Innovation, Exclusion and Commodification of Plant Types: A Social and Philosophical Investigation of Plant Variety Rights in Australia

by Andrew Alexandra, Jadran Lee & Frank Vanclay

Abstract

Plant Variety/Breeder's Rights legislation, allowing ownership of plant types, was introduced into Australia in the 1980s. The most influential arguments in favour of the controversial legislation were consequentialist in nature. In effect, it was asserted that the benefits, especially the economic benefits, of the introduction of property rights over plant varieties would more than outweigh whatever costs there would be in taking such a step.

However, despite the importance of the legislation there has been very little investigation into its actual effects. In this paper we report views about these effects gained through interviews with a range of stakeholders, and briefly outline some of the implications of this information. While the new system is now entrenched, our research provides reasons to believe that government and growers' bodies should remain actively involved in facilitating, funding and directing Australian plant breeding.

Introduction

In 1987 the Australian Federal Parliament passed the Plant Variety Rights Act making possible for the first time in Australia the legal ownership of plant types. This legislation was modified and extended in 1994 by the Plant Breeder's Rights Act, and again by the Plant Breeder's Rights Amendment Act of 2002. Australian legislation is modelled on that previously enacted in northern hemisphere countries such as the USA and Britain, and informed by The International Convention for the Protection of New Varieties of Plants (UPOV 1991), to which Australia is a signatory. Australia is obliged to have legislation of this sort under the terms of the 1992 GATT Agreement on Trade Related Aspects of Intellectual Property Rights (known as the TRIPS Agreement 1994).

 Holders of a plant breeder's right (henceforth PBR) over a plant type gain the exclusive right to produce and sell, or to licence others to produce or sell, plants of that type. They are also empowered to charge royalties on all sales of seeds or other propagating materials, either directly or through agents. And they are entitled to sell or
Innovations, Exclusions and Commodification of Plant Types - Alexandra Lee, Vanda & Olivia
give away their ownership of the plant variety type, with all attached entitlements. In certain circumstances, holders of a plant variety right are entitled to control of the material harvested from plants of that type and products made from this material.

Prior to its introduction, this legislation was very controversial. The effect of the legislation was to criminalise behaviour, such as the selling or swapping of seeds among farmers, which was previously well established within the farming culture and which appeared to harm no-one. Furthermore, the giving of exclusive rights over plant types to one group of people could be seen as a form of enclosure of the intellectual commons - allowing one group to control, and profit from, the product of a long process of collective development of useful plant types (Berland & Lewontin 1986; Buttel & Belsky 1987; Alexandra & Walsh 1997).

The case for the legislation rested on claims about its consequences (Edwards 1985; Senate Standing Committee 1994). In effect, it was asserted that the benefits, especially the economic benefits, of the introduction of property rights over plant varieties would more than outweigh whatever costs there would be in taking such a step. However, despite the fact that 16 years has now passed since the introduction of the legislation, very little research has been undertaken on what its consequences actually have been. Our research has been motivated by the concern to explore those consequences. We report on our findings below, briefly considering some of the implications of those findings in the Conclusion of the paper.

**Investigating PBR: Methodology and Research Questions**

Unstructured and semi-structured interviews were conducted with a range of key informants, including plant breeders in public organisations and private industry, seed sellers, farmers, representatives of growers' bodies, and agricultural entrepreneurs. In all, some 30 people were interviewed during 2001.

The interviews were organised around the following topics, which also structure the remainder of this part of the paper:

1. Where is breeding best done: in public research organisations or by private companies?
2. Is PBR perceived as legitimate? By whom, and for what commodities?
3. Is the PBR framework and operation effective and efficient?
4. What are the social consequences of PBR?
5. Has PBR lived up to the promises made when it was introduced? Specifically, has PBR fostered greater innovation in Australian plant breeding?

