Intellectual Property Protection – Stimulating or Constraining Innovation and Technology Transfer?

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Abstract

Grassland farming is becoming more technically advanced leading to improvements in productivity, environmental outcomes and animal welfare. As a result, farmers have an increasing range of new innovations being made available to them. The question examined here is whether widespread uptake of new innovations by farmers is more effective when driven by marketing through dedicated paths to market where the intellectual property (IP) is controlled or through multiple paths to market where there is no IP control?

The role of IP in stimulating the development, manufacture and sale of new technologies is hotly debated. For plant breeders and patent owners, strong IP protection offers an effective form of security; and more importantly brings returns on investment through licences and commercialisation arrangements. When launching new products IP protection not only provides legal security but is confirmation that the product is unique, distinctive and of value. Some view IP rights as a way to foster innovation and invention by encouraging individuals to develop/invent new ideas from which they can potentially gain a return. Without the ability to capitalise on their work innovators have little incentive, other than an altruistic motive, to produce any invention.

However, there is an opposing view that patents and plant variety rights are "killing freedom to operate and crushing science with rules", and in so doing are stifling innovation rather than encouraging it. Some believe that IP rights holders abuse the system to unfairly extend their monopoly on a technology and prevent others from using it to the benefit of the industry and the economy as a whole. We propose to examine the value and motivations for IP protection, and examine the different forms of IP protection available. Case studies will be used to show how IP protection may be a benefit or disadvantage to grassland farmers.

Introduction

Intellectual property rights (IPRs) provides a system, protected in law, for the inventor or creator to earn recognition or financial benefit from the invention or creation. IP results from creations of the mind and might include inventions, literary and artistic works, designs, and symbols, names and images primarily for use in commerce (WIPO). There are 7 types of IP protection that can be obtained:

1. Copyright – provides rights over literary and artistic work, computer programmes, databases, advertisements, maps and technical drawings
2. Patent – provides protection for a unique invention
3. Trademark – protection for a distinguishing brand or mark used to brand a product
4. Plant variety right – also known as plant breeders right, protects the development of distinct, uniform and genetically stable varieties of plants
5. Industrial designs – protects the ornamental or aesthetic aspect of a design
6. Integrated circuit design – protects layout design of semi-conductors and integrated circuits
7. Geographical indications – protects the association of provenance with product's origin
8. Trade secrets – protection that is self-imposed and ensures that IPRs are held confidentially

Research and development that leads to new innovative technologies that improves the well-being of mankind should be actively encouraged. Some consider that protection of IPRs is a prerequisite for better identification, planning, commercialisation, rendering, and thereby protection of invention or creativity (Saha and Bhattacharva 2011). Formal IP protection systems have the main purpose of not only stimulating R&D and innovation, but also stimulating knowledge disclosure. For example, all patents are published and methodology embedded in them freely available within a year of filing, i.e. inventors are given a monopoly of 20 years in return for full disclosure of how to work the invention to allow others to build on and develop the idea.

However, there is a view that the use of IPRs can be counterproductive and limit the use of technologies which should be accessed openly. When public sector (government) and public-good organisations invest in technology development any resulting output usually becomes widely available, with no expectation of a full return to be paid back to the funder for that investment. However, with public-good and government investments into applied research faltering or stopping altogether (Shelton and Tracy 2017), investment by the private sector has resulted in increased levels of IP protection so that returns from sales can be realised. In agriculture, publicly funded cultivar development tends to be in crops which have a lower market value/size than those considered a priority by the private sector. Leaving research outputs in the public domain may allow more open access to all, but likewise it places no value on the invention/technology and provides no incentive for continued improvement. Here the following conundrum will be examined - intellectual philanthropy versus IP protection – is there a place and time for both, or are they mutually exclusive?

Methods

Three approaches have been taken to examine the impacts of IP protection on the uptake of technologies:

1. Review of published commentary on the apparent conflict between intellectual philanthropy and IP; and
2. Examine case studies relevant to grassland farming of two technologies, one protected by IP and one freely available, and determine the likely impacts on availability and end user uptake.

