The Potential Impact of Patents on Australian Horticulture Industries

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The Potential Impact of Patents on Australian Horticulture Industries

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ABBREVIATIONS

ACIP	Advisory Council on Intellectual Property
ACIPA	Australian Centre for Intellectual Property in Agriculture
ALRC	Australian Law Reform Commission
Cth	Commonwealth
CLIMA	Centre for Legumes and Mediterranean Agriculture
EPC 2000	European Patent Convention
EPO	European Patent Office
GM	Genetically modified
GMO	Genetically modified organism
HAL	Horticulture Australia Limited
IP	Intellectual Property
NRDC	National Research Development Corporation
PBR	Plant Breeder's Rights
PCT	Patents Cooperation Treaty
PPA	*Plant Patent Act*
PVPA	*Plant Variety Protection Act 1970*
PVR	Plant Variety Rights
TRIPs	Trade-Related Aspects of Intellectual Property Rights
UPOV	International Convention for the Protection of New Varieties of Plants
USPTO	United States Patent and Trademark Office
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

GLOSSARY

Common General Knowledge	In patent law, the background knowledge and experience against which inventive step is assessed.
Compulsory Licence	A compulsory licence requires the patentee to grant the applicant a licence to work the patented invention. A number of conditions need to be satisfied for a compulsory licence to be ordered.
Confidential Information	In general terms, information that is not available to the public. This may be through the use of contracts or in equity.
European Patent Office (EPO)	The EPO provides a uniform application procedure for those seeking patent protection in up to 36 European countries.
European Union (EU)	The EU is an economic and political partnership between 27 European countries.
Fairly Based	In patent law, means that the patent claims are consistent with the patent specification.
Inventive Step	To qualify for a standard patent in Australia, an invention must involve an inventive step (when compared to the prior art).
Licence	A licence is a form of contract that generally gives the licensee permission to do something and/or places restrictions on what the licensee can do.
Novelty	In Australia, a patent will only be granted to inventions that are novel. Generally speaking, an invention lacks novelty if it has already been published or used.
Patent	A patent is a right granted for any product, method or process which is novel, inventive and useful. A patent gives the owner the exclusive right to commercially exploit the invention for the life of the patent.
Patent Cooperation Treaty (PCT)	The PCT is an international patent law treaty that has over 140 signatories including Australia, the United States and European Union.
Plant Breeder's Rights (PBR)	Plant Breeder's Rights are exclusive

	commercial rights to a registered plant variety. See also Plant Variety Rights.
Plant Variety Rights (PVR)	In some countries including the United States and the United Kingdom. See also Plant Breeder's Rights.
Priority Date	Generally, the priority date is the date the patent application is filed. In the United States, however, the priority date is the date of invention.
Steering Committee	This project was advised by a Steering Committee consisting of Philip Roeth, Garry Fullelove, Brian Chung, Stephen Hubicki and Jay Sanderson.
TRIPs Agreement	The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs) is an international agreement that sets out minimum standards for intellectual property law. The TRIPs Agreement has over 150 members and is administered by the World Trade Organization.
UPOV	The *International Convention for the Protection of New Varieties of Plants* (UPOV)
USPTO (United States Patent and Trademark Office)	The United States Patent and Trademark Office has the responsibility of granting utility patents in the United States.
World Intellectual Property Organization (WIPO)	The World Intellectual Property Organization (WIPO) is a specialised agency of the United Nations that is 'dedicated to developing a balanced and accessible international intellectual property system while safeguarding the public interest'. See http://www.wipo.int/portal/index.html.en

1.0 Executive Summary

Australian horticulture industries are actively engaged in the protection of innovation, information and invention through intellectual property. Over the last ten or so years, plant breeder's rights has been the major way that horticulture industries have protected their new plant varieties. That said, there has been a level of dissatisfaction with the plant breeder's rights system: most notably with saved propagating material (often referred to as farm saved seed regardless of whether seed, bulbs or cuttings are saved), and the breeders/research exemption. Furthermore, research and development into promoter and enabler technologies (as well as a desire to protect research methods and processes) has meant that some horticulture industries are looking to protect innovations outside the plant breeder's rights system.

There has been a general transformation in the use of legal systems used to provide protection over horticulture industries: so that now there is the possibility of using plant breeder's rights, patents, confidential information, trade marks and contracts to protect plant-related innovation. This has the potential to have an impact on the management, research and commercialisation practices of the Australian horticulture industries and requires further investigation into alternate or conjunctive intellectual property protection to that provided under plant breeder's rights.

1.1 Scope of the Report: Patent Law

While plant innovation may be protected by other legal means (including plant breeder's rights, trade marks, contracts and in some instances using biological mechanisms such as hybridisation) the focus of this report is patent protection. The reason for this is that there is growing anecdotal evidence that key players in Australian horticulture industries are increasingly concerned about the expanding use of patents as a way of protecting plant innovations in Australia. For over eight years, the Australian Centre for Intellectual Property in Agriculture (ACIPA) has been actively involved in research and education programs relating to intellectual property issues affecting Australian horticulture and agriculture industries. Feedback received from participants at events organised by ACIPA – including seminars and workshops for both growers and scientists, intellectual property master classes for research and commercialisation managers and industry stakeholders, and conferences – has indicated that interested parties at all levels are concerned about the use of patents to

protect plant innovations. At the same time, some researchers and industry participants have expressed an interest in the use of patents to protect plant innovations resulting from research by both the public and private sectors.

While the Report is focused on patent law, a necessary consequence of examining patents is a need to include some discussion of the area of confidential information. Confidential information is often used either in conjunction with, or instead of, patent law.

Target Audience

The Report is aimed at a number of audiences including consultants, breeders, researchers and growers. The focus of the Report is on the consequences to breeders, researchers and growers that may result from a move away from plant breeder's rights towards patent protection.

1.2 The use of Case Examples

In order to elaborate concerns and illustrate examples, the research focuses on three specific case studies from the Australian horticulture industries. In consultation with the Steering Committee the case studies were chosen due to their divergent use of patent law and the challenges that each crop present. Examples from the case studies have been woven into the Report where relevant. The case examples are:

Mango

The mango industry is one of the few Australian crops with experience in obtaining plant patents in the United States. Because of this, the mango industry (particularly Queensland Primary Industries and Fisheries) is in a unique position to provide insights about the United States plant patent system.

Extractive Crop

The extractive crop industry was chosen as a case study because of its relatively small size and the fact that it is not a regular user of the plant breeder's rights or patent systems. Instead, extractive crop industries rely predominantly on confidentiality: both for new cultivars and also for the processes and methods used for extraction. In Australia, the main industries are poppies, pyrethrum and essential oils which are generally found in Tasmania. Also, the poppy industry (more specifically,

GlaxoSmithKline) has recently been involved in a legal dispute in the Victorian Supreme Court over the purported use of confidential information by a former employee.

Potato

In contrast to the extractive crop industry, the potato business is a large global industry. In 2007, Australia produced over 1.2 million tonnes of potatoes. Coupled with the size of the industry is the fact that potato breeders are searching for innovative new varieties that might have resistances to viruses, insects or blight.

In 2008, there were sixteen applications for new potato varieties by the Australian Plant Breeder's Rights Office - all of which came from overseas breeders. While the Australian potato industry utilises plant breeder's rights, there are a number of concerns over the plant breeder's rights scheme for the potato industry. Namely, in relation to the farm saved seed (propagating material) exemption and the duration of plant breeder's rights protection impacts on the management of potato varieties.

1.3 Structure of the Report

The Report is broken down into five sections.

Section 1: Executive Summary

The Executive Summary (this section) provides an overview of the Report's essential findings by considering: the scope of the Report; the target audience; the case examples; what the patent data showed in relation to the number and types of patent applications for the horticulture industries; and the consequences for researchers, breeders and growers of a shift to patent protection.

Section 2: Introduction

The Introduction examines whether plants can be patented in Australia, the United States and Europe. The Introduction also provides an overview of confidentiality and considers to what extent plant related innovations can be protected by confidentiality agreements.

Section 3: Trends in the Patenting of Plants

Section 3 provides an overview of the trends in the patenting of plants and plant-related innovation in Australia, the United States and Europe.

Section 4: Consequences of a shift to patents and confidential information

This section examines the consequences for breeders, researchers and growers if patent protection or confidentiality is sought. The questions asked and discussed in Section 4 include:

Considerations for breeders/researchers (Section 5.1)
Can plant innovation be protected by patents?
If researchers obtain a patent, what level of protection do they get?
Does research or breeding infringe another person's patent?
What is a compulsory licence? Can researchers/breeders get a compulsory licence?
Is it more expensive to access patented materials?
Can researchers publish the results of their research? Can researchers freely conduct research?
Can researchers use their invention before they lodge the patent application?
Should researchers use confidentiality or patent? Or both?
Should researchers have a confidentiality agreement?
What should be included in a confidentiality agreement?
What (if any) effect will patenting have on commercialisation?
What are the cost and time considerations of patenting?
Considerations for growers (Section 5.2)
Are there any post-sale restrictions on patents?
How does the doctrine of implied licence relate to propagating material?
Can growers save propagating material?
Will the cost of patented plant material be more expensive?
Will using patented plant material affect farm management?

Section 5: Conclusion

The conclusion summarises the major points of the Report and presents the key messages. These are that: plant related innovations are generally patentable; there are important differences between plant breeder's rights and patents; and there is no single correct approach, rather industries must consider all the potential consequences of using patents and/or confidential information.

The Report also contains four Appendices.

Appendix 1: An Overview of the Patent System

Appendix 1 provides a brief overview of the Australian patent system. Rather than putting this at the beginning of the Report, it was felt that it would be better served by including this information at the end of the Report: for those readers interested in background knowledge.

Appendix 2: Steps in Getting and Maintaining an Australian Standard Patent

Appendix 2 reproduces a summary of the steps in getting and maintaining a standard patent under the *Patents Act 1990* (Cth).

Appendix 3: Extract from United States Plant Patent 17,770 P3

Appendix 3 provides an extract of United States plant patent for a 'Mango tree named B74'.

Appendix 4: Extract from Australian Plant Breeder's Rights Application for the mango variety 'B74'

Appendix 4 provides an extract of Australian Plant Breeder's Rights application of 'B74'.

1.4 Number of Patent Applications

In Australia, the patent data shows that there was an increase in the number of plant related patent applications between 1995 and 2001. While there was a reduction of applications (between 2003 and 2005) the research indicates that there has been a slow rise in plant related patent applications since 2005.

The research also supports the contention that there are a number of possible patent types over plants including over technologies for plant transformation, gene sequences and genetically coded traits, elite germplasm and various promoters. That said, in Australia, the majority of patent applications related to plants has been for biological information and gene sequence patents.

1.5 Consequences of a shift to patent law

The research highlights a range of potential consequences of shifting away from plant breeder's rights towards patent protection. Due to the target audience, these have

been divided into two groups: those having impact on breeders; and those that impact upon growers.

(a) Potential impact of patenting on breeders/researchers

Generally, there are two major areas that may be impacted for breeders and researchers: (1) the effect of other patents on their research; and (2) taking out patents of their own research. The Report considers the following potential considerations for breeders and researchers.

Can innovation be protected by patents? There are very few limits on the subject matter that is capable of being protected by patents: so long as the subject matter is new, non-obvious, useful and has not been secretly used, your innovation will generally be patentable.

Does research or breeding infringe another person's patent? Generally speaking, it is not possible to use patented plant material in breeding programs without the consent of the patent owner. However, the law is different in Australia, the United States and Europe.

What is a compulsory licence? Can researchers/breeders get a compulsory licence? A compulsory licence may be granted in certain situations, although in practice obtaining a compulsory licence is very uncommon.

Is it more expensive to use patented products or processes? Although there is little empirical data, generally it is more expensive to apply for a patent than PBR. This depends on the type of technology utilised and the patentee's objectives (eg does the patentee want to make a profit or does the patentee want to ensure wide adoption and uptake?).

