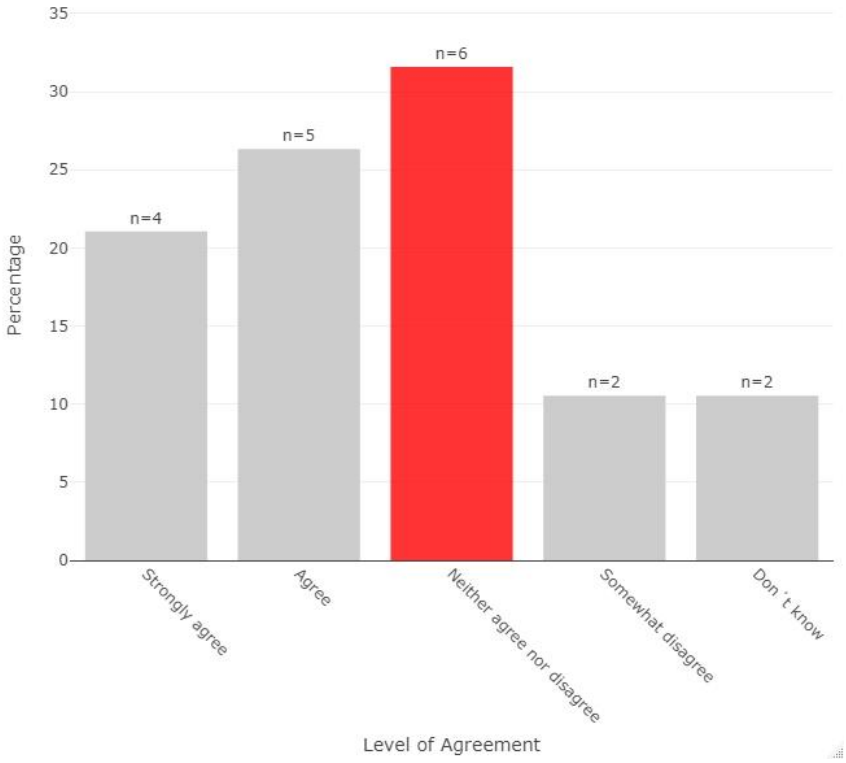


Respondents were asked whether they believed access to new plant varieties in the Canadian marketplace had increased following the 2015 PBR amendments. While most agreed (10% strongly agree, 37% agree), an equal number of respondents (47%) said they neither agreed nor disagreed. That is, almost half of the respondents do not know whether there are more plant varieties in the market as a result of the 2015 amendments. Those who agreed provided commentary for their decision. One respondent stated "More varieties are being brought in from other countries. While options are helpful, preserving the integrity of the quality assurance system that supports the Canada brand is essential." A sentiment of allowing foreign varieties into Canada while simultaneously breeding and protecting Canadian bred varieties was echoed in many comments on this question.

Respondents were asked to agree or disagree with the following statement: "Additional incentives beyond the 2015 PBR amendments are required to generate greater investment into the development" (Figure 8). Most respondents (32%) had no opinion on this question. Those who responded in the affirmative were asked to comment on their response. Two respondents called for clearer communication of a public sector breeding strategy in Canada, as well as increased return on investment from crops with a high percentage of common or farm-saved seed usage. Another respondent called for more proactive communication from all stakeholders (public administration, public research and farmers' organizations) about the benefits of new varieties and the role of

PBRs protection to ensure a fair level of investment for the breeding sector that drives further innovation is essential.

FIGURE 8: ARE ADDITIONAL INNOVATION INCENTIVES NEEDED (N = 19)



Respondents were asked to provide any further thoughts and comments about the 2015 PBRs amendments. Table 6 shows respondent comments that have been edited only for grammar.

In conclusion, our respondents report that the 2015 Canadian PBR amendments have had a positive impact in several areas, while the impacts were inconclusive in others. As it has been only seven years since these changes were enacted, and it takes many years to develop a new plant variety, we may be in the time lag between the changes and when significant positive impacts will be realised. This interpretation of survey results is supported by the fact that 47% of respondents did not have an opinion when asked whether they had a perceived increase in new plant varieties in the Canadian marketplace. Overall, special interest organizations report satisfaction with the 2015 changes to PBRs resulting in stronger protection.