**Topic 1: Where is Breeding Best Done: In Public Research Organisations or by Private Companies?**

Ideally, new plant varieties are developed to meet the needs of the users of those varieties. Could private companies alone, motivated as they are by profit, meet those needs? No doubt they can play an important role. However, there are commercial disincentives for them to engage in the breeding of certain kinds of plant varieties. There are a number of factors that are likely to impact on the
profitability of breeding new varieties, including:

(i) How widespread the crop is in Australia. Some crop types (such as wheat) are very widespread in Australia. Others, such as oats, lentils, and corn, are less widespread. Correspondingly, the potential market for new varieties of such crops is much smaller. Other things being equal, there will be a tendency to invest in the more widespread crops.

(ii) How extensive farm-saving of seed is for this crop. Rather than returning to seed merchants every time they plant, many farmers use seed gathered from a previous harvest — thus 'farm-saved seed'. There is a high level of variability of rates of farm-saved seed between different crop types. There appear to be two main determinants of these levels: (a) the quantity (and hence cost) of seed required per hectare; and (b) the capacity of farm-saved seed to retain desirable agronomic traits. These factors can be seen at work in contrasting ways in wheat and canola. Wheat is a crop with high levels of farm-saved seed, because wheat requires a large quantity of seed to be sown per hectare, and because the quality of farm-saved seed is good. Canola, on the other hand, has traditionally had low levels of farm-saved seed, since not much seed is used per hectare, and since saved canola seed tend to lose desirable genetic properties, especially resistance to blackleg fungal infection, and seed stock is prone to contamination by weeds. Hybrid crops, like maize (and some wheat varieties), have basically no farm-saved seed, since seed taken from hybrids tends to be infertile or not to breed 'true'.

(iii) How 'mature' in terms of agronomic potential the crop is. The key issue here is how much room is there for rapid progress in improving the crop? Potatoes, for example, are a mature crop in Australia. Canola, on the other hand, is not: it's quite easy to make significantly better varieties of canola without too much research investment.

(iv) The value of the crop. High value crops, that is, crops that typically return high gross margins (dollars net profit per hectare) will be attractive for investment because farmers will be prepared to pay higher input costs in the hope of increased returns. The marginal cost of a PBR variety is small compared to the other costs for inputs, and to the available profit. By contrast, in a low value commodity, the margins for PBR are a greater proportion of the value of the crop making them less attractive.

(v) The potential adoption rate. Many factors contribute to the likelihood of adoption by farmers, and these are hard to predict. In general, however, add-on technologies (crop types that are more-or-less similar to past practices) are more likely to be adopted than crop types that are substantially different, or PBR varieties that require vastly different management. Seed cost is an important additional factor. That cost is related to seed size and the seed multiplication rate. In the case of canola, for example, seed production is very high (in terms of propagule numbers) and seeding costs relatively low, while in the case of pulses costs of seed is high due to large seeds and low numbers of seeds.

The interplay of these factors means that there can be considerable commercial incentive to invest in breeding and gaining PBRs in new varieties of crops such as canola, sufficient to motivate
private companies. In the case of crops such as potatoes, on the other hand, there is much less incentive. Funding for such research will probably have to come from elsewhere: from growers' levies or government support (or both).

There is now a good deal of overlap between public sector research organisations such as the universities and CSIRO and private industry. Public sector organisations work with private industry, either under contract or in collaboration. In both private and public organisations, there is an emphasis on applied rather than fundamental research. Private companies, with their focus on getting a quick pay-off on their investments, have not been good sources of funding for fundamental research into plant breeding in Australia. Many universities, perhaps because they are under pressure to be 'productive' and self-funding, are focused on producing useful new varieties. Likewise, funding bodies like the Rural Industries Research and Development Corporation, which get their money from industry levies, want a steady flow of new varieties, and are not very willing to gamble on fundamental research. Fundamental research into plant breeding can produce beneficial results, in the form of improved plant varieties, but it typically takes several years for these results to materialise. Such fundamental research as there is, occurs in public sector organisations. There needs to be public sector commitment to, and funding for, this type of research. And not just any kind of public sector entity can be relied on. Entities like the Australian Research Council seem to be the ones that are, in the current climate at least, best suited for funding basic research.