Can researchers publish the results of their research? Can researchers freely conduct research? Generally, researchers need to keep the invention secret (using the language of patent law, you cannot disclose the invention) before you apply for a patent. That said, there are some statutory exceptions or 'grace' periods that may apply. However, these 'grace' periods should only be used as a 'fall-back' for inadvertent disclosures.

Should researchers use confidentiality or patent or both? This will depend on the circumstances. Importantly, patent protection and confidentiality are not mutually exclusive and a breeder/researcher may need to use both (depending on the stage of their research).

Should researchers have a confidentiality agreement? The answer is likely to be yes. A breeder/researcher can ensure far greater (and clearer) protection by having a written confidentiality agreement.

What should be included in a confidentiality agreement? No single agreement will work in every situation. However, researchers and managers should think about: what information is to be protected; what is the purpose of the disclosure; and what parties can have access to the information?

What, if any, affect will patenting have on commercialisation? This may depend on the aims and objectives of the patentee, who may decide to assign or licence their invention on the terms that they choose.

What are the cost and time considerations of patenting? Because of the application process and the technicality of patent applications, it is generally more expensive and time consuming to obtain patent protection than PBR. In some instances, the requirement of comparative field trials under plant breeder's rights reduces some of these differences.

(b) Potential impact of patenting on growers

The considerations for growers are less numerous than for breeders. However, they are still significant and often revolve around the use of patented plant material. The major consideration for growers relates to the broad scope of the patent right and the absence of any exceptions to the right.

Can growers save propagating material? No, the use of second generation propagating material, without the authorisation of the patentee, constitutes an infringement of the patent holder's right. Also, non-propagation clauses may be included in the patent licence that a grower may agree to.

Does it cost more to use patented plant material? Although there is no empirical data, it is possible that the cost will be higher.

Will using patented plant material impact farm management practices? Patented material is often sold with a licence agreement that stipulates how the patented material is to be managed and used.

2.0 Introduction

Intellectual property law began to have a pronounced influence upon plant breeding with the introduction of the *International Convention for the Protection of New Varieties of Plants* (UPOV) in 1961.[1] The UPOV Convention is a *sui generis* regime of intellectual property protection specially adapted to plant breeding. In particular, UPOV:

- limits the scope of protection for new plant varieties to propagating material of the variety (and in certain circumstances harvested material, products derived from harvested material, dependant varieties and essentially derived varieties); and
- exempts certain uses of propagating material from infringement, namely the use of propagating material for private and non-commercial purposes, the use of propagating material for experimental purposes, and the use of propagating material for the purpose of breeding other varieties.

The latter exemption, known as the 'breeder's exception', is a defining feature of the UPOV system. In addition, UPOV also permits, as an optional exception, farmers to save propagating material harvested from a crop for the purpose of producing further crops (known as the 'farm-saved seed' exception). The vast majority of countries, including Australia have implemented plant breeder's rights (referred to in some countries as plant variety rights) protection based on the UPOV model.[2]

One of the motives which led to the adoption of plant breeder's rights was the perception - on both moral and practical grounds - that patent law was ill-suited to plant breeding. On a moral level, it was argued that living organisms were beyond the scope of the patent system. On a more practical level, it was felt that living organisms such as plants were not amendable to the written description and enablement requirements of patent law. Another reason given why patents were unable to protect the products of

[1] Although there were earlier attempts to protect plant innovations. For example, the United States introduced the *Plant Patent Act* in 1930 and some European countries provided some form of protection for new varieties of plants or seed certification.

[2] The *Plant Variety Rights Act 1987* (Cth) introduced, the first regime, in Australia, for the protection of new varieties of plants but was replaced in 1994 by the *Plant Breeder's Rights Act 1994* (Cth). Following the introduction of the Agreement on Trade-related Aspects of Intellectual Property Rights (TRIPs) in 1994, the protection of new varieties of plants by, at a minimum, effective *sui generis* means is required of all members of the World Trade Organization.

plant breeding was that the methods involved in the plant breeding (eg selection and crossing) had been practised since antiquity, and, were, therefore not novel.[3]

In these circumstances, it is not surprising that patent law had little direct impact upon the development and protection of the products of plant breeding in a majority of countries (with the exception of the plant patent regime in the United States). As a result, plant breeder's rights have generally been used as the predominant form of protection for new plant varieties in the vast majority of countries.

In recent years, however, objections to the use of patent protection for plants have been either swept away or marginalised. In part this has been prompted by the emergence of modern biotechnology - which has dramatically transformed both the legal and scientific landscape – and the fact that the scope of patentable subject matter has been liberalised.[4] Furthermore, public expenditure on plant breeding, both in Australia and elsewhere, has declined to the point where plant breeding is predominantly privately funded.[5] Finally, the prohibition on the dual protection of new plant varieties by both patents and plant breeder's rights was removed from the 1991 text of UPOV (though member countries remain entitled to maintain the prohibition in their national laws). This convergence of events has been instrumental in clearing the way for the patenting of plants.

2.1 The patentability of plants

Article 27(3)(b) of the *Agreement on Trade-Related Aspects of Intellectual Property* (TRIPs Agreement) provides that WTO members can choose to exclude from patentability plants and animals other than microorganisms, and essentially biological processes for the production of plants and animals. However, Article 27(3) requires that

[3] Senate Standing Committee on National Resources, *Plant Variety Rights* (1984) 38-42 : Alec Lazenby, *Australia's Plant Breeding Needs: A Report to the Minister for Primary Industry* (1986) 122. Lazenby acknowledged, however, that in Australia plant varieties were patentable by referring to the decision of *National Research Development Corporation v Commissioner of Patents* (1959) 102 CLR 252 and the decision of the Assistant Commissioner of Patents in relation to *Rank Hovis McDougall Ltd's Application* to the Australian Patents Office in 1976.

[4] An Official Notice announcing the acceptance of higher life forms as patentable subject matter in Australia was published by the Commissioner of Patents: see 'Patent Applications Concerned with Living Organisms' (1980) *50 Australian Official Journal of Patents, Trade Marks and Designs 13* (17 April 1980) 1162. The difficulties associated with the written description and enablement requirements have largely been negated by the ability to deposit plant material, *Treaty on the International Recognition of the Deposit of Micro-organisms for the Purposes of Patent Procedure* (Budapest Treaty) 1977.

[5] Fernandez-Cornejo, J., & Schimmelpfennig, D., 'Have Seed Industry Changes Affected Research Effort?' (2004) *Amber Waves* (February); Linder, B., 'Economic Issues for Plant Breeding – Public Funding and Private Ownership' (2004) *12 Australasian Agribusiness Review*, 6; Kingwell, R., 'Institutional Change and Plant Variety Provision in Australia' (2005) *13 Australasian Agribusiness Review*, 5.

a WTO member, that has decided to exclude plants and animals from patentability, must provide an effective *sui generis* system for the protection of plant varieties. Most countries have chosen to protect plant varieties by implementing a plant variety rights system based on the UPOV Convention.[6]

Despite the prevalence of plant breeder's rights, plants can also be patented in a number of countries including Australia, Japan, the United States, and (subject to a number of important qualifications which are discussed below) the majority of European countries. This Report focuses on the situation in Australia, the United States and Europe.

2.1.1 The patentability of plants in Australia

Australia is one of the few countries to grant patents for plants and plant varieties.[7] This means that, in Australia, plant breeders have a choice between protecting new plant varieties by means of patents and/or plant breeder's rights. To be successful, plant innovations would need to satisfy the requirements set out by the Australian *Patents Act 1990* (Cth) including being novel, involving an inventive step, being useful, not being secret used prior to the priority date.[8]

While there is no express provision outlining the position for plants in Australian patent law (and there is no case law specifically on this point), it is generally accepted that plants are appropriate subject matter for patents. Support for the eligibility of plants for patent protection comes from two sources: implicitly from the case law and explicitly from the Australian Patent Office.

The Australian High Court has given implicit support for the idea that plants are patentable subject matter in a number of decisions. In *National Research Development Corporation v Commissioner of Patents* (1959) 102 CLR 252 *(NRDC)*, the High Court held that agricultural and horticultural methods *per se* were not exempt from patentability. Later, in *Grain Pool of Western Australia v Commonwealth of Australia*,

[6] Currently there are 67 members of the International Union for the Protection of New Varieties of Plants ('UPOV'): see UPOV, *Members of the International Union for the Protection of New Varieties of Plants* (12 May 2009). One member acceded to the *International Convention for the Protection of New Varieties of Plants*, opened for signature 2 December 1961, 815 UNTS 89 (entered into force 24 April 1968) ('UPOV 1961'), later revised on 10 November 1972; 23 members acceded to the Convention, as revised on 23 October 1978 ('UPOV 1978'); and 43 members acceded to UPOV 1991 <http://www.upov.int/export/sites/upov/en/about/members/pdf/pub423.pdf >.

[7] The first Australian patent for a plant was granted to Adelaide Orchids Pty Ltd for a 'Cymbidium Orchid Cultivar' (otherwise known as 'Scott's Sunrise Aurora'), Australian Patent No. 532235 (1 May 1981).

[8] These requirements are discussed in more detail in Appendix 1.

the High Court held that the 'effect of the decision in *National Research Development Corporation* is to confirm that there is no intrinsic impediment to the patentability of plant varieties'.[9]

Nevertheless, the Australian Patent Office did not grant patents for plant varieties prior to the 1980s. Notably, the High Court's comments in *NRDC* were directed to agricultural and horticultural methods only: so the idea that plants (as products) were not patentable subject matter continued to persist. The decision of the Assistant Commissioner of Patents in *Ranks-Hovis McDougall Ltd's Application*[10] signalled a change in the Australian Patent Office's attitude towards the patenting of living organisms. In that case, the Assistant Commissioner accepted a number of claims to mutant strains of a microorganism on the basis that the mutant strains had been produced by a 'man controlled microbiological process' which resulted in the strains having 'improved or altered useful properties'.[11]

The Australian Patent Office now takes the view that plants are patentable subject matter. Accordingly, new plant varieties are considered by the Patent Office to constitute patentable subject matter if it: involves the technical intervention of man that results in a state of affairs that does not occur in nature; and is useful in economic affairs.[12]

Furthermore, the Australian Patent Office has granted patents in respect of the following types of subject matter: new plant varieties; plant components such as genes and chromosomes; reproductive material (for example, seeds and cuttings); products from plants including fruit, flowers, oils, chemicals or pharmaceuticals; genetic engineering techniques; and breeding and cultivation methods.[13]

Patents have also been granted in respect of the following agricultural and horticultural methods/processes:

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[9] *Grain Pool of Western Australia v Commonwealth of Australia* (2002) 202 CLR 479, 502.
[10] *Ranks-Hovis McDougall Ltd's Application 46 Australian Official Journal of Patents, Trade Marks and Designs 39*, 3915 (21 October, 1976).
[11] The Commissioner of Patents confirmed the validity of *Rank-Hovis McDougall Ltd's Application*: see, Australian Patent Office, 'Patent Applications Concerned with Living Organisms' *50 Australian Official Journal of Patents, Trade Marks and Designs 13* (17 April, 1980) 1162.
[12] IP Australia, *Australian Patent Office Manual of Practice and Procedure, Volume 2: National*, para. [2.9.2.15] 'Agriculture and Horticulture'; see also [2.9.2.14] "Micro-Organisms and Other Life-Forms". The Manual can be accessed at: <http://www.ipaustralia.gov.au/pdfs/patentsmanual/WebHelp/Patent_Examiners_Manual.htm>.
[13] IP Australia, *Australian Patents for Plants*, <http://www.ipaustralia.gov.au/pdfs/patents/specific/Australian%20Patents%20for%20Plants.pdf>.