TABLE 8: RESPONDENT COMMENTARY ON 2015 PBRS AMENDMENTS

	Comments
1	Although PBR offers some protection to the breeders, most of the regulation of varieties is controlled through the branding and licensing agreements. It would be nice if the US would adopt the Canadian PBR system for their country's genetic protection. Then breeders could use the same data for both countries to register a plant. Related to Q. Do current PBRs allow breeders to be competitive with other countries - there was strong agreement when the tree or shrub has a large share in the Canadian market such as sweet cherry. PBR is a helpful tool if cherry growers are non-compliant, which is a regular occurrence. Shrubs that have a huge potential for sales are worth protecting such as the UofS sour cherries with a large Canadian market. However the answer is strongly disagree for plants with small regional demand developed in Canadian breeders as there is little need for PBR protection since Trademark registration for the commercial name is all that is required. Since there are only a few tree growers in Canada, it is easy to keep track of productions. The annual maintenance fee is a deterrent for new horticultural varieties with limited markets. Foreign breeders have embraced the PBR system and therefore have flooded the market and out competed Canadian breeders. Its not a complaint, but it is the reality. Only a small percentage (0-33% depending on the species) of roses, hydrangeas, ninebark, spirea and potentilla registered are Canadian bred.
2	It is a challenge to enforce PBR of seed which is sold without variety name i.e. "common seed". The PBR advisory committee is very important and should be appointed.
3	Gene editing could allow for quicker and a regional focus on Atlantic genetics. We acknowledge our market is small and feed focussed but occasionally we export out of the region.
4	The US Plant Variety Protection Board is a critical way for the users of the PVP system to make their voices heard with the PVP office and we support similar appointment-based processes in Canada.
5	When you think in changes, think BROAD... many species should benefit of a new framework and its implementation

CASE STUDIES

A number of case studies were undertaken to a garner some concrete examples of PBR uses in various sectors and how the 2015 amendments impacted stakeholders. The eight case studies cover a broad spectrum of crop sectors that use PBRs, with PBRs relatively more important in certain sectors than in others. Plant breeders/variety developers interviewed were all aware that Canada's PBR Act now conforms to UPOV'91, and generally welcomed the changes. However, not all of these were as aware of which specific provisions changed in the law. Generally, plant breeders/variety developers that were fully dependent on royalties for the success of their breeding and/or commercialization business were strongly aware of the changed provisions that directly impacted their business. Plant breeders that had their breeding program

financed by other funding sources (in part or fully), such as public institutions, were less aware of the changes in the PBR Act (2015).

The following eight sections illustrate the importance of the PBR Act (2015) to the plant breeding and commercialization efforts for eight different organizations in the fruit, vegetable, ornamental and cereal sectors.

UNIVERSITY OF SASKATCHEWAN - HASKAP (EDIBLE BLUE HONEYSUCKLE)

Haskap, otherwise known as edible Blue Honeysuckle, is a fruit bearing circumpolar species native to northern boreal forests in Asia, Europe, and North America. It is mainly found in low lying wet areas or high in mountains, and is related to related to the Snowberry and Elderberry. Haskap plant breeding began more than 20 years ago at the University of Saskatchewan – Crop Development Centre (CDC) and has developed an international reputation and considered the world's top haskap breeding program. The breeding program has the globe's most diverse haskap germplasm collection, and has been instrumental in commercializing haskap production in Canada.

IMPACT OF CHANGES IN THE PBR ACT (2015)

The novelty feature, with the ability to test the market for one year without applying for PBR, status was viewed as helpful to the variety development process.

Additionally, the provisional protection feature provides significant clarity on the ability to sell a variety when the PBR application is under review, particularly when the time frame between PBR application and being granted PBR status can be two or three years. While this feature provides the same rights in the provisional period as when PBR is granted, the change avoids any improper use of the germplasm. To date, it is understood that haskap the propagators respected the breeder's ultimate rights during the review process at the PBR Office, while the variety is pending grant of rights.