**Topic 2: Is PBR Perceived as Legitimate? By Whom, and for What Commodities?**

Not surprisingly, the canola breeders interviewed at Pioneer Seeds (a private company) perceived PBR as being legitimate. Similarly, representatives of Australian Wheat Board Ltd. and Crop and Food Research - both private companies that do plant breeding - voiced strong support for PBR.

The public sector breeders interviewed also generally expressed support for PBR, though in most cases this support was lukewarm rather than enthusiastic. Generally, public sector breeders' support for PBR seemed to be based on their being wearily resigned to ever-shrinking levels of government funding. PBR revenues help to pay their bills - for harvesters, staff, etc. However, one breeder pointed out that PBR revenues are also used as a justification for cuts in government support, and of course the PBR process itself involves additional work and costs. This may explain why most public sector breeders seemed half-hearted in their support for PBR. Some public sector breeders noted that PBR was part of Australia's international obligations. This compounds the aura of inevitability for PBR. Most breeders, being practically minded, seemed to accept it as part of the new way of doing things.

One dissenter, involved in potato breeding, was clearly hostile towards PBR. He complained that it made it hard for him to access foreign germplasm. However, other breeders did not share this difficulty. This breeder's complaints about PBR are partly explicable with reference to the particularities of potato breeding. Political attitudes, and attitudes towards change, may also play a role. A former colleague described the
dissenter as having "a real old-school Department of Agriculture mindset".

As for farmers, the Victorian Farmers' Federation supports PBR. It claims that PBR has stimulated breeding, thus providing farmers with more and better varieties. The VFF does have concerns about PBR, but these are matters of detail. The two Victorian farmers we spoke to expressed similar views. The Nursery and Garden Industry of Australia also voiced its support for PBR, also citing the role of PBR as a stimulus to innovation.

**Topic 3: Is the PBR Framework and Operation Effective and Efficient?**

The operation of the Plant Breeder's Rights Office, which administers the Act and determines the allocation of Plant Breeder's Rights, appears to be generally well thought of. Plant Breeder's Rights is by far the most commonly used form of intellectual property right protection used for plants. At least in part this is due to the greater expense and inconvenience of the patent system. One interviewee complained of having to read fat stacks of documents in 'legalese' when he was trying to patent one of his creations. This took up to a third of his time for a six-month period. Though the PBR system may be relatively less time consuming, however, there are often complex issues of ownership and distribution of entitlements that must be resolved before new PBR varieties are released.

The legislative framework, on the other hand, was perceived, at least in some quarters, as being somewhat problematic. One worry concerned the criteria that were used to make varieties eligible for registration as 'owned' under the PBR legislation. Plant types must satisfy what are known as DSU ('distinctiveness', 'stability' and 'uniformity') requirements. A plant is counted as 'distinctive' when it is perspicuously different from varieties whose existence is common knowledge. The relevant differences are morphological in nature - things like leaf shape, colour etc. But these differences do not necessarily track agronomic differences, which may be the important differences that are being selected for. A new variety of canola, for instance, may not be morphologically very distinct from an older variety, even though it yields more or better oil, which is what really matters. Under the present legislation, this superior variety may not count as distinct, and so be ineligible for registration. Some respondents argued that allowing for the use of genetic information in establishing distinctness - as the PBR office in fact now does - will alleviate this problem.

A related worry concerned the marketing of newly registered varieties. Registration does not depend on, or indicate, agronomic superiority over existing varieties. Nevertheless, there tends to be a presumption that 'newer is better'. Marketeers often promote new varieties in terms of their superiority in some desired trait, such as yield - but in fact this may be accompanied by inferiority in some other trait, such as hardness. One of our respondents noted that, for example, nut size might be used as one of the characteristics for showing distinctness in nut trees, and then the new variety marketed on the basis of this. But the PBR office doesn't care if nut size is accompanied by a yield of just a few nuts for the whole tree! In the case of some plant types, where uptake could last for years, market forces tended to mitigate against the making of over-inflated marketing claims. But in the case of other plant
types, such as cut flowers, where there is a constant search for new varieties, they did not.