- preventing male gametes in grass from reaching maturity;
- sterilizing male anthers in plants;
- the production of genetic variations by exposing plants to applied magnetic or other force fields;
- the asexual propagation of pineapple plants by tissue culture techniques; and,
- the production of male sterile maize by genetic selection.[14]

2.1.2 The patentability of plants in the United States

In the United States, there are three forms of intellectual property protection for plants. These are:

(a) **plant patents**, which protect asexually-reproduced varieties;

(b) **utility patents**, which are available for all plant varieties, as well as components of plants (including genes, cells and seed) and for processes employed in the production of plants; and,

(c) **plant variety protection**, which covers sexually reproduced or tuber propagated plant varieties.[15]

(a) United States Plant Patents

The United States was one of the first countries to provide patent protection for plants when it introduced the *Plant Patent Act* (PPA) in 1930. In the United States, the choice between plant patent and plant breeder's rights (called plant variety rights or PVR in the United States) is often out of your hands. One of the distinguishing features of the acts is that they cover different plant material depending on the mode of reproduction. On one hand, plant patents are available in respect of cultivated, asexually-reproduced plants, including sports, mutants, hybrids, and newly found seedlings. On the other hand, sexually-reproduced and tuber propagated plants are not capable of protection by plant patents, nor are uncultivated, asexually-reproduced plants.

[14] IP Australia, *Australian Patent Office Manual of Practice and Procedure, Volume 2: National*, [2.9.2.15] 'Agriculture and Horticulture'. The Manual can be accessed at: <http://www.ipaustralia.gov.au/pdfs/patentsmanual/WebHelp/Patent_Examiners_Manual.htm>.
[15] The United States *Plant Variety Protection Act* 1970 is not considered in this Report. For more details see the United States Plant Variety Protection Office, <http://www.ams.usda.gov/AMSv1.0/ams.fetchTemplateData.do?template=TemplateC&navID=PlantVarietyProtectionOffice&rightNav1=PlantVarietyProtectionOffice&topNav=&leftNav=ScienceandLaboratories&page=PlantVarietyProtectionOffice&resultType=>.

The asexual/sexual distinction

In the United States, the type of protection sought may depend on how your plant variety has been propagated or reproduced; as plant patents only provide protection for asexually reproduced plants.[16] That is, plants that are reproduced through plant parts or apomixis (eg strawberries, onion, mangoes, and gladiolus) are generally eligible for protection under the *Plant Patent Act*. By contrast, plant variety rights provide protection for any sexually reproduced or tuber propagated variety; provided that the other prerequisites are satisfied.[17]

Potatoes, which are generally grown from seed, would only be eligible for plant variety rights protection in the United States. So potato breeders would be ill-advised to seek plant patent protection. Since 2006, there had been approximately 69 applications for new potato varieties under the plant variety rights scheme in the United States.

The relevance of the distinction between asexual and sexual propagation can be further illustrated by the approach taken by the Queensland Primary Industries and Fisheries who have been awarded Plant Patent number 17,770 (Mango tree named 'B74').[18] The Plant patent relates to the discovery and asexual propagation of a new variety of mango tree. The B74 tree was first asexually propagated by grafting onto seedling rootstocks and because of the mode of production the Queensland Primary Industries and Fisheries could not have applied for plant variety rights in the United States. In Australia, B74 was granted plant breeder's rights protection 20 May 2002 because there is no restriction on asexually reproduced plants under the Australian *Plant Breeder's Rights Act*.[19]

Another consideration for the Queensland Primary Industries and Fisheries in taking out plant patents is the strength of the right (as compared to plant breeder's/variety rights). A plant patent gives the patent owner the rights to exclude others from asexually reproducing the protected plant, and from using, offering for sale, or selling the protected plant, or any of its parts, throughout the United States, or from importing

[16] This distinction appears to be based on policy, rather than on biology: Cary Fowler, 'The Plant Patent Act of 1930: A Sociological History of its Creation' (2000) 82 *Patent and Trademark Office Society* 621; Mark Janis and Jay Kesan, 'US Plant Variety Protection: Sound and Fury...?' (2002 – 2003) 39 *Houston Law Review* 727.
[17] The requirements of plant breeder's rights are generally that the new variety is new, distinct, uniform and stable.
[18] An extract of the patent including the claims and description are included in Appendix 3.
[19] Application number 1998/018, published in the Plant Varieties Journal (Volume 14, Issue 2). An extract of the Australian plant breeder's rights application is included in Appendix 4.

the protected plant, or any parts thereof, into the United States. Therefore, a plant patent is infringed by the unauthorised asexual reproduction of the new variety as well as by the sale or use of such asexually reproduced plants. Technically, then, sexual reproduction of the patented variety would not constitute infringement of the plant patent. That said, the sexual reproduction of protected plants is unlikely to duplicate the traits of the protected plant.

(b) United States Utility Patents

In addition to plant patents, plants are also capable of being protected by utility patents in the United States. Utility patents may be granted in respect of any new and useful process, machine, manufacture or composition of matter, or any new and useful improvements thereof.

In addition to being new and useful, the invention claimed in a utility patent must also be non-obvious. As mentioned above, an applicant for a utility patent must also file a specification containing a written description of the invention, including the manner and process of making it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, to make and use the invention. The specification must also set forth the best mode contemplated by the inventor of carrying out the invention. In practice, the written description requirement for plants is usually satisfied by filing a deposit of reproductive material of the claimed plant or plant material with a recognised depositary institution.

The utility patent system was not widely utilised to protect plants until the mid-1980s.[20] Utility patents were granted for plants and plant materials prior to this time, however these has primarily been for plants and plant materials that were not covered by the *Plant Patent Act 1930* or the *Plant Variety Protection Act 1970*– which provided 'UPOV-like' protection for sexually-reproduced plant varieties. This reflected the United States Patent and Trademark Office's (USPTO) view that the PPA and the PVPA were the exclusive forms of intellectual property protection for the types of plants covered by those statutes. Under the USPTO's policy, a plant was only capable of being protected by a utility patent if it was not otherwise capable of being protected by either the PPA or the PVPA. In 1985, the USPTO abandoned this policy after the Board of Patent Appeals and Interferences – an administrative tribunal within the USPTO – handed

[20] Jack Ralph Kloppenburg Jr., *First the Seed: The Political Economy of Plant Biotechnology* (1988).

down its decision in *Ex parte Hibberd*.[21] In that case, the Board decided that both sexually and asexually-reproduced plants are eligible for utility patent protection, regardless of whether or not they also qualify for protection by under either the PPA or the PVPA. The Board's decision was later affirmed by the United States Supreme Court in *J.E.M. Ag Supply v Pioneer Hi-Bred International Inc*.[22]

Three points of contrast between Australian patent law and the utility patent regime in the United States are worth mentioning.

1) In contrast to Australia and other countries, patent rights in the United States are granted to the first to invent a particular invention, rather than the first to file for protection. This heightens the importance of maintaining accurate supporting evidence of the research process, such as laboratory books;

2) In contrast to Australian patent law, prior use of the invention within the United States only will deprive a utility patent of novelty; prior use of the invention outside of the United States will not affect the novelty of the invention, unless such prior use has been published in a printed publication.

3) As is the case in Australia, prior publication or use of the invention within 12 months of the date of application for a utility patent will not affect the novelty of the invention. However, in contrast to the position in Australia, an applicant may commercialise an invention for up to 12 months prior to the date of application for a utility patent; in Australia, this would render the patent invalid on the basis of prior secret use.

2.1.3 The patentability of plants in Europe

The patent law of most countries within Europe is governed by the European Patent Convention (EPC 2000). The EPC 2000 provides a mechanism for the granting of national patents in a number of European countries, and is administered by the European Patent Office (EPO), which is based in Munich. At the beginning of 2009, the European Patent Convention had 34 member states.[23] As well as providing a procedure for obtaining patent protection in its member states, the EPC 2000 also sets

[21] *Ex parte Hibberd* 227 USPQ 443 (1985).
[22] *J.E.M. Ag Supply v Pioneer Hi-Bred International Inc* 534 US 124 (2001). At the time of the Supreme Court's decision in *J.E.M. Ag Supply* over 1,800 utility patents had been granted for plants.
[23] For more information see the European Patent Convention website: <http://www.epo.org/index.html>.

out the basic rules of patentability and patent validity for European patents. However, matters of infringement, enforcement, revocation, maintenance and litigation are exclusively dealt with by national law. One of the consequences of this arrangement is that a patent granted by the EPO for two countries might be interpreted, and enforced, differently in each country.

Where an applicant wishes to protect their invention in a number of European countries, they may choose to file for protection in each of the individual countries in which protection is sought, or file a single application with the EPO. The primary benefit of filing with the EPO is that it involves only a single application and search procedure, and a single grant of a bundle of different patents in each of the member states in which protection is desired. While applications may be filed in any language, the applicant must (if necessary) translate the application into an official language (English, German or French) within two months.

A 2004 study showed that the average cost of obtaining a patent directly at the EPO was €24,100.[24] Therefore, where protection is sought in only a few European countries, it may be more cost-effective to apply for separate patents in each country.

(i) Plant Varieties in Europe

The question of whether or not plants are patentable under the EPC 2000 is complex and controversial.[25] This complexity arises by virtue of the fact that Article 53(b) of the EPC 2000 expressly prohibits the granting of patents in respect of plant varieties. This provision reflects the fact that the EPC 2000 was drafted in light of the UPOV Convention: at the time the EPC 2000 was being negotiated, the UPOV Convention prohibited dual protection of plants varieties both by patent law and plant variety rights. In order to ensure that plant breeders were not able to obtain patent protection and plant variety protection for the same plant variety, it was decided that the two conventions should be mutually exclusive: a person could be given a plant variety right or patent protection, but not both.

Although the prohibition on dual protection of plant varieties has been removed from UPOV, the prohibition of the patenting of plant varieties has been retained in the European Patent Convention. However, the relaxation of the prohibition on dual

[24] European Patent Office, A *Study on the Cost of a European Patent* (2004).
[25] Margaret Llewelyn & Mick Adcock, *European Plant Intellectual Property* (2006).

protection may explain the increasingly liberal position adopted by the EPO with respect to the patenting of plant varieties. Despite some early doubts as to whether plant varieties were patentable at all under the European Patent Convention,[26] it is now clear that plant varieties are patentable provided a number of conditions are met.

The most important of these conditions is that in order to be patentable a claim must not be limited to a particular plant variety. In other words, whilst a claim which embraces more than one plant variety will be patentable, a claim to a specific plant variety will not. Claims to genetically-modified plants are likely to be patentable under this interpretation, at least to the extent that the invention is capable of being implemented in more than one variety of plant. So too will plant varieties that are ineligible for protection under the UPOV Convention.

(ii) Essentially Biological Processes in Europe

Another complicating factor with respect to the patentability of plants under the *European Patent Convention* is that Article 53(b) also prohibits the granting of patents in respect of 'essentially biological processes' for the production of plants. The scope of this provision remains unclear. In *Novartis/Transgenic Plant*,[27] the Technical Board of Appeal postulated three possible approaches to the interpretation of the provision:

1) Under the first approach, a process or method would be excluded if it includes an aspect or step that is biological. In other words, only those processes or methods consisting exclusively of non-biological steps would be patentable according to this approach;

2) The second approach would require the decision-maker to weigh up the overall degree of human intervention in the process or method. The question of whether or not a process or method is 'essentially biological' would then be judged by considering the essence of the invention, taking into account the totality of human intervention and its impact on the result achieved;

[26] See the decision of the Technical Board of Appeal in *Plant Genetic Systems/Glutamine Synthetase Inhibitors (Opposition by Greenpeace)* [1995] EPOR 357, in which the Technical Board of Appeal held that claims which encompassed or included within their scope a plant variety could not be patented in light of Article 53(b) of the European Patent Convention.
[27] *Novartis/Transgenic Plant* T1054/96 [1999] EPOR 357.