The essentially derived varieties provision, while not used to date, is also seen as important, as haskap breeding is starting to occur in other jurisdictions. This provision gives protection to first innovators, such as the CDC, when their varieties are used by other plant breeders under the "breeder's exemption" to create new varieties. A slight change to a CDC variety, resulting in an essentially derived variety, can now enable the CDC to exercise their rights, and possibly strike an agreement to capture royalties on these essentially derived varieties.

The expanded scope of breeder rights is also seen to be an important provision in the future. The clarity and scope of coverage will enable the CDC to use PBRs to develop license agreement where purchasers of CDC varieties may pay a modest per plant royalty and then also pay a royalty on the on-going volume of production associated with that CDC variety. This royalty structure is used with some tree fruit varieties and can be extended to perennials such as haskap.

Over the past 15 years, the breeding program has been receiving PBR-enabled royalties, increasing incrementally each year. This has created a self-sustaining funding environment, whereby this public breeding program is now fully supported by royalty income.

POSSIBLE FUTURE CHANGES TO PBR AND ASSOCIATED ADMINISTRATION

The farmer's privilege provision in the current PBR Act was viewed as a weakness that needed to be addressed. Haskap growers in Canada could use cuttings of CDC haskap varieties from their own operation to produce more fruit-bearing plants from these cuttings, without compensating the CDC. By doing so, CDC's IP would not be adequately protected and there would be no royalty income flowing back to the CDC on these on-farm plantings. The farmer's privilege portion of the PBR Act requires a clarifying change to indicate whether farmer's privilege should only extend to seeds, where it is the customary practice of farmers to save and reuse seed, and not asexually propagated crop kinds such as haskap.

SUMMERLAND B.C. - SWEET CHERRIES

Through Agriculture and Agri-Food Canada (AAFC), there has been a public sweet cherry breeding program in place since 1936. This has allowed AAFC to have an extensive collection of germplasm to support a breeding program that has become world renowned, with AAFC sweet cherry varieties grown in northern and southern hemisphere countries. Summerland Varieties Corporation (SVC) an exclusive licensee owned by the British Columbia cherry growers, was created to test all AAFC sweet cherry varieties and to commercialize these varieties in domestic and international markets.

IMPORTANCE OF CHANGES IN THE PBR ACT (2015)

SVC indicated that they will soon release a number of new highly-anticipated sweet cherry varieties under UPOV'91, which will benefit from the strengthened amendments to Canada's Plant Breeders' Rights Act.

Modernizing the PBR Act (2015) to better align with UPOV 91 is seen as very beneficial to sweet cherry variety development and growth of the BC cherry industry. The benefits will continue to materialize as new varieties are launched. The cooperative relationship between AAFC and SVC is focused on releasing early to late season sweet cherry varieties. The northerly latitude of cherry production, and the higher elevation of orchards allows British Columbia growers to fill market needs when competitors in California and Washington are no longer in season.

Cherry trees can be in production for more than 30 years. The duration of rights being extended to 25 years (from 18 years) is very beneficial to sweet cherry breeders and growers. After a variety is granted PBR, it can be 6 years before orchards with the new variety are supplying fruit to the marketplace. This feature can provide for an IP royalty

flow back to the rights holder on a production related royalty system over a longer time frame. The grower also benefits by having exclusive access to the variety and a protected domestic market for a longer period of time.

The sweet cherry sector would welcome a longer period of protection on fruit trees, such as 30 years of PBR protection. It can be 20 to 25 years after PBR is attained to reach maximum production of a sweet cherry variety.

The scope of breeder's rights provision is seen as very beneficial as it better articulates the full breadth of PBR rights – from providing plant material to propagators through to the sale of trees to growers.

The provisional protection feature is very useful to the industry. This allows propagators and growers to begin to develop a critical mass of plantings and be able to go to market with a new variety as soon as possible. As well, it ensures that IP rights are in place during this provisional period.