Results

Intellectual philanthropy versus intellectual property protection

As a result of formal IP protection systems private agricultural research in OECD countries has in the past grown at a faster annual rate (5.1% per annum) than that of public agricultural research organisations (1.7%) (Alston et al. 1998). However, the problem that arises from this disparity is that IPR can become ‘locked up’ by a few powerful multinational companies which can then lead to raising the barriers to market entry for potential competitors. For example, 60% of global proprietary seed sales are received by 4 multinational companies which for farmers can means less choice and higher prices for seed (https://civileats.com/2019/01/11/the-sobering-details-behind-the-latest-seed-monopoly-chart/). This leaves breeders of publicly funded programmes to focus on areas that are not viewed as sufficiently profitable to warrant significant investment from private industry, e.g. minor crops, geographical locations, management systems (Shelton and Tracy 2017). However, even amongst publicly funded breeding programmes only 13.6% of plant breeders indicate that their cultivars are rarely or never protected with IP. But of these publicly funded plant breeders 64.2% and 55.7% believe their freedom to operate with either private or public seed industry IP is restricted, respectively (Shelton and Tracy 2017). Even for the philanthropically focused Gates Foundation (https://www.wipo.int/wipo_magazine/en/2013/04/article_0006.html) IP is managed to achieve global access but this does not necessarily preclude IP licenses, confidentiality agreements or material transfer agreements.

Open source is seen by some as an alternative to the IP model (Thiruthy 2017). Open source means the licence does not restrict selling or giving away the output and does not distinguish on who, what or why it is going to be used. It is argued that open source improves the speed, quality and content of innovation. But it needs to be managed carefully to ensure that investments in innovation still make a financial return and generate revenue back to the primary investor. Open source is increasingly associated with plant material where there are no restrictions or IP protection (https://seedworld.com/open-source-plant-material-and-intellectual-property/). It is argued that this unrestricted plant material allows breeders free access for breeding and research. However in reality the same applies to cultivars protected by PVR which any breeder can include in their breeding programmes. PVR simply prevents others selling the cultivar itself.

Case study 1 - AR1 and AR37 Epichloë endophytes

In New Zealand the persistence of ryegrass pastures is reliant on the presence of a fungal endophyte which behaves as an obligate mutualist (Card et al. 2016) from the genus *Epichloë*. Early work showed that some of these endophytes were responsible for serious animal disorders such as ryegrass staggers and heat stress. These ailments were associated with particular alkaloids produced by the endophyte. However, plants without the endophyte showed poor persistence due to impacts of insect pests and drought. Further research led to the discovery of endophyte strains that do not produce the toxic alkaloids, and so do not cause serious animal health and welfare issues, but do provide some resistance to pasture insect pests.

The first endophyte to be commercialised was AR1. Whilst AR1 was protected by patent, PVR and trademark, research and development into this endophyte was largely funded by the government and as a result licences for this technology were available to all seed companies. This non-exclusive release showed rapid uptake by

New Zealand farmers peaking at 70% of the total perennial ryegrass sales within 7 years of release (Figure 1) (Caradus et al. 2013). Initially seed companies actively marketed this technology, but soon realised that because there was no way to differentiate their product in the market from other seed companies selling the same product profiling AR1 specifically added little value and so instead focused on unique traits of their own PVR protected ryegrass cultivars carrying the endophyte.

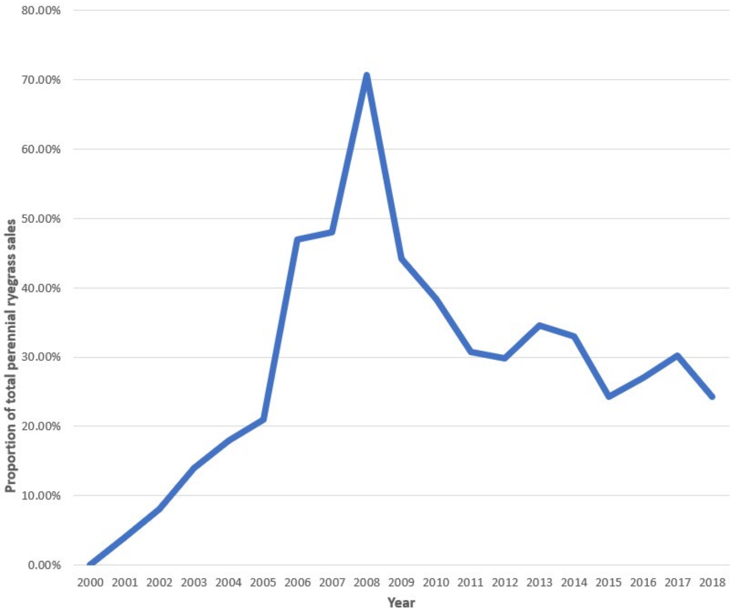

Figure 1 – Proportion of total perennial ryegrass sales in New Zealand containing AR1 endophyte (from Caradus et al. 2013).