3) The third option treats any single artificial or technical element in the process or method as sufficient to carry the process or method outside of the exclusion and render it patentable.

The Technical Board of Appeal did not indicate which of the three possible approaches it preferred as the process being considered in *Novartis* was clearly not essentially biological. However, in previous decisions, the Technical Board of Appeal has expressed its support for the second approach.[28]

The correct approach has been further complicated by the subsequent introduction of the European Biotechnology Directive. Article 2(2) of the Directive provides that a process for the production of plants is essentially biological if it consists entirely of natural phenomena such as crossing and selection. Support for this view can be found in the negotiating history of the *European Patent Convention*, which shows that the drafters of the EPC 2000 considered that plant breeding processes based on selection and hybridisation were intended to be covered by the exclusion. However, the Technical Board of Appeal recently described this view as based on a 'legal fiction',[29] and it is inconsistent with prior decisions of the Technical Board of Appeal in which it has been held that a process or method consisting entirely of natural phenomena such as crossing and selection may fall outside of the exclusion if the degree of human intervention in the process or method is such that it has a decisive impact on the final result.[30]

The matter was recently referred to the Enlarged Board of Appeal – the final appellate body within the EPO.

As well as the use of patent law, confidential information is also becoming more prevalent for plant related innovation. It is assumed that a choice has to be made between patent and confidential information because patent law requires disclosure while confidential information relies on secrecy. However, this is not necessarily the case: you may decide it is in your best interest to use both forms of protection. Indeed,

[28] For a discussion of Article 53(b) of the *European Patent Convention* see Llewelyn & Adcock, above n 25, 289-319.
[29] According to the Technical Board of Appeal, this legal fiction arises from the fact that 'the systematic crossing and selection as carried out in traditional plant breeding could not occur in nature without the intervention of man', *Plant Bioscience/Broccoli* (2007) *12 Official Journal of the European Patent Office*, 644 at 660, 668.
[30] See *Lubrizol/Hybrid Plants* T320/87 [1990] EPOR 173 and *Plant Genetic Systems/Glutamine Synthetase Inhibitors (Opposition by Greenpeace)* T356/93 [1995] EPOR 357.

both forms of protection are mutually supportive and may be used at different stages of the research or commercialisation process. It may be necessary to maintain secrecy until the patent application has been filed. As we will see, prior disclosure may be detrimental to any patent application. These consequences, as well as other considerations are discussed fully in Part 5.

2.2 Confidential Information

For various reasons you may be unable (or not want) to use plant breeder's rights or patent protection. There are two obvious reasons why patents or plant breeder's rights may not be appropriate:

(1) Your information may not satisfy the requirements of patentability (eg the invention is not novel or inventive);

(2) The information may be an important part of the research and development stage of your work (prior to patent application) and you need to keep the innovation secret at least until you decide which strategy you will adopt. In so doing, confidentially can be part of an overall commercialisation strategy.

The key to maintaining confidential information is that you need to keep the information out of the public domain. Confidential information can help protect information such as operational instructions, client lists, technical processes and farm management practices.

If secrecy is the preferred option, adequate precautions must be taken to prevent the information from being disclosed. Unlike a patent, confidential information is not property,[31] and once released, you can do little to get the information back. However, it is again important to stress that patents and confidential information are not mutually exclusive. In many instances the two forms of protection are complimentary.

One of the requirements for obtaining a patent is that the applicant must describe the invention fully, including the best method known to the applicant of making and using the invention. In practice, this requires only that the applicant provide sufficient instructions to enable a person of ordinary skill in the applicable field of technology (eg

[31] *Victoria Park Racing & Recreation Ground Co Ltd v Taylor* (1937) 58 CLR 479.

plant breeding) to make and use the invention. As such, the applicant or patent owner is given a wide degree of leniency in complying with this requirement.

It is accepted that in attempting to implement the instructions contained in a patent specification, the skilled worker is required to perform ordinary methods of trial and error. However, the skilled worker must not be required to take an inventive step or undertake prolonged experiments when attempting to implement the instructions contained in the specification. This will be a question of fact and degree in each particular case, and serves to highlight the fact that patent applicants/owners are given a fairly wide discretion to choose what information to include, and what information to exclude, from a patent application.

The drafting of a patent specification is a tactical task. Provided the applicant or patent owner has disclosed the best method known to them of working the invention, an important aspect may be left out. In some instances, this 'know how' is more commercially valuable than the patent itself. If the patent applicant/owner is able to keep this information secret, they might attain a potentially significant commercial advantage over their competitors.

In this section we consider the elements of the action for breach of confidence (which is the primary legal remedy for the protection of confidential information) as well as contractual confidentiality. The primary advantages and disadvantages of relying upon this remedy to protect valuable commercial information will also be examined.

2.2.1 What is confidential information?

Put simply, confidential information is information that is not available to the public. Confidential information includes commercial secrets, personal secrets, artistic secrets and state secrets. While the terms confidential information and trade secrets are often used interchangeably, trade secrets are technically a kind of confidential information that occurs in the context of business or trade. Examples of trade secrets can include manufacturing processes, recipes, technical designs, product specifications, customer lists and marketing information.

2.2.2 How to protect information

In Australia, maintaining confidentiality can be done by contract and in equity.

(i) By contract

While confidential information is protected regardless of whether or not you have a written agreement, it is a good idea to seek a signed confidentiality agreement. Commonly, contractual protection is sought by employers, licensees and by parties wishing to conduct collaborative projects or negotiating commercialisation agreements. These agreements will often provide for disclosure of confidential information on the condition that the receiver of that information does not disseminate or pass that information on.

A written agreement generally ensures stronger protection (as you don't have to establish the elements of an equitable action discussed below at 3.2.3). A contract also allows you to clearly set out the information that you want to keep confidential, and to whom and for what purposes you are disclosing the information.

The scope and nature of confidentiality will depend on the terms of your contract and may be as broad or narrow as you deem necessary. The scope of material covered by confidentiality may depend on if you are the Discloser (wide as possible) or the Recipient (as narrow as possible). Arguably, the most important part of the confidentiality agreement is the definition of 'Confidential Information'. An example of a definition of confidential information might be:

> ...all information relating to the Project including inventions, discoveries, facts, data, chemical composition or formulation, techniques, drawings, and other knowledge.

In addition to determining what information is protected, confidential information is usually only revealed for a specific purpose. Therefore, the agreement should also outline for what purposes the information is being disclosed. For example, stated purposes may include 'assessing the research application for future funding'; or 'conducting further research'.

(ii) Equitable Breach of Confidence

There are three requirements that need to be satisfied to make out an equitable action for breach of confidence. It is up to the person alleging a breach of confidentiality (the discloser) to establish these requirements, and, as mentioned previously this may be more difficult, time consuming and expensive than relying on a breach of contract. That

said, an action for breach of contract does not preclude an action in equity (and vice versa).

The elements of equitable breach of confidence are:

(a) the information must be of a 'confidential' nature;

(b) the information must have been communicated in circumstances that indicate that the person receiving it must respect its confidential nature; and

(c) there must be unauthorised use (this can include unauthorised disclosure) of the information to the detriment of the party communicating it.[32]

(a) Is the information 'confidential' in nature?

The first requirement is that the information is confidential in nature (or in general terms the information is secret). This means that the information is not 'public property or public knowledge'.[33] Importantly, the standard of secrecy is not absolute: the fact that other people know the information does not mean that it is not secret for the purposes of equity.

Because absolute secrecy is not necessary, information may have been disclosed to a number of people (e.g. a research team) and that information remains confidential because those people are prevented from divulging the information to individuals outside of that group. Whether or not the information is confidential in nature may depend on a range of factors including:

- the effort (and money) expended in developing the information;
- the extent to which the information is known outside the business;
- the extent to which the information is guarded;
- the extent to which employees are told that the material is confidential;
- the value of the information.

[32] See, for example, *Smith Kline & French Laboratories (Australia) Ltd v Secretary, Department of Community Services and Health* (1990) 17 *Intellectual Property Reports* 545.
[33] *Saltman Engineering Co Ltd v Campbell Engineering Co Ltd* (1948) 65 PRPC 203 at 215.

(b) Has the information been communicated in circumstances that import an 'obligation of confidence'?

The second requirement is that the 'information must have been imparted in circumstances importing an obligation of confidence'.[34] This will depend on the circumstances in which the information was disclosed and may depend on the relationship between the parties, including commercial and employment relationships.

An obligation of confidence is often implied from the nature and context of the communication of information. Therefore, it is more likely that in a commercial context the courts will find that the circumstances imparted an obligation of confidence. Writing 'confidential' on the pages of your document will not necessarily make it confidential, although, it is not going to harm your prospects.

An obligation of confidence also applies in circumstances where the information was obtained surreptitiously or improperly (see the discussion of the case of *Franklin v Giddins* at 3.2.4).

(c) Has there been unauthorised use of the information?

The last element of an action for breach of confidence is that there is actual or threatened unauthorised use of the information. The question to be asked is: has the information been disclosed without the consent of the discloser?

2.2.3 Can plant related innovations be kept confidential?

Plant related innovations can be protected by confidentiality either by contract or under an equitable action for breach of confidence. The fact that plants (and plant related information) can be protected by confidential information can be illustrated by the case of *Franklin v Giddins*[35]*.* Mr Giddins was deemed to have obtained the 'trade secret' – in the form of the property of Mr Franklin – which allowed him to propagate 'Franklin Early White' nectarines. In this case, Franklin explained how he had propagated 'Franklin Early White' nectarines over many years and that the trees could only be propagated by grafting. In the Supreme Court of Queensland, Justice Dunn found that the nectarine budwood was a trade secret. Importantly, Franklin had taken steps to protect the budwood (by supervising pickers and by letting people know that this budwood was his) and had expended much time and effort developing that particular tree. The Court

[34] *Coco v A N Clark (Engineers) Ltd* [1969] RPC 41 at 47.
[35] [1977] 1B *Intellectual Property Reports* 807.

found that Giddins had stolen the budwood, and, 'although the information had not been confidentially imparted…the male defendant had behaved unconscionably and in contravention of the plaintiffs' rights'.[36]

While plant material can be protected using confidentiality, in most cases confidentiality is used to protect methods or processes.

2.2.4 Protecting methods (eg extractive) through confidentiality

The extractive process is an important one. Interestingly, innovations in this area are not generally protected through patent law. Instead, confidentiality arrangements are used. There are a number of reasons for this, most notably the way in which the techniques/methods are developed and the relatively small size of the extractive crop industry in Australia[37]. More specifically, there is a relatively small market for the products and processes used in the extractive crop industries, and, therefore confidentiality is often seen as the best method of protection. Using confidential information is also relatively inexpensive. While the majority of extractive processes are freely available, they generally need to be refined and tailored to specific circumstances. In this way, determining the most effective and efficient method of extraction is often a process of trial and error.

Take for example, the pyrethrum industry, which uses CO_2 extraction to extract the required essential oils. Researchers have developed the best temperature and pressure to extract the required quality and quantity of oil. Instead, of disclosing this information in a patent application the researchers have decided to keep it confidential. The reasons for this are complex but include the fact that the process is not generic enough to be transferred to other crops (and it is unlikely to justify the cost of patent applications). Also, unlike patent protection, which usually lasts for 20 years, confidentiality can last forever. This can be important as one particular method of CO_2 extraction has already been used for 15 years and may continue to be useful well beyond the 20 year patent term.

In keeping this information confidential, Botanical Resources Australia require staff to sign confidentiality agreements (which extends beyond the term of employment); they

[36] [1977] 1B *Intellectual Property Reports* 807, 807. Mr Giddins wife was also found to have infringed the plaintiff's rights because she knew about the conduct of her husband.
[37] Interview with Brian Chung from Botanical Resources Australia (18 February 2009).

are selective about who enters the premises; and only certain employees know the most valuable information (temperature and pressure).