PBR extension to harvested materials is an improvement where breeders can now exercise their rights on the sale of harvested materials (the fruit), and not just on the fruit tree, in cases where there has been an infringement. This also allows Canada to protect its domestic market from fruit that is illegally grown in other countries and imported into Canada.

The essentially derived variety provision in UPOV 91 is critically important part of the suite of new PBR. Given the technologies now available to breeders, such as precision gene editing, protection of a breeder's IP would be further strengthened by better defining essentially derived varieties.

The success of the AAFC and SVC relationship is also predicated on licensing Canadian bred sweet cherry varieties into other markets internationally. SVC has filed for PBR protection in seven other countries/jurisdictions (see Table 9).

TABLE 9: PBR APPLICATIONS FOR AAFC SWEET CHERRY VARIETIES BY COUNTRY/REGION

Country	Number of PBR applications
EU	22
Canada	18
Australia	12
US	11
S. Africa	9
Chile	8
NZ	7
Argentina	3
Total	**90**

UNIVERSITY OF GUELPH AND FOX SEEDS - ASPARAGUS

Asparagus breeding at the University of Guelph is an example of a public breeding program that enabled the expansion of asparagus acreage in Ontario, and its alignment with a grower-owned, private seed company resulted in the distribution of Guelph hybridized asparagus varieties in a number of markets. The breeding program began in 1979. 'Guelph Millennium', the first variety released from the program in 2000, had superior winter hardiness and longevity, resulting in higher yields. It is the main variety grown in temperature regions of North America. Following the success of Millennium, two newer varieties 'Guelph Eclipse' and 'Guelph Equinox' are generating interest domestically and internationally.

IMPORTANCE OF CHANGES IN THE PBR ACT (2015)

With released asparagus varieties based on hybridization, a biological form of IP protection, the University of Guelph indicated that the changes to the PBR Act are of lesser importance to their breeding program when compared with other breeding programs.

Changes that were viewed as beneficial include:

- The increase in the protection period from 18 years to 20 years;
- The additional clarity provided in the expanded scope of breeder's rights and associated greater control over propagating material;
- The provisional protection provision which does not restrict sales and offers full PBR rights during the PBR application period, which can be exercised after PBR is granted.

POSSIBLE FUTURE CHANGES TO PBR AND ASSOCIATED ADMINISTRATION

The current PBR Act provides PBR protection for 20 years for asparagus, and 25 years for trees and vines. Asparagus takes up to four years before a variety is in full production, and many growers will not adopt a new variety until it has shown acceptable performance for a number of years (e.g., in years five and six). Since a variety can provide a healthy crop and returns for 20 years, after the initial growth period and after a few years of observed production growth period, the actual years of protection can be less than 10 years for some adopters of a variety, with 14 years for the earliest adopter. Consequently, the greatest potential for seed sales will be after 6 or 7 years after variety introduction, therefore adding five years of protection will be important as it will cover the time period when sales are at their maximum. This indicates that asparagus as a perennial plant could benefit from a longer period of protection, such as 25 years, similar to trees and vines.

VEGETABLE SEED PLANT BREEDING – RIJK ZWAAN IN CANADA

Rijk Zwaan is a Netherlands-based, globally-focused vegetable plant breeding company, selling seeds into more than 100 countries internationally, with a portfolio of over 1,500 varieties, spanning more than 25 different species. As a breeding company, 40% of Rijk Zwaan staff is employed in R&D. Thanks to the passage of the PBR Act (2015), Rijk Zwaan expanded its seed sales into the Canadian greenhouse vegetable sector. The size and growth of the greenhouse vegetable sector in Canada, and an increasing number of suitable varieties, led to Rijk Zwaan's decision to invest more heavily within Canada. Rijk Zwaan also collaborates with the Lettuce Foundation, a non-profit organization of Canadian lettuce growers, to develop new varieties.

IMPORTANCE OF CHANGES IN THE PBR ACT (2015)

Rijk Zwaan indicated that there were a few changes in the PBR Act (2015) which were beneficial to their vegetable seed business and expansion in Canada.