There was also some concern about the duration of protection. For many plants, which can become obsolete in less than five years, 20 years is more than enough. Woody plants, on the other hand, tend to have much longer commercial lives. Though the term for such plants is 25 years, under the 1994 legislation, the PBR office counted the 25 years from the moment the variety was first commercialised – even if this was a matter of a few apples being sold from an experimental plot to defray costs. This problem has now been addressed in the recent Plant Breeder’s Rights Amendment Act 2002 (in Items 26 and 28).

There are problems in enforcing the legislation. There are a number of reasons for this. The legislation criminalises behaviour that is both deeply entrenched in farming practice and difficult to detect, such as farmers selling or exchanging seed. It is not always easy to identify a variety that is being illegally grown, since the same variety can look different in different environments. The mere threat of legal action (by e.g. licensed growers) is typically sufficient to persuade unlicensed growers to destroy their crop. Nevertheless, there seems to be fairly general agreement that breaches of the legislation are common. Such breaches may become less common as a consequence of the increasing use of end-point royalties (discussed below), with their auditable paper trails, making it more likely that a grower who delivers a variety covered by a Plant Breeder’s Right but who has not legally purchased seed of that variety will be caught out.

**Topic 4: What are the Social Consequences of PBR?**

**Consequences of PBR?**

There were two major concerns relating to the social consequences of PBR.

(i) Does PBR Affect Farmers’ Autonomy, for Example by Increasing the Power of Supermarkets and Other Buyers of Farm Products?

According to the VFF, many farmers complain that PBR has facilitated the use of closed-loop contracts, where a farmer buys seed from an agribusiness company and is contractually obliged to sell the entire harvest back to that company. These contracts are often unwelcome to farmers, in that they feel their autonomy is being restricted. The farmer becomes like an employee (like a serf on at least one account), locked into a contract that may punish them for relatively minor infractions like having a few weeds in the field. Closed-loop contracts can and do exist in the absence of PBR, but they are easier to enforce when the variety in question is PBR-protected. In some special circumstances, farmers welcomed closed-loop contracts. In such cases, farmers were willing to trade off their independence for other advantages – such as protection from the risk of crop failure, which can be written into the contract.

Another important related development, which is made possible by PBR, involves coordination between breeders and the food industry. The release of superior new varieties is limited, so that there is a guaranteed market for those, and only those, who grow them. This is happening, for example, in the banana industry where growers tender for the right to use the new variety. This makes for a more rational market – whereas traditionally the market in food crops has been beset with coordination problems, producing gluts and...
shortages. It also would seem beneficial for the successful tenderers. On the other hand, it 'locks out' other growers, and adds to the already considerable power of the food industry (i.e., processors and supermarket chains).

(ii) Does PBR Make Public Plant Breeding Bodies and RDCs Behave Like Corporations?

The public breeders we interviewed felt that they still put the interests of the public first. Research projects are still chosen, they claimed, mainly with the goal of creating value for farmers and consumers. Making some money through PBR is a secondary goal, a means of earning the funds for pursuing the primary objective.

Farmers, on the other hand, expressed some scepticism about these claims. One concern they had is 'double-dipping'. Farmer levies support research, but the results of the research can be sold off to a private company which then charges farmers 'all over again'. Public breeders rejected this double-dipping argument, claiming that farmers' levies pay for only a small portion of research costs. Without PBR-related revenues, breeders said, they would do significantly less research.

A related complaint from the Victorian Farmers' Federation (VFF) is that the profits from a variety developed with farmer support are sometimes swallowed up into the Victorian budget's general revenue, instead of being reinvested in plant breeding. But the breeders we spoke to said that when their research yielded a PBR registered variety, they would be rewarded by having (most of) the royalties put back into their project's budget. The VFF suggested that the accounts of public breeders be made more transparent in order to address farmers' concerns.

**Topic 5: Has PBR Lived up to the Promises Made When it was Introduced? Specifically, has PBR Fostered Greater Innovation in Australian Plant Breeding?**

One way to approach this is to ask: "Is Australian plant breeding in better shape today than it was before the introduction of PBR?" Many interviewees, including farmers, breeders, and others believed that there had been an increased rate of progress in Australian plant breeding since the introduction of PBR in crops such as wheat and other grains, though not such as potatoes. (However, there appears to be no hard evidence that such an increased rate of progress has actually taken place. For a sceptical view about the impact of PBR on the rate of progress in the US, see Buttel and Belsky, 1987.)