The relevance of confidentiality to the extractive crop industry can also be illustrated by a recent Victorian Supreme Court case. In 2008, there was a dispute in the Victorian Supreme Court between GlaxosmithKline Australia (GSK) and a former employee of the company. The dispute centred on the fact that Mr Ritchie who was previously employed as a senior scientist, had misused confidential information about the methods of extraction of opiate alkaloids from the opium poppy (papaver somniferium).[38] While the Court said that GSK had failed to adequately identify the information that was confidential the decision raises some important considerations. Firstly, the Court distinguished between the employee's 'know-how' and the companies confidential information. An employee's 'know-how' is the general background knowledge and experience of employees which can be used in new employment, while confidential information cannot be used in new employment. Secondly, it is essential that to protect confidential information that employers use appropriately worded confidentiality clauses in employment contracts.

From the examples above, it can be seen that confidentiality agreements play an important role in Australian horticulture industries. This is particularly the case when research methods and processes are involved. Furthermore, appropriately worded confidentiality clauses are essential in employment contracts.

[38] *GlaxoSmithKline Australia Pty Ltd v Jarrod Ritchie and TPI Enterprises Limited* (No 2) [2009] VSC 25 (6 February 2009).

3.0 The number and types of patents in the United States, Europe and Australia

As we saw in Section 2.0, plants are capable of patent protection. However, this does not necessarily mean that patent protection is sought by Australian horticulture industries. In this section, an analysis of the number and kinds of patents that are being sought over plants and plant-related innovations is presented. While it is too early to suggest patents are a predominant form of intellectual property protection, the research raises some interesting issues for the future. The data presented was obtained from the relevant patent or plant variety offices.[39] Using the selected databases, titles and abstracts were analysed to exclude patents on products or processes outside of the focus of this report, including agricultural equipment, water and solar plants.[40]

There are a number of limitations with a project such as this: the process of searching and identifying plant-related patents is not straightforward. It is almost impossible to obtain the exact number of relevant applications because of the inherent difficulty of categorising and searching each database. For example, relevant applications fall into a range of categories, use different terminology and may not specifically state that they related to plants or plant breeding. This is particularly the case if the patent is for biotechnology, a single gene or for a promoter. Despite (or because of) these difficulties, comparisons were made using a range of patent databases in order to improve validity and reliability.[41] That said, the data and associated trends are consistent with other empirical investigations and literature in this area.[42]

One of the consequences of these changes is that patents either have or are becoming a form of protection of new plant varieties in those countries which permit the granting

[39] The various offices can be found at: United States Patent and Trademark Office at <http://www.uspto.gov/#>, European Patent Office at <http://www.epo.org/> and IP Australia at <http://www.ipaustralia.gov.au/>.
[40] The primary search terms used were 'plant' and 'cultivar'. Patent applications were assessed, rather than grant dates because applications are a good indicator of interest in protecting plant intellectual property and applications are not affected by processing or other factors.
[41] Additional searches (and cross-references) were done using other patent databases including: Derwent International, Patent Lens, and WIPO.
[42] See, for example, Phoebe Chan, 'International Patent Behavior of Nine Major Agricultural Biotechnology Firms', (2006) *AgBioForum*, 9(1), 59; Graff et al. 'Agricultural Biotechnology's Complementary Intellectual Assets' (2003) *Review of Economics and Statistics*, 85(2), 349; Brian Wright and Philip Pardey, 'The Evolving Rights to Intellectual Property Protection in the Agricultural Biosciences' (2006) *International Journal of Technology and Globalisation*, 2(1), 12.

of patents for plants.[43] This trend is more notable in the United States and Europe. Since the early 1980s, there has been a sharp increase in the number of patents granted in respect of agricultural biotechnology by both the United States Patent and Trademark Office and the European Patent Office.[44] At this stage the empirical evidence does not necessarily show a definite increase in patent applications for the horticulture industries. However, overseas experience may indicate that it is only a matter of time before this occurs.

3.1 United States

In the last twenty years the rate of growth in the patenting of innovations relating to agricultural biotechnology in the United States generally surpassed the upward trend in overall patenting during the same period.[45] In respect of plant biotechnology in particular, the growth in the number of patents granted by the United States Patent and Trademark Office ('USPTO') since the early 1980s has been 'exponential'.[46]

In 1996, genetically modified crops were commercially introduced for the first time in the United States. By 2001, approximately 75 million acres of genetically modified crops were grown in the United States, the major crops being soybeans (68%), cotton (69%) and corn (26%).[47] The patenting of plants remains high in the United States because the use of genetically modified crops is still on the increase. In 2008, approximately 90% of all soybean, cotton and corn crops grown in the United States were genetically modified.[48] Globally, the dominant biotechnology crops are soybean (57% of the global biotechnology area); corn (25%); cotton (13%) and canola (5%).[49] Importantly, this trend is not limited to genetically-modified varieties of plants,[50] but applies to traditionally bred plants.

[43] It has been argued that irrespective of what improvements are made to plant variety laws, the protection is unlikely ever to reach the level offered by patents because it inherently lacks generic character, being always pitched at the level of specific varieties: Crespi, R. S., 'European Union', in Erbisch, F. H., & Maredia, K. M. (ed.'s), *Intellectual Property Rights in Agricultural Biotechnology* (2nd Ed.), Oxford: CABI International, 2004, pp. 261-277 at 276.
[44] King, J., & Heisey, P., 'Ag Biotech Patents: Who's Doing What?' (2003) *Amber Waves* (November).
[45] King, J., & Heisey, P., 'Ag Biotech Patents: Who's Doing What?' (2003) *Amber Waves* (November).
[46] Graff, G. D., Cullen, S. E., Bradford, K. J., Zilberman, D., & Bennett, A. B., 'The Public-Private Structure of Intellectual Property Ownership in Agricultural Biotechnology' (2003) *21(9) Nature Biotechnology*, 989.
[47] United States Department of Agriculture, *Acreage Report* (June 2009).
[48] ISAAA, http://www.isaaa.org/.
[49] The dominant traits are herbicide tolerance (68%); insect resistance (19%) and stacked traits (13%). See, ISAAA, http://www.isaaa.org/.
[50] Heisey, P. W., King, J. L., & Day, K., 'Patterns of Public-Sector and Private-Sector Patenting in Agricultural Biotechnology', (2005) *8(2&3) AgBioForum*, 73-82, at 79.

3.2 Europe

By comparison to the United States there is still a focus on the plant variety rights scheme in Europe.[51] As a result, the patenting of plant-related innovation is relatively low. There are a number of possible explanations for this. First, the laws are more complex in Europe and there have been questions about whether an expansive approach to patenting is appropriate for plants.[52] Secondly, the European Patent Office has taken time to develop its approach to this question. Thirdly, and most importantly, at this time there are few genetically modified crops grown in Europe. That said, according to a recent study, at least 35 patents have been granted by the European Patent Office in respect on non-GM plants since 2000.[53]

3.3 Australia

While the level of patent protection for plant invention in Australia is not yet at the levels of the US and Europe, preliminary research indicates that this scenario is changing. There is growing anecdotal evidence that key players in Australian horticulture industries are increasingly concerned about the expanding use of patents as a way of protecting plant innovations in Australia. For over eight years, ACIPA has been actively involved in research and education programs relating to intellectual property issues affecting Australian horticulture and agriculture industries. Feedback received from participants at events organised by ACIPA – including seminars and workshops for both growers and scientists, intellectual property Master Classes for research managers, commercialisation managers and industry stakeholders, and conferences – has indicated that interested parties at all levels are concerned about the use of patents to protect plant innovations. At the same time, some researchers and industry participants have expressed an interest in the use of patents to protect plant innovations resulting from research by both the public and private sectors. Is there empirical evidence to support such claims?

[51] Applications to the Plant Variety Rights Office come mainly from Denmark, The Netherlands, France and the United Kingdom.
[52] See 3.1.3 for an overview. See Llewelyn and Adcock, above n 25.
[53] See, No Patents on Seed, *Patents on Normal Plants*, available from <http://www.no-patents-on-seeds.org/index.php?option=com_content&task=view&id=69&Itemid=20>.

3.3.1 Plant Breeder's Rights Applications

Recent research shows that since 2002 there has been a slight reduction in the total number of Australian plant breeder's rights applications.[54] Of more interest though, is the fact that the distribution of industries seeking protection appears to be changing as there has been proportionally fewer applications accepted from the nursery industry in recent years. In 1988, there were approximately 21 applications (57 per cent) from the nursery industry, nine applications (24 per cent) for agricultural varieties, and five applications (19 per cent) from horticultural plant breeders.[55] By contrast, in 2007, there were 155 applications (48 per cent), 87 applications (27 per cent) and 81 applications (25 per cent) from the nursery, agriculture and horticulture industries respectively.

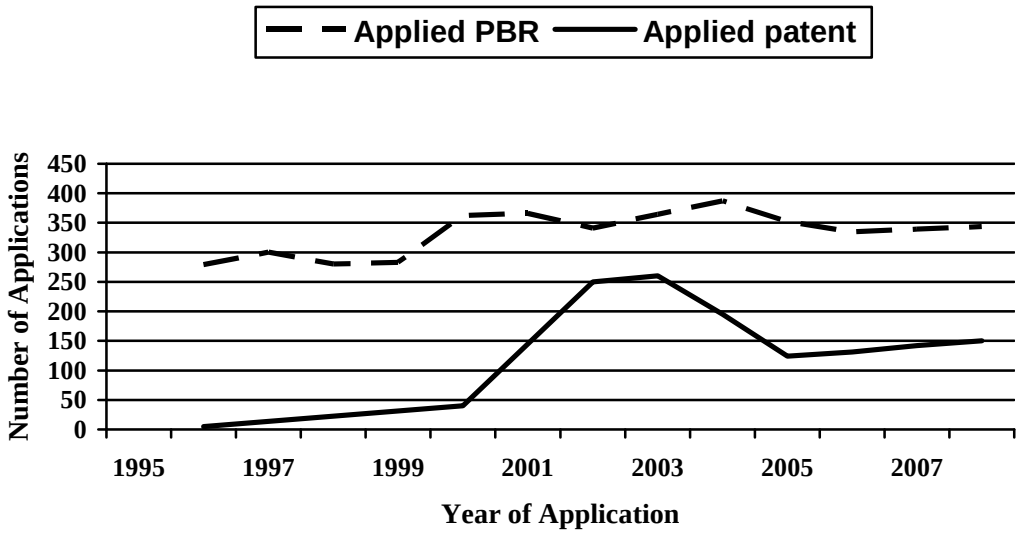
There are a number of possible explanations for the reduction in nursery applications including the effects of the changing climatic conditions: as much of the nursery and garden sector has had to restructure, modify their approach or shut down as a result of the limited availability of water.[56] People may be less inclined to purchase plants from their local nursery due to the negative attitudes towards water usage and strict water restrictions. Another possible explanation raised is the availability of alternative forms of protection including patents.

3.3.2 Patent Applications

In Australia, there appears to be two main trends in plant related patent applications. Firstly, the use of patents increased markedly between 1995 and 2001. Secondly, there has been a reduction in the number of applications from 2003 (see Figure 1).

[54] Jay Sanderson and Kathryn Adams, 'Are Plant Breeder's Rights Outdated? A Descriptive and Empirical Assessment of Plant Breeder's Rights in Australia, 1987–2007' (2008) 32(3) *Melbourne University Law Review* 980.
[55] The nursery industry was one of the main sectors pushing for the introduction of plant breeder's rights, see Sanderson and Adams, above n 54.
[56] See, for example, the South Australian government's Drought Response Initiative which specifically provides assistance to the nursery industry: South Australian Government Drought Response Initiative, *SA Drought E-news* (2 August 2007) <http://www.pir.sa.gov.au/pirsa/drought/programs__and__services/e-newsletters/2007_sa_drought_e-news_archive/sa_drought_e-news,_2nd_august_2007#two>.