The novelty feature is critical, since prior to 2015 the company was restricted to filing an application first, and did not allow Rijk Zwaan to test a variety for grower and marketplace acceptability in the Canadian marketplace. Now with the amended UPOV'91 Act, the one year period for "novelty" allows for the variety to be sold and tested in the Canadian marketplace first, determining if there is grower acceptance, before a decision needs to be made on filing a PBR application.

The legislative change on essentially derived varieties widens the scope of IP protection for plant breeders. On the one hand it acknowledges the breeder's exemption that allows anyone to use PBR protected varieties for the development of other varieties without the consent of the PBR holder. On the other hand, it extends the PBR protection to varieties that are predominantly derived from the protected initial variety and retain almost the whole genome of the initial variety. This enables the breeder of the initial variety, who might have needed 10 to 15 years to develop a new variety by combining different genomes, to get return on investment which is necessary to continue developing improved varieties. Previously, this could not occur since the prior version of the Canadian PBR Act was based on UPOV'78 and did not extend PBR protection to essentially derived varieties.

Provisional protection can help Rijk Zwaan to seek compensation if a variety was already produced and sold during the provisional period, while the application was pending granted of rights by the PBRO.

An administrative feature that is beneficial to foreign breeder companies such as Rijk Zwaan is that the PBRO started to accept the necessary data and reports developed by the variety developer in its home country (e.g., in the EU). This reduced administrative and monetary burden, removing the requirement for a breeder to conduct trials within Canada to support its PBR application.

In general Canada's conformance to UPOV'91 appears to have caused foreign plant breeding organizations to provide more seed varieties to Canadian vegetable growers, which should result in performance improvements in their growing operations.

POSSIBLE FUTURE CHANGES TO PBR AND ASSOCIATED ADMINISTRATION

The farm saved seed exception could be excluded for vegetable seeds like it is in the European Union. The farmer's privilege was only ever envisioned to be applied to agricultural crops such as cereals, where it is a customary practice for farmers to save and reuse seed.

An administrative feature that would be beneficial to foreign breeder is for the PBRO to use UPOV's harmonized forms for PBR, with associated exhibits required for DUS determination. There is an additional cost to non-Canadian plant breeders to draft forms and templates that are specific to Canadian requirements.

Another administrative feature, which is not unique to Canada, is for a specialized court that could be created to deal with PBR infringement issues. With infringement cases determining proof of a PBR violation can be difficult, and the judiciary often lacks expertise in this form of IP law. Having qualified PBR experts to rule on PBR infringement cases will likely be beneficial to the plant breeding sector.

VINELAND RESEARCH INNOVATION CENTRE – COLD HARDY ROSES

The Vineland Research Innovation Centre (VRIC) began its winter hardy rose breeding program in 2010, which started with the transfer of all the AAFC rose breeding material to VRIC based on a partnership with the Canadian Nursery Landscape Association (CNLA). The CNLA is a national not-for-profit federation of nine provincial landscape and horticulture associations representing over 3,800 members. These locally owned companies grow, sell, design, install, and maintain plants and other landscape features. Several CNLA members will propagate (multiply) the PBR protected varieties on behalf of VRIC for eventual sale to the consuming public. The original rose germplasm was transferred from AAFC, and is now owned by CNLA, with VRIC using this material to develop new cold hardy rose plants. VRIC is an independent, not-for-profit R&D (innovation) center, focused on improving productivity and expanding markets for Canadian horticultural products (which includes ornamentals). The center has around 90 staff fulltime staff with expertise in areas such as plant variety development, automation, biological crop protection, plant responses and the environment, and consumer insights and sensory evaluation.

CHANGES IN THE PBR ACT (2015)

According to the VRIC, there are four changes in the PBR Act (2015) that were beneficial to their business model.

The novelty provision where a new variety can be sold within Canada for up to one year before determining whether to seek PBR protection was deemed important. The benefit is that it provides VRIC with some measure of security in the event of unauthorized sales.