Subsequent decline in the proportion of sales was largely due to the release of a new endophyte that provided greater pest resistance than AR1. This was branded AR37 and its development was funded by a single seed company and the commercial subsidiary of the research organisation that developed it. This again was protected by patent, PVR and trademark and was initially licensed exclusively to the investing seed company. While various other third party endophytes have entered the market, sales of AR37 still attain more than a 50% market share some 12 years after commercialisation. This is largely driven by good marketing of the technology and its efficacy in the field, and so farmers view this as a first choice option.

So here are two similar technologies, both well protected using multiple IP options, but funded and licensed in very different ways – one available to all non-exclusively and the other as an exclusive license to the single investor. However, in both cases due to the excellent performance of both technologies, uptake by end user farmers has been high over an extended period due largely to the managed release of the novel technology by the owner utilising reliable IP management systems.

Case study 2 – Perennial ryegrass cultivar Grasslands Nui

Grasslands Nui ryegrass was selected from an ecotype population collected from a farm close to Auckland, New Zealand and became commercially available in 1973 (Armstrong 1977) before PVR protection was available in New Zealand. Grasslands Nui was renowned for its ability to persist through dry conditions. The work was funded entirely by public funding, remains publicly available and is still used both in New Zealand and overseas. It is considered to have been superseded by new cultivars and is the cheap option sold at a price well below that of current proprietary cultivar prices. Based on National Forage Variety Trials it is ranked thirtieth based on dry matter production (https://www.nzpbra.org/wp-content/uploads/Perennial-Ryegrass-Summary-2019.pdf) and is calculated to deliver an economic value of $-56 to $79/ha compared with up to $576/ha for proprietary cultivars (https://www.dairynz.co.nz/feed/pasture-renewal/select-pasture-species/cultivar-selector-tool/). Grasslands Nui is now sold essentially as commodity and with no effective IP protection is not considered an added value product.

Discussion

One of the major issues faced with IP law is that while most assume it is there to stimulate the progress of science, there is also a motive to use it to restrain advancement and maintain the status quo (Beebe 2010). This can be motivated either by trying to block competition entering the market or litigate against copies of the technology. Patents allow the owner the right to exclude others from commercially exploiting the patented invention for a specified time. This allows innovators to obtain appropriate returns from their investments and as a result provides an incentive for further innovation. Companies seeking investment to further scale up technologies will inevitably fail if they are unable to protect their uniqueness. This can drive two behaviours, neither of which are helpful. One is to realise late in the development of a technology that there is valuable IP to be protected risking others pre-empting them in protecting the invention. Alternatively, there can be a drive to patent every development and as a result consume valuable funds on what in the end may be patents of little value. An approach that identifies the most important IP to be protected and does it in a timely manner is recommended.

Some have argued that IP protection serves as the foundation of innovation modern economies (Scherer 1999). However, IP protection can also be used in inefficient and anti-competitive behaviours as explained above. Follow-on innovation that adds value to ground-breaking inventions needs to be encouraged and championed to ensure continued technological advancement and development, which will include technologies for improving the production and sustainability of the world's grasslands. Tensions can also develop between commercial companies funding innovation through government owned research organisation and/or Universities. If commercial companies are totally funding the plant breeding activity, even if it is located within public good agencies, why should the government owned research institute or university expect any ownership and resulting royalties? If there was a co-investment model then a shared royalty return would be acceptable to most commercial companies.

As a broad generalisation government or federal funding often stimulates research capability and this in time can deliver technologies of value which are generally licensed non-exclusively (as occurred with AR1 in the example above). However, in time commercial companies realised that if they fund the development of new improved versions of a technology then they can control its commercial delivery by protecting the IP, usually through a patent (as occurred with AR37 in the example above). This has also happened with plant breeding which initially was often driven by public good funding until Plant Variety Protection systems were legislated allowing commercial investment to gain a return from employing plant breeding capability. This transition has occurred in most developed countries and now the majority of plant breeding capability is found in commercial companies rather than in government owned research institutes or universities.

There is no simple answer to whether IP protection stimulates or constrains innovation and technology transfer. However, IP protection is here to stay and it is really up to both individuals and organisations who use IP protection to do so while delivering maximum benefit to the end user farmer. IP protection in itself does not constrain innovation however abuse of the temporary monopoly it grants can do.

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