Figure 1. Trends in the Number of Applications under Plant Breeder's Rights and patents in Austalia, 1995 - 2007



This reduction in patent applications may be a consequence of the genetically modified organism (GMO) moratorium in place in the majority of states and territories of Australia. In 2004, Monsanto announced that it was going to cease its genetic engineering program in canola in Australia. In Australia the only commercially available GMO is cotton. However, recently, a number of Australian States have removed the GMO moratorium for the commercialisation of canola.[57] As can be seen from the trends in the United States, the future development and use of GMO plants and plant material may have a significant impact on the patenting of plant-related innovations in Australia.

(a) Type of patent applications: plants and plant-related innovation

The second parameter that requires investigation is the type of subject matter that is being patented. This is important because the subject matter of patents is not limited to the plant variety (that is, the whole plant). There are a number of possible patent types over plants including technologies for plant transformation; gene sequences and genetically coded traits; elite germplasm, or plant varieties; and promoters.

[57] The first commercial genetically modified crops were cotton (in 1996) and carnations (in 1995). New South Wales and Victoria ended a four year moratorium on genetically modified canola crops in 2008. In 2007, both Victoria and New South Wales decided not to extend the moratorium on growing genetically modified canola: Department of Primary Industries, Victoria, *Review of the Moratorium on GM Canola* (21 July 2008) <http://www.dpi.vic.gov.au/DPI/nrenfa.nsf/LinkView/5477226A88881F86CA2572E300074EEF89E6C67B468BD2A7CA256FB70001BAB8>; Department of Primary Industries, New South Wales, *GM Canola Moratorium Information* (2005) <http://www.dpi.nsw.gov.au/aboutus/news/recent-news/agriculture-news-releases/?a=148650>. For a brief discussion of the moratoria and the legal issues faced by farmers who grow both GM and non-GM crops, see Troy Anderson, 'Seeds of Conflict: Potential Legal Issues with Genetically Modified Crops' (2008) 44(3) *Law Society Journal* 56.

The broad range of subject matter capable of plant protection is reflected by IP Australia's position on the patenting of plants which clearly states that there are a range of patentable subject matter for plants including:[58]

- new plant varieties;
- plant components such as genes and chromosomes;
- reproductive material (for example, seeds and cuttings);
- products from plants including fruit, flowers, oils, chemicals or pharmaceuticals;
- genetic engineering techniques; and
- breeding and cultivation methods.

Like the total number of patents, the range of plant-related subject that is being patented is not uniformly sought for all plant innovations in the United States, Europe and Australia. In the United States, there is a trend to use patent law to protect plant varieties.[59] By comparison, in Europe and Australia, the trend is for patents on genes, biological information and methods and processes (see Figure 2).[60] From this, commentators have identified some key categories or groupings of plant-related patents.[61]

(i) *Biological information and gene sequence patents:* applies to biological information including isolated genes, proteins and promoters. These types of patents may include biological information that improves crop yield, provides resistance to disease or pests, or delays the ripening of fruits.

(ii) *Plant variety patents:* relates to specific plant varieties or cultivars (for example, soybean and cotton).

[58] IP Australia, *Australian Patents for Plants* (1998) available from: <http://www.ipaustralia.gov.au/pdfs/patents/specific/Australian%20Patents%20for%20Plants.pdf>.
[59] Remember though that the United States has both the *Plant Patent Act* and the *Patents Act* that may provide protection for plant varieties.
[60] Phoebe Chan, 'International Patent Behaviour of Nine Major Agricultural Biotechnology Firms', (2006) 9(1) *AgBioForum*, 59 (examining the patenting of nine agriculture companies including Asgrow, DuPont, Monsanto and Pioneer).
[61] See also, Phoebe Chan, 'International Patent Behavior of Nine Major Agricultural Biotechnology Firms', (2006) *AgBioForum*, 9(1), 59; Graff et al. 'Agricultural Biotechnology's Complementary Intellectual Assets' (2003) 85(2) *Review of Economics and Statistics*, 349.

(iii) *Breeding and cultivation method patent:* refers to process technology which includes processes of plant breeding, hybridisation and selection.

Figure 2. Type of patent applications (Australia, 1995-2000)

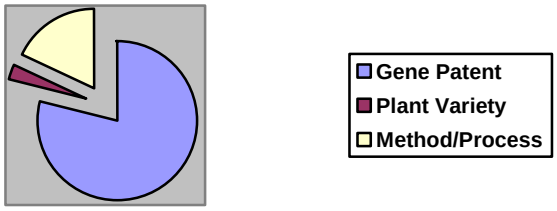


Figure 3. Type of patent applications (United States, 1995-2000)

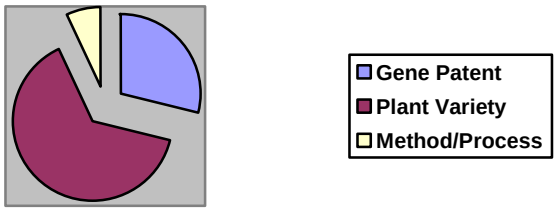
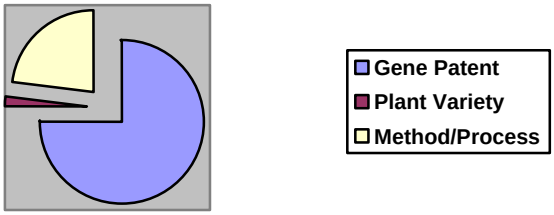


Figure 4. Type of patent applications (Europe, 1995-2000)



(b) Type of crops

The prevalence of patent protection is also dependent on the particular crop concerned and the research methods employed. In the United States, for example, patents are sought over crops including: soybeans; coffee; and canola. While patents are not readily sought by Australian horticulture industries, there are important policy and legal changes that may alter the Australian patent landscape.

An interesting (and potentially influential) aspect of Australian law in relation to patenting of plant varieties is the moratoria on genetically modified organisms (GMOs). In light of the removal of the genetically modified organism (GMO) moratorium for the commercialisation of canola,[62] canola is likely to be Australia's first genetically modified food crop and future research may focus on canola to assess the interrelationship between plant breeder's rights and patents.[63]

There may be significant implications of removing the moratoria on GMO's in Australia that could include the use of patent protection. In addition, the research shows that patents are not necessarily sought for plant varieties but may play an important role in the development and commercialisation of emerging and enabling technologies. Furthermore, the plant breeder's rights system has been criticised in recent times as being outdated and outmoded: particularly in the context of the advent of new technologies. With all of this in mind, Australian horticulture industries are at an important juncture and should not delay further investigations into the use of patent law to protect plant-related innovation.

[62] In 2007, both Victoria and New South Wales decided not to extend the moratorium on growing genetically modified canola: Department of Primary Industries, Victoria, *Review of the Moratorium on GM Canola* (21 July 2008) <http://www.dpi.vic.gov.au/DPI/nrenfa.nsf/LinkView/5477226A88881F86CA2572E300074EEF89E6C67B468BD2A7CA256FB70001BAB8>; Department of Primary Industries, New South Wales, *GM Canola Moratorium Information* (2005) <http://www.dpi.nsw.gov.au/aboutus/news/recent-news/agriculture-news-releases/?a=148650>. For a brief discussion of the moratoria and the legal issues faced by farmers who grow both GM and non-GM crops, see Troy Anderson, 'Seeds of Conflict: Potential Legal Issues with Genetically Modified Crops' (2008) 44(3) *Law Society Journal* 56.

[63] The first commercial genetically modified crop was cotton in 1996: Department of Agriculture, Fisheries and Forestry, Australian Government, *A National Market Access Framework for GM Canola and Future GM Crops* (2007) 5.

4.0 Consequences of shifting to patents and confidential information

In recent years, a number of commentators have raised concerns about the negative consequences of the increased use of patents as a way of protecting plant inventions in the United States and Europe. Of particular concern, is the negative impact that patent law may have on the breeding and growing practices in the horticulture industries. More specifically, commentators are worried about the absence of a breeder's exemption and a right to save propagating materials. Other more subtle differences between plant breeder's rights and patents include:

- the scope of protection;
- the manner and mode of registration; and
- the requirements for validity have also been raised as points of difference that need to be considered.

In this section the potential implications of a shift away from plant breeder's rights protection towards the use of patents and confidential information to protect horticultural innovation is considered. The consequences are separated out into those affecting breeders and those affecting growers. Although there is a degree of overlap between these issues that should not be dismissed.

4.1 Considerations for breeders/researchers

Generally, the greatest concerns for breeders and researchers relate to the ability to use patented materials for research/breeding purposes without the authorisation of the patent owner(s). Unlike plant breeder's rights - which permits the use of a protected variety for experimental purposes and for the purpose of breeding other plant varieties - there is no express breeder's exemption in patent law. Furthermore, the existence and scope of any implied research exemption in Australian patent law is uncertain.

A greater emphasis upon the use of patent law to protect horticultural innovation has the potential to affect existing research practices by requiring researchers and breeders to obtain the authorisation of the patent holder before using protected materials for research or breeding purposes. Further, because the scope of patentable subject matter is potentially greater than for plant breeder's rights, plant breeders and

researchers face the prospect of having to obtain a greater number of licences than is presently the case with varieties protected by plant breeder's right. This is because a patent can be granted for a range of subject matter that may extend to products or processes developed by a breeder or a researcher.[64]

4.1.1 Can a researcher's innovation be protected by patents?

In contrast to plant breeder's rights, which limits protection to the propagating material of a new plant variety (and, in certain circumstances, to materials harvested from propagating material and products derived from harvested materials), there are very few limits on the subject matter that is capable of being protected by patents: so long as the subject matter is new, non-obvious, useful, and has not been secretly used by the patent applicant or owner before the priority date, it is capable of being protected.[65] In addition, instead of being limited to protecting the variety that is eventually placed on the market, researchers and investors can potentially protect a range of different products of the research process.

4.1.2 If researchers obtain a patent, what level of protection do they get?

Traditionally, plant breeder's rights protection is regarded as being weaker than patent protection as there are few exceptions to the patent owner's right. That said, it is worth noting that the scope of protection afforded by plant breeder's rights has also increased over the past 15 years. Once solely limited to propagating material of the protected variety, a plant breeder's rights owner's rights now extend in certain circumstances to harvested materials and to products derived from harvested materials, as well as dependent varieties and essentially derived varieties. Whilst the scope of protection afforded to dependent and essentially derived varieties remains uncertain, the fact remains that the scope of protection afforded by plant breeder's rights has moved closer towards that provided by patents. The key difference is that the scope of subject matter that is capable of being protected by patent law is greater than plant breeder's rights. Therefore, patent law may provide those who invest in horticultural innovation with greater opportunities to recover their investment.

[64] See 3.3.2.
[65] An overview of the requirements of patent law is provided in Appendix 1.

4.1.3 Does research or breeding infringe another person's patent?

One of the most frequently-cited factors in the shift towards the use of patents to protect plant innovation is that patent rights are subject to fewer exceptions than alternative forms of protection, such as plant breeder's rights. Whether you infringe a patentee's right depends on the country in which they have patent protection.

Australia

In Australia, the following are express exceptions to infringement of a patent holder's rights:

- use of the invention in, or on, foreign vessels, aircraft, or vehicles;
- prior use of the invention within Australia; and,
- use of the invention for the purpose of obtaining inclusion in the Australian Register of Therapeutic Goods of goods that are intended for use as therapeutic goods.

Whether it is an infringement of a patent to use another person's patented invention for experimental or research purposes is a controversial and uncertain aspect of Australian patent law. At present, the Australian *Patents Act 1990* (Cth) does not contain an express exemption from patent infringement in respect of use of an invention for the purpose of research. Despite this, a number of commentators have suggested that the use of a patented invention for experimental purposes is exempt from infringement under Australian patent law. Others, however, have cast doubt over such claims.