Additionally, the VRIC indicated that the change to the provisional protection period (the time period between application for PBR and the granting of PBR by PBRO) was helpful. This provision eliminates unauthorized use of the variety and any disagreement between parties on ownership of genetics. Prior to the amendment there was a risk that plant propagators could claim that they had ownership rights to the material developed during the application period. The time period between application and granting of PBR was 2.5 years for one VRIC application. As well, some foreign varieties had PBR status pending for up to 4 years in the last decade. This window mitigates market place risk by ensuring that all IP rights are in force during the application period.

Another feature of importance is the enhanced scope of breeder rights. The specificity of breeders' rights covering all acts necessary to move the variety to commercialization, from propagation through to the import and export, and eventually sales into the marketplace assists VRIC on exports of breeding stock into non-Canadian markets. License holders can be assured that the variety is protected through the complete supply chain, which eliminates any possible duplication by another party with almost identical germplasm.

Finally, PBR protection is enhanced through the essentially derived varieties provision. This feature provides VRIC and CNLA members with protection when a new variety is bred by another breeder using the VRIC variety, using breeding techniques which result in minor or additive changes. An example could be a foreign variety seeking registration in Canada, that is almost identical to a VRIC variety except for one or two additional traits. As well, it could be a natural mutation such as a sport from a plant, which is then propagated, that is essentially similar to the parent except for a characteristic such as flower colour. While this feature does not prevent registration, this provision enables VRIC to benefit from their value added of black-spot resistance and cold-hardiness.

POSSIBLE FUTURE CHANGES TO PBR AND ASSOCIATED ADMINISTRATION

Possible additional changes to the PBR Act were not identified by VRIC personnel. However, some administrative changes were suggested for consideration by CFIA and PBRO. The first possible change is in the registration process and how the distinct feature of DUS (distinct, uniform and stable) is administered. Currently, distinctiveness for roses varieties is visual and based on plant morphology. This can work against new varieties that have built in genetic traits without altering morphology. A solution is to based distinctiveness based on DNA and the use of genetic markers (for specific distinct traits).

SPRING MEADOW NURSERY IN MICHIGAN

Spring Meadow Nursery, based in the United States (Grand Haven, Michigan), develops and supplies new ornamental varieties for the wholesale nursery and landscape market internationally. Within Canada, the new ornamental varieties are mostly developed and introduced by foreign plant breeders. Spring Meadow Nursery sells ornamental varieties directly to Canada, but also licenses many Canadian growers to propagate their varieties for sale into the market. The company had a reasonable market share within Canada prior to the amendment of the PBR Act (2015), with the changes to conform to UPOV'91 providing additional IP protection and confidence for Spring Meadow to expand its business in Canada.

IMPORTANCE OF CHANGES IN THE PBR ACT (2015)

Spring Meadow Nursery indicated that the changes made to the PBR Act (2015) to conform with UPOV'91 were important for their business. The changes provided more confidence in Spring Meadow Nursery as the company and its licensees conduct business in Canada.

The novelty feature that allows for product to be sold in Canada for up to one year before applying for PBR enabled Spring Meadow to test the market in Canada to see if a variety would have some potential. As well, the one-year period reduced the costs and administrative burden in Spring Meadow's application filing process.

The provisional protection provision also provides more confidence to Spring Meadow Nursery as Canadian nurseries grow out the plants for retail sales (over a 12-month period) and then make retail and commercial sales, while the application is pending and before PBR are granted. While not the case with its licensees, this feature provides confidence that rogue actors will not appropriate Spring Meadow Nursery germplasm. Misappropriation has not been the case for the company in Canada; however, it provides another layer of protection.

While for many woody plant varieties, new varieties replace older varieties before 10 to 15 years of marketplace sales; however, the extension of PBR to 20 years will be beneficial to some more durable and long-lasting varieties.

The change on essentially derived varieties widens the scope of IP for plant breeders in cases where there are very small changes to a plant that is also distinct (from another variety). This provides another layer of comfort to variety developers supplying the Canadian market.