One caveat is that, even in cases where the innovation rate appears to have increased, it may not have been accompanied by a corresponding increase in quality. Farmers complained that PBR has given breeders a financial incentive to 'rush to market' with new varieties that may not perform well (at least under Australian conditions). Some respondents suggested that better testing of new varieties, to demonstrate that they actually constituted an improvement over existing varieties, as a condition for obtaining PBR, could tackle this problem, though this would require quite a radical change in the philosophy animating PBR.
Another suggestion is that more use of end-point royalties, rather than high up-front payments on seed, would help to protect farmers from the risk of under-performing new varieties. The extension of information systems like the Australian Crop Accreditation System (ACAS) could also be useful in this context. A range of government and semi-government agencies in the grains industry funds ACAS. It collates data from independent field trials on new field and grain crop varieties and publishes them on the Internet [http://www.acas.org.net]. (The usefulness of such information in particular cases depends, of course, on the ability of farmers to understand and apply such information).

Of course, any change in the quality of Australian plant breeding since PBR was introduced, is likely to reflect the influence of more than one variable. One salient factor is the decline in government funding for plant breeding that has taken place during this period. Any gains made thanks to PBR have been, at least in part, a matter of compensating for the drop in government funding for research.

So perhaps we should ask:

**How successful has PBR been, as a means of fostering innovation in Australian plant breeding? To what extent has it managed to compensate for declines in government funding?**

PBR promotes innovation by allowing people to earn a return on their investment in research. How successful it is at doing this varies for different species, depending on a number of factors. The factors we mentioned in our discussion of Topic 1 above are relevant here. A crop that is widespread, which has low farm-saving of seed, which is not yet mature, which is high value, and which has a high potential adoption rate will typically be one for which PBR can effectively encourage research. A couple of other factors are also relevant:

**Are there other forms of IP that work better than PBR for this type of product?**

Particularly for ornamentals, but also to some extent for fruits, trademark protection is often used instead of PBR. Where this is the case, the role of PBR in encouraging research will be relatively small.

**Is this product one that evolves so quickly that it may not make sense to use any kind of IP?**

Flowers are a fashion-driven business. This year’s varieties will often be obsolete next year, or the year after. Moreover, it is hard to quickly ‘plagiarise’ annual flowers, which cannot be grown from cuttings. Breeders of annual flowers know that by the time their competitors can imitate the new variety, it will be obsolete. Consequently only a small percentage of annuals have PBR on them: PBR has not been a major spur to innovation for annuals.

Where PBR has fostered innovation, it has not always been a matter of encouraging private companies to engage in breeding. Often it is a matter of public agencies using PBR-derived revenue to help support their research.

**Has PBR increased Australian access to overseas information and technology?**

Some informants argued that if Australia did not have PBR today, Australian farmers would most likely have significantly less access to foreign innovations than they do, as IP holders would have no commercial incentive to make their products available here.
(This was an influential claim at the time of the debate about the introduction of PBR legislation.) However, very few varieties of overseas bred crops are directly suited to commercial production in Australia. Typically, Australian breeders take overseas varieties and engage in a complex process of crossing, selection, multiplication and evaluation to develop plants adapted to the local environment. Furthermore, there is some evidence that the emphasis on the commercialisation of research has created some obstacles in the way of sharing information, plant materials etc., both nationally and internationally.

Has PBR provided export revenue for Australia, by allowing Australians to export local knowledge?

Some Australian breeding is cutting-edge, and this knowledge can be exported. CSIRO, for instance, has a policy of getting IP for a new variety in any country where that variety is likely to be grown or sold in significant quantities. In any case, so far, the sums involved seem to be relatively minor, especially in comparison to the overall size of Australia’s plant-based rural exports. One area where Australian breeders could do better is in taking advantage of Australia’s tremendous biodiversity. Many of the varieties sold overseas, that are derived from Australian natives, have been bred by the Israelis, Dutch, and French. Australian botanic gardens are attempting to rectify this situation, by doing more breeding research on native plants.