The uncertainty surrounding the existence and scope of any experimental use exemption in Australian law prompted the Australian Law Reform Commission (ALRC) to recommend in 2004 that the *Patents Act* be amended to incorporate such a defence. The defence proposed by the ALRC drew a distinction between research '*conducted with*' a patented invention and '*research on*' a patented invention. For example, with a view to finding out something unknown about the invention or testing a hypothesis about the invention. The ALRC proposed that the defence should only be available for research of the latter kind, whereas research '*conducted with*' a patented invention would require the prior authorisation of the patent owner. The ALRC did not consider the issue of whether the research was conducted for a commercial purpose to be relevant to the availability of the defence.

Under the ALRC proposal, the use of a patented plant variety in a breeding program within the aim of producing a new plant variety would not be covered by the defence. As such, it would constitute patent infringement if done without the prior authorisation of the patent owner. Likewise, the introduction of a patented gene into an unpatented plant variety would fall outside the defence and would amount to infringement if done without the permission of the patent owner. On the other hand, use of a patented variety in greenhouse or field trials for the purpose of ascertaining whether the variety is suitable for local conditions would be covered by the defence and would not require the prior authorisation of the patent owner.

Following the ALRC's recommendation, the Federal Government asked the Advisory Council on Intellectual Property (ACIP),[66] to inquire into whether it was desirable to amend the Act to introduce an experimental use defence. ACIP agreed with the ALRC that it was desirable to introduce an experimental use defence into the Act, but considered that the distinction between '*research on*' a patented invention and '*research with*' a patented invention too vague to be of assistance. Instead, ACIP recommended a differently worded defence:

> 'The rights of a patentee are not infringed by acts done for experimental purposes relating to the subject matter of the invention that do not unreasonably conflict with the normal exploitation of the patent.
>
> 'Acts done for experimental purposes relating to the subject matter of the invention include:
>
> - determining how the invention works;
> - determining the scope of the claims;
> - determining the validity of the claims; and
> - seeking an improvement to the invention.'

The (then) Howard Federal Government agreed in principle with ACIP's recommendation, but did not indicate whether it approved of the wording of the defence proposed by ACIP. The Government also stated that, in addition to the list of exempted uses put forward by ACIP, that research designed to ascertain new uses for, or

[66] The Advisory Council on Intellectual Property (ACIP) is an expert panel appointed to provide advice upon intellectual property law and policy to the Federal Government, see <http://www.acip.gov.au/>.

determining new properties of, a patented invention would also be covered by the defence. This is consistent with the ALRC's recommendation that experiment on a patented invention should be exempt from infringement.

To date the Rudd Government has not indicated whether it supports the Howard Government's position on experimental use. Until the law is changed, the lack of clarity regarding the nature and existence of the experimental use defence in Australian patent law is likely to be exploited by companies seeking to maximise the extent of protection available for horticultural innovation. That said, while the existence and scope of a research exemption under patent law is still unclear, it is safe to assume that a researcher cannot freely use another person's patent in their work. As a result, researchers and breeders should obtain prior permission from the patentee to use the patent.

United States and Europe

Most European Countries incorporated a research exemption into their national laws that is based upon Article 27(b) of the the Agreement Relating to Community Patents (the Community Patent Convention). Article 27(b) states that patent protection does not extend to:

- acts done privately and for non-commercial purposes; and
- acts done for experimental purposes relating to the subject matter of the invention.

The courts in a number of European countries have interpreted these provisions broadly. For example, it has been held that research undertaken for the purpose of improving upon a patented invention or in order to discover something unknown about the invention are covered by the defence. Furthermore, the fact that the research has a commercial purpose or application does not affect the availability of the defence. Thus, in one case the use of a patented pharmaceutical composition in clinical trials for the purpose of determining whether the composition was capable of being used to treat a different medical condition from which it was presently being used to treat, was held to

be covered by the research exemption.[67] In another case, the use of a patented herbicidal composition in field trials to determine whether it was suitable for use in local conditions was held to be exempt from infringement.[68] A crucial factor in each of these decisions was that experimental use of this sort does not diminish the economic value of the patent, but enhances it, since the patent owner's permission would be required to exploit any improvement that is brought to market and falls within the scope of the claims.

In contrast, the experimental use defence in United States patent law has been described as being 'truly narrow'. Like Australia, the United States Patent Act does not contain an experimental use defence. However, case law in the United States has established that such a defence does exist, albeit of a limited nature. Courts in the United States have determined that the defence is not available if the research has 'the slightest commercial implication' or where the act is done 'in furtherance of the alleged infringer's legitimate business interests'.[69] Only acts that are performed 'for amusement, to satisfy idle curiosity, or for strictly philosophical inquiry' are exempt from infringement.[70] Significantly, courts in the United States have held that academic and non-profit research is not covered by the defence, even if the research has no commercial purpose. In *Madey v Duke University*,[71] the United States Court of Appeals for the Federal Circuit held that the activities of universities are inherently commercial and, as such, the use of patented inventions by academic researchers is not covered by the defence.

Although the use of patented inventions in non-commercial or academic settings is not necessarily exempt from patent infringement, it is widely acknowledged that academic researchers frequently ignore patents when conducting research. To some extent, this attitude has been encouraged by a general reluctance on the part of patent owners to prosecute academic researchers for patent infringement. There are a number of reasons for this. First, although infringement of patents by academic researchers is widespread, it is often difficult to detect infringement, particularly where the research does not result in a commercial product or process. Second, patent owners are often

[67] *Klinische Versuche (Clinical Trials) I* [1997] RPC 623 (Federal Supreme Court of Germany). See also *Klinische Versuche (Clinical Trials) II* [1998] RPC 423.
[68] *Monsanto v Stauffer Chemical Co* [1985] RPC 515 (English Court of Appeal).
[69] *Madey v Duke University* 307 F. 3d 1351 (2002), at p. 1362.
[70] *Madey v Duke University* 307 F. 3d 1351 (2002), at p. 1362; *Roche Products Inc v Bolar Pharmaceutical Co Inc* 733 F. 2d 858 (1984), at pp. 862, 863. See *contra* Newman J's dissent in *Integra Lifesciences Ltd v Merck KGaA* 331 F. 3d 860 (2003).
[71] *Madey v Duke University* 307 F. 3d 1351 (2002).

wary of commencing patent infringement proceedings against academic researchers because of the potential for these proceedings to generate negative publicity. The small protective gains acquired through patent infringement actions are unlikely to offset these costs. Similarly, the financial remedies resulting from any successful patent infringement action are unlikely to offset the costs of patent infringement litigation, which can be substantial.

Finally, patent owners may be reluctant to sue academic researchers for patent infringement, at least at the commencement of a research project, because the use of patented inventions by academic researchers can increase the value of the patents: if the use of a patented invention leads to a commercially-valuable discovery or product that is covered by the claims of the patent, the patent owner can seek a licence to exploit that discovery from the infringer, who will also be more willing at this stage to do so. The licence fee sought by the patent owner is also likely to be greater than would be the case where no commercial outcome is envisaged by either party.

At present, little empirical evidence is available regarding the extent to which the proliferation of patents in agriculture generally, and horticulture specifically, is adversely affecting the ability of researchers to obtain freedom to operate. The majority of studies thus far have focussed on the effect of patenting upon access to health care and the use of diagnostic tests and procedures. What little evidence exists in relation to agriculture has focussed on agricultural biotechnology. Here, it has been suggested that the presently available evidence regarding freedom to operate in agricultural biotechnology indicates that 'the effects on research of lack of access to needed technology have been more serious on average for biotechnologists working on agriculture than for those focussed on human health'.[72] For example, in a recent, unpublished study more than a third of respondents to a survey of agricultural biotechnologists working in US universities reported delays in obtaining access to patented research tools. In some cases, these delays resulted in all or part of the research project being abandoned.[73] Overall, a majority of the respondents believed that the patenting of research tools is having a negative effect on research in agricultural biotechnology.

[72] Wright, B.D., and Pardey, P.G., 'Changing Intellectual Property Regimes: Implications for Developing Country Agriculture' (2006) *2 (1/2) International Journal of Technology and Globalisation*, 93 at 102.
[73] Zhen, L., Juneja, R., and Wright, B.A., *Implications of Intellectual Property Protection for Academic Agricultural Biotechnologists*, Berkeley: Dept. of Agricultural and Resource Economics, 2006.

Little data is available on whether these problems are being experienced outside of the United States. In Australia, the only documented example of patents being used to prevent the commercialisation of a product is a Basta (phosphinothricin)-resistant lupin variety developed by the Centre for Legumes and Mediterranean Agriculture (CLIMA) at the University of Western Australia. In this instance, CLIMA was unable to reach agreement with AgroEvo (now Aventis) on the terms of the licence, and, consequently, the variety was unable to be released commercially.

The CLIMA case, and others like it, are usually characterised by proponents of the patent system as instances of a failure to obtain a commercially-acceptable outcome rather than as evidence of any systemic failure of the patent system. However, it is clear that the ability to obtain patent protection for various aspects of enabling technologies that are necessary to conduct research has the potential to increase both the transaction costs associated with performing horticultural research, and the difficulties associated with obtaining freedom to operate. The CLIMA case also highlights the necessity of obtaining clearance or freedom to operate at the outset of a project. As the CLIMA case demonstrates, failure to obtain freedom to operate may in some instances result in a research project being abandoned; in other instances, the burgeoning patent landscape may result in delays in commencing or continuing with research.

Whether a patent is one for a product or process may also be important in this area. A summary is provided below:

> Plant material: materials that are necessary to perform research (so called 'research tools') – could become prohibitive, particularly in situations where a researcher is required to obtain permission from a number of different patent owners in order to obtain freedom to operate.[74] An often-cited example of the potential difficulties involved in obtaining freedom to operate in these circumstances is 'Golden Rice', a vitamin A-enriched variety of rice which is subject to over 70 patents internationally, covering both products and processes. Obviously, the difficulties involved in obtaining freedom to operate in this situation are at once daunting and formidable. Rather than providing incentives to innovate, a proliferation of patent rights could actually inhibit research and innovation.

[74] See, in particular, Heller, M.A., and Eisenberg, R.S., 'Can Patents Deter Innovation? The Anticommons in Biomedical Research', (1998) *280 Science (1 May)* 698-701.

Enabling technologies: Equipment and/or methodology that, alone or in combination with associated technologies, provides the means to generate giant leaps in performance and capabilities of the user.

4.1.4 What is a compulsory licence? Can researchers/breeders get a compulsory licence?

A compulsory licence is an order usually granted by a court or administrative body requiring the patentee to grant the applicant a licence to work the patented invention.[75] In Australia, the compulsory licence provision has 'rarely (if ever) been utilised'.[76] To be granted a compulsory licence in Australia, a number of preconditions need to be satisfied including:[77]

- the applicant has tried for a reasonable period, but without success, to obtain from the patentee an authorisation to work the invention on reasonable terms and conditions; and
- the reasonable requirements of the public with respect to the patented invention have not been satisfied; and
- the patentee has given no satisfactory reason for failing to exploit the patent; or
- the patentee has contravened, or is contravening, Part IV of the *Trade Practices Act 1974* (Cth).

4.1.5 Is it more expensive to access patented materials?

Concern has been expressed about the transaction costs associated with obtaining access to patented materials or enabling technology. However, there is little empirical evidence to support this. The evidence is anecdotal, (see 5.1.2) and may depend on the objectives of the patentee. For example, HAL may want adaptation and uptake by its members, and therefore, making a profit is not at the forefront of their commercialisation strategy. The cost to access patented inventions may also depend on the type of technology.