POSSIBLE FUTURE CHANGES TO PBR AND ASSOCIATED ADMINISTRATION

Several ornamentals supplied by Spring Meadow Nursery can be vegetatively propagated. The farmer's privilege provision in the PBR Act (2015) enables growers to propagate a Spring Meadow Nursery variety, if they so choose. According to Spring Meadow Nursery, the farmer's privilege feature could be strengthened so as to be limited to seed reproduced crops, that are a customary practice for farmers, or even a

sub-set of seeds. Excluding vegetative propagation would provide an even higher level of confidence to ornamental breeders such as Spring Meadow Nursery, and be consistent with international norms such as Europe. With this weakness in the current system, variety developers from other jurisdictions could, in theory, supply a Spring Meadow variety into the Canadian market without any royalty income flow back to the company.

The annual cost to renew PBR is approximately $300 per year. According to Spring Meadow Nursery, this feature can cause some breeders to discontinue sales of a variety as sales decline sooner than would otherwise occur with smaller annual fees. One administrative change that could be considered by PBRO is to reduce the annual renewal fee after a specific number of years and/or have a lower fee for varieties that demonstrate minimal annual sales. With such a change, a variety developer may choose not to withdraw rights as quickly with the result that there is more choice for the landscape industry.

CÉRÉLA – CEREAL BREEDING IN EASTERN CANADA

Céréla inc. is a private cereal breeder/variety developer in Quebec that was incorporated in 2010. Céréla purchased the assets of the Nevico Research Centre, also known as Semico. As part of the purchase, Céréla acquired a germplasm bank of wheat, barley, oats, and soybean lines under evaluation, as well as many registered varieties. The cereal breeding and sales program at Céréla is focused on developing spring and winter wheats, barley, oats, soybeans and hemp high yielding cultivars, without genetic modification (non-GMO), that can be grown productively in a few regions. Céréla has distribution agreements for its varieties in Canada, USA, South America, and Europe. However, three-quarters of its seed is sold and used in Quebec and eastern Ontario. Céréla began applying for PBR protection for its new varieties, as a result of the improved IP environment created by the 2015 amendments to the PBR Act, and to assist in commercialization efforts by its seed distributors.

CHANGES IN THE PBR ACT (2015)

Company representatives acknowledge the importance of IP protection and how the updated PBR Act provided additional PBR for cereal breeders. Notwithstanding the benefits of the PBR Act (2015), the Céréla breeding program developed because 85% of the cereal crops grown in Quebec are certified (cereal) seed market, with very low levels of farmer saved seed, a unique feature in Canada.

All newly released varieties by this company apply for PBR under the new UPOV 91 level of protection. Céréla has three spring wheat varieties with PBR protection, and another eight still in the approval process still pending grant of rights at the PBRO.

POSSIBLE FUTURE CHANGES IN PBR AND ASSOCIATED ADMINISTRATIVE

The company is aware of the current weakness of PBRs as they pertain to the ability of plant breeders/variety developers to easily capture royalties on growers' use of farm-saved seed. Canada is not meeting its obligations to UPOV, failing to implement a farm saved seed or harvested material royalty system, which "safeguards the legitimate interests of the breeder". This feature needs strengthening to enable all variety developers and seed companies to operate on a level playing field and capture IP revenues on crops grown with their varieties' (bin-run) farmer saved seed. A Variety Use Agreement (VUA) is a possible mechanism to capture royalty income on farmer saved seed, however, it does ensure a level playing field when only subset of breeders require the use of VUA on their Certified seed sales, and is not applied across all breeding institutions, both private and public. Consequently, the law should be changed so it is clear that breeders have the right to fair compensation, when farmers have saved and replanted seed of a PBR protected variety. This creates a fair and balanced marketplace where both farmers and breeders benefit.

LIMAGRAIN CEREALS RESEARCH CANADA – WHEAT BREEDING

Limagrain Cereals Research Canada (LCRC) is a partnership between Limagrain and Canterra Seeds. Canterra Seeds is owned by western Canadian seed growers and agricultural retailers, Limagrain, Ceres Global Ag and private investors. Limagrain is the fourth largest seed company worldwide, and is a cooperative group founded and managed by French farmers. LCRC has a full spring wheat breeding team with staff specializing in breeding, pathology, field and lab trialing, greenhouse/early generation breeding and seed production. LCRC is located in Saskatoon, and was established immediately after the 2015 PBR Act amendments, anticipating that these changes would create a more conducive business environment for investment and innovation.