Conclusion

At the time of the introduction of PBR legislation Australia was faced with a choice between two options: the institution of legal ownership of plant types as a means of providing commercial incentives to investment in plant breeding, or persisting with the status quo. Two conditions have to be satisfied to demonstrate that the choice to introduce PBR was justified: firstly that the benefits of the new system of property rights outweigh its costs; and secondly that the balance of benefits relative to costs are greater than would have been the case if the status quo ante had been retained.

There seems little doubt that the first condition is satisfied. The new system clearly does provide incentives for investment in the development of new varieties. Nevertheless, as we have seen, there are some obvious costs associated with the new system. Firstly, it involves the creation of a bureaucratic process for the assessment and allocation of property rights, as well as for their enforcement. Further, in as much as it provides commercial incentives for investment in research, these incentives are likely to lead to a misallocation of research effort, leading to the promotion of applied over basic research, and to the development of new varieties which will give developers a greater return, rather than those which are of most benefit to farmers and/or consumers.

The status of the second, comparative, condition is more contentious. The main advantages claimed for the new system were economic in nature, and can be represented in the form of two claims. The first is that the introduction of property rights over plant types would create incentives for investment in research leading to greater stimulus for the development of desirable new plant types, relative to the pre-existing system.
innovation, Evaluation and Commercialization of Plant Types: Alexandra, Lee & Vanclay

(Arrow 1962; Horbulyk 1993; Svatos 1996). The second claim is that the benefits of such development would flow not only to the developer, but also to growers, consumers, and ultimately the community as a whole (Edwards 1985; Senate Standing Committee 1994). The first claim is, of course, logically prior to the second. It is only if the new system is in fact beneficial relative to the existing system that the question of how those benefits are to be distributed can even arise.

These claims, as the underpinning rationale for PBR legislation continue to be confidently asserted. The 'Regulation Impact Statement' in the 'Explanatory Memorandum' of the Plant Breeder's Rights Amendment Bill 2002, for example, contains the claim that: Plant breeders' rights encourage the development of new plant varieties by providing an opportunity for the breeder to recoup their investment of time and money. In this way the PBRA promotes investment in plant breeding, secures access to elite varieties from overseas and speeds technology transfer. ... Innovation in plant breeding serves the public interest. For example, new varieties are created that are better suited to Australian conditions or meet market needs. ... Consumers and producers benefit and the breeder is rewarded.

Economic theory appears to give no reason to believe that the granting of intellectual property rights in plant types must be economically beneficial (Godden 1991; Kennedy & Godden 1993), so the economic effects of the legislation are a matter for empirical discovery.

While our research has no ambitions to even attempt to give an answer to the question of what the actual economic effects of the PBR legislation have been, it does provide reasons to be sceptical that they are demonstrably superior to what would have been achieved under the previous system. With the possible exception of easy access to some overseas germplasm (and even this is not uncontroversial), most of the good consequences of the new system would have occurred under the old system, and we have pointed above to costs that are peculiar to the new system.

Whatever conclusions might retrospectively be drawn about the relative merits of post- and pre-PBR systems of plant breeding, however, given Australia's obligations under international agreements, and given the level of investment predicated on the existence of a system of plant intellectual property, there appears to be no point in even wondering if we should return to the old system. On the other hand, there is much value in thinking about how we can make the current system as effective as possible. In particular, our research indicates that that government and growers' bodies should remain actively involved in facilitating, funding and engaging in Australian plant breeding, and encouraging both basic research, and breeding of the full range of varieties of interest to farmers.

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References


Dr. Andrew Alexandra is Senior Research Fellow in the ARC Special Research Centre in Applied Philosophy and Public Ethics at the University of Melbourne.

Dr. Jadran Lee was a Research Fellow on the project. He now works at the Centre for the Study of Ethics in the Professions, Illinois Institute of Technology.

Professor Frank Vanclay is Professorial Fellow in Rural Sociology at the Tasmanian Institute of Agricultural Research at the University of Tasmania.