IMPORTANCE OF CHANGES IN THE PBR ACT (2015)

LCRC indicated that the PBR Act amendments (2015) which explicitly prohibit the practice of brown bag seed sales (farmer-saved seed or common seed sold to other farmers for seeding purposes) was a small step forward in terms of protecting the IP of variety developers. Farmer's privilege is retained in the PBR Act, where Section 5.3 (2) of the PBR Act indicates that "*The rights referred to in paragraphs 5(1)(a) and (b) and — for the purposes of exercising those rights and the right to store — the right referred to in paragraph 5(1)(g) do not apply to harvested material of the plant variety that is grown by a farmer on the farmer's holdings and used by the farmer on those holdings for the sole purpose of propagation of the plant variety*". However, LCRC noted that the associated regulatory framework which would enable plant breeders to capture value on associated farm saved seed remains absent. This is inconsistent with Canada's obligations under UPOV'91 where any farmer's privilege should "safeguard the legitimate interests of the breeder", providing a mechanism for equitable remuneration on farm saved seed. Such a provision would create balance, farmers retaining the customary practice of saving and replanting seed, while breeders are fairly compensated, ensuring continuous reinvestment in breeding.

A number of provisions in the PBR Act, which conform to UPOV'91 are viewed positively, such as:

- Extending the duration of rights by 2 years to 20 years;
- Providing additional clarity on the scope of breeder's rights;
- The novelty feature which allows for one year of market testing before applying for PBR;
- Provisional protection which results in IP protection during the application period while PBR status is pending;
- The extension of IP protection in essentially derived varieties;
- The breeder's exemption measure which enables breeders to utilize germplasm of other breeding programs

POSSIBLE FUTURE CHANGES TO PBR AND ASSOCIATED ADMINISTRATION

LCRC stated that a major weakness of the PBR Act (2015) a framework has not been provided that enables plant breeders to capture the value they created when farmers use of farm-saved seed. Australia and many European countries have developed approaches that enables plant breeders to capture value when farmers decide to plant a crop using their farmer saved seed.

Given this void, Canterra has had no choice but to use Variety Use Agreements (VUA), a contract-based system to capture royalty income on farmer saved seed. While contracts (such as VUA) can be used, they do not result in a level playing field as growers will choose public varieties (e.g., AAFC or CDC varieties) where royalty payment back to breeders is not required when using farm-saved seed. The current system does not support a level playing field as public institutions are highly subsidized by taxpayers.

CONCLUSION

The 2015 PBRA amendments led to some significant changes in the IP environment for our country's agriculture, horticulture, and ornamental sectors. For all the crop types examined in the economic analysis of this study, production (except apples), yield, farm cash receipts, export value, and export value increased after the amendments were enacted. Although not enough time has passed to determine the full economic impact of the changes, the PBR Office witnessed an increase in the number of applications post UPOV'91 adoption, when compared to the declining trend under the UPOV'78 version of the law. This suggests that the amendments are having an overall positive effect on the sectors served by the PBR regime.

Additionally, reaction obtained from stakeholders through the survey and case studies has been largely positive. A majority of survey respondents noted the amendments led to greater investment in plant breeding and facilitated greater economic opportunities, while only a small number of respondents disagreed with those statements.

However, stakeholders did indicate that several areas could be improved upon, targeting the needs of specific sectors and appropriate IP for certain types of varieties. For instance, some asked for a longer period of protection for varieties that require longer periods of time to bred and gain marketplace adoption. Others stated that the optional "farmer's privilege" was never intended to be applied to asexually propagated varieties such as fruit trees, berry fruit, and ornamentals, and should be removed from the exception. Finally, some grain sector respondents noted that lack of value creation system for the collection of royalties on farm saved seed or harvested grain. The absence of such a mechanism that fairly share benefits, will limit investment, innovation, and economic opportunities for both farmers and breeders.