[75] *Patents Act 1990* (Cth), s 133-140.
[76] See, Jane Nielsen and Dianne Nicol, 'Whither Patent Use without Authorisation in Australia' 36 *Federal Law Review* 333, 345 (Nielsen and Nicol analyse the provisions of the Patents Act dealing with compulsory licensing including recent reform). Australian Law Reform Commission, *Genes and Ingenuity: Gene Patenting and Human Health*, Report No. 99 (2004) 594, 611.
[77] *Patents Act 1990* (Cth), s 133(2).

4.1.6 Can researchers publish the results of their research? Can researchers freely conduct research?

One of the most important features of patent law is the need for any invention to be kept confidential and not to be disclosed prior to the filing date of the patent application. As we have already mentioned, researchers can decide to forego patent protection and keep their invention secret. If researchers do so, publishing their results or information may divulge the very thing they are trying to prevent others from seeing.

Alternatively, researchers may decide to patent the invention. However, this does not mean that researchers can disclose their invention without further consideration as there is the potential for disclosure (through publications; trial and experiment) to be fatal to patent applications based on the requirement of novelty.[78] Novelty is assessed by comparing the claimed invention 'with the prior art base as it existed immediately before the priority date of that claim'. When considering the prior art base, one must consider disclosures in documents, articles and conduct anywhere in the world.

Researchers may have the following options:

- Wait to publish;
- Don't make public all the 'essential' features of the invention. The questions is whether the publication anticipates the claimed invention; or
- Rely on the 'fall-back' grace period (provided that a complete application is filed within 12 months of the disclosure).

4.1.7 Can an inventor use their invention before they lodge a patent application?

Under the *Patents Act 1990* (Cth), an invention is not patentable if the invention was 'secretly used'. However, there are some circumstances in which acts are not taken to be 'secret use' including using the invention for reasonable trial or experiment. Also, using the invention in the course of confidential disclosure may not constitute 'secret use'.

[78] *Patents Act* 1990 (Cth), s 18(1)(b)(i).

4.1.8 Should breeders/researchers use confidentiality or patent? Or both?

To decide whether breeders and researchers should use confidentiality or patent law they will need to evaluate the risk of someone obtaining the information through reverse engineering or illegal means. Another important consideration is whether someone might (independently) develop the same invention. Remember that once information is publicly available, the rights to control its use or disclosure are lost. If these risks are high, researchers may prefer to obtain patent protection which requires full disclosure in return for certain exclusive rights.

However, if the information can be kept secret and reverse engineering is difficult, there may be advantages in relying on the law of confidential information. By using confidentiality, breeders and researchers will control the information (and get the commercial benefits of the control) for an indefinite period, rather than the limited period of patent protection of 20 years.

4.1.9 Should researchers/breeders have a confidentiality agreement?

The answer to the question of whether researchers and breeders should use confidentiality agreements is likely to be yes: even if researchers and breeders decide to patent the invention. While confidential information may be protected if researchers do not have a written agreement, they can ensure far greater protection by having a signed confidentiality agreement. Generally, the rights and obligations are clearly set out in a written agreement, so the parties are aware of, understand and better appreciate the conditions of disclosure. Another advantage of a written agreement is that you can tailor the terms or clauses of the agreement to your particular circumstances.

4.1.10 What should be included in a confidentiality agreement?

No single confidentiality agreement will work in every situation. Nevertheless, researchers should take into account (at least) the following:

- What information is to be protected? Is the confidential information clearly defined?
- What is the (limited) purpose of the disclosure?

- Who are the parties that can have access to the confidential information? To whom can the information be disclosed?
- Is there a notification process if one party is compelled to disclose the information? For example, by subpoena or other legal processes.
- Parties may clearly state what constitutes a breach.

4.1.11 What, if any, effect will patenting have on commercialisation?

The uptake, adoption and/or commercialisation strategy may be influenced by the patenting of plant related innovation. There are a number of ways to exploit patented technology. The patentee may choose to assign or licence their technology. While an assignment refers to a transfer of the entire property,[79] in most cases, innovators will choose to licence their technology. In the United States, there has been a proliferation of contracts and licenses associated with patented plant material and processes.

Importantly, a licence does not convey proprietary interest in a patent. Instead, the scope of the licence is determined by the terms of the contract or licence. For instance, an owner of patent rights may license their patent to third parties to manufacture or distribute the patented invention only. This could relieve the patentee of the burden of manufacturing the invention or distributing the invention.

Licensing is generally concerned with the transfer of technology for profit, or the expectation of profit, although, this is not always the case and for some organisations profit will not be the desired outcome. Rather the licence may be a means for ensuring uptake and adoption of the patented technology. In this way, if the research provider (the licensor) wants wide adoption, they may decide to have a royalty free licence.

Whatever the licensing strategy, success with licensing requires effective management: badly drafted contracts often reflect disorganised and unprepared research and commercialisation strategies as the licence agreement expresses and formalises your intentions.

[79] An assignment must be in writing, *Patents Act 1990* (Cth), s14.

4.1.12 What are the cost and time considerations of patenting?

It is generally assumed that obtaining and maintaining patent protection is both more time consuming and costly than plant breeder's rights. A major reason for the relatively high cost of patent applications is that patent specifications are complex, technical documents and should only be prepared by, or after consulting, a registered patent attorney.

The exact time-frame for completion of patent examination depends on the type and complexity of the invention. In general, however, the Australian Patent Office will issue an examination report within 14 months of receipt of a request for examination. Likewise, the cost of prosecuting a patent application will depend on the type and complexity of the invention. For simple mechanical or electrical inventions, the cost of a patent application (including patent attorney's fees) will range from A$3000-$5000. For complex biotechnology inventions, the cost may range upwards of A$10,000. Fees will vary across jurisdictions. More information can usually be found on the relevant Patent Office website. [80]

Despite the generally accepted view that patent applications are more expensive and time consuming than plant breeder's rights in some cases this may not hold true given that the comparative trials necessary for plant breeder's rights protection can be both time consuming and expensive.

The different requirements of plant patent applications can be illustrated by the experience of the Queensland Primary Industries and Fisheries with the United States *Plant Patent Act* of 1930. As is the case for utility patents (which are discussed below), an applicant for a plant patent must file a specification containing a written description of the invention. The written description requirement for plant patents is less rigorous than for utility patents: the description contained in a specification for a plant patent must only be 'as complete as is reasonably possible'. On the other hand, the description contained in a utility patent specification must contain sufficient information to enable a person skilled in the art to make and use the invention to the full extent claimed, including the best method known to the applicant of working the invention.

[80] Australia: more information about patent fees can be found at IPAustralia: <http://www.ipaustralia.gov.au/patents/fees_index.shtml#roughguide>. United States: more information about patent fees can be found at the United States Patent and Trademark Office: <http://www.uspto.gov/go/fees/>.

The US Plant Patent description for B74 includes a comparison with presently available cultivars:[81]

> The new mango tree cultivar `B74` can be compared, for example, to `R2E2`, which is commonly grown in Australia, by the following distinguishing characteristics: The leaves of the new mango tree variety are shorter and wider than the leaves of `R2E2.` The new mango tree cultivar has a higher percentage of bunch bearing inflorescences than `R2E2.` The fruit of `B74` is smaller than that of `R2E2.` The flesh color of the new mango tree variety is pale yellow, while the flesh color of `R2E2` is yellow. The skin color of ripe fruit of the new mango tree variety is approximately equal amounts of yellow and red blush (approximately 30% to 55% red blush), while the predominant skin color of ripe fruit of `R2E2` is predominantly yellow with a small proportion of red blush.

A specification for a plant patent will be considered to comply with the written description requirement if it contains a description of the characteristics of the claimed plants which distinguish it from other known varieties. The specification should also include the origin or parentage of the plant and the manner in which it has been asexually-reproduced, as well as the species and genus designation of the plant variety. The content of a plant patent application is therefore similar to an application for the grant of a plant breeder's right. In recognition of these similarities, the *Plant Patent Act* of 1930 provides that an applicant for a plant patent may rely upon an earlier application for plant breeder's rights filed in another UPOV member country for the purpose of establishing priority.

For plant breeder's rights the description required can be complex particularly when you take into account the need to conduct comparative field trials. Appendix 4 contains an extract of the plant breeder's rights Australian application for the mango variety 'B74'. This includes details of the comparative trials and some of the characteristics used to distinguish the 'B74' variety from 'Kensington Pride' and R2E2'.

[81] See Appendix 3.

4.2 Considerations for growers

A major consideration for growers is the scope of the patent right. As we have seen, a patent confers upon the patentee the exclusive right to 'exploit' the patented invention and to authorise another person to exploit the invention, and that generally patents do not offer any exceptions to the right. Therefore, generally speaking there are more restrictions on what growers can do with patented material.

4.2.1 Are there any post-sale restrictions on patents?

Generally speaking, there is no breeding or saved propagating material exemption under patent law. That said, the extent of the rights granted by a patent depends on the type of invention that is patented – in particular, whether the invention is a product or a method/process. The rights enjoyed by the owner of a patent for a product are greater than those enjoyed by the owner of a patent for a method/process and include the right to make, use, sell and import the invention.

Applied literally, these rights might prevent a purchaser of a patented invention from using the invention on the basis that the owner enjoys the exclusive right to use the invention. To avoid this conundrum, the courts developed the doctrine of 'implied licence'. This doctrine operates by creating a fictional licence between the patent owner (or its licensee) and the purchaser that authorises the purchaser to deal with the patented goods (or goods produced by a patented method/process) free without interference from the patent owner.[82] In effect, the doctrine of implied licence treats patented goods that have been legitimately purchased as if they were not patented at all. However, the doctrine of implied licence may be overridden by the express terms of a licence.

It is common practice of many patent owners to 'licence' their invention. This means that growers need to be diligent in understanding what they can (and cannot) do under the terms of their particular licence. More specifically, patent owners may place restrictions in licence agreements which limit the ability of purchasers to deal with the goods, as well as products produced from the use of the purchased goods. For example, a patent owner may require that the purchaser of patented propagating

[82] In other jurisdictions - notably, the United States and Europe – a similar doctrine, known as the doctrine of 'exhaustion', is applied by the courts. According to the doctrine of exhaustion, the patent owners rights in goods subject to the patent are 'exhausted' once the goods (or goods produced by a patent process/method) have been placed on the market.

material may only sell fruit harvested from that propagating material to designated persons.[83]

Provided that these terms are brought to the purchaser's attention at or prior to the time of sale, the purchaser will be bound by these terms (unless the terms are contrary to competition law). If the purchaser breaches these terms, they will be liable for both breach of contract and patent infringement. On the other hand, if the terms are not brought to the purchaser's attention at, or before, the time of sale, the purchaser will not be bound by them, even if they are brought to his or her attention subsequently. Likewise, a person who subsequently purchases patented goods from the initial purchaser will only be bound by restrictive terms in the licence agreement if they were aware of the terms at the time of purchase.

4.2.2 How does the doctrine of implied licence relate to propagating material?

It is important to emphasise that the implied licence granted to a purchaser of patented goods applies only to the specific goods that they have purchased: the implied licence does not permit the purchaser to make a copy or copies of the patented product. Whilst this poses few problems for the majority of patented products, living organisms, such as plants, as well as propagating materials used to produce living organisms, create special difficulties. This is because reproduction of (at least some) plants necessarily entails the production of copies of patented materials, or propagating material from which copies of patented materials can be produced. This raises a question of whether the mere production of a crop from propagating material that has been purchased amounts to patent infringement?

To date, no Australian court has considered this issue. However, courts in the United States have determined that 'the original sale of seeds does not confer a licence to construct new seeds'.[84] Were this logic to be followed, it would have the consequence that the production of a crop from propagating material that has been purchased would constitute patent infringement.[85] Although the position has not been considered by an Australian court, it is likely that such activities would fall within the scope of the implied licence, or, alternatively, that a court would imply from the circumstances surrounding

[83] Similar provisions are contained in licence agreements relating to other types of intellectual property.
[84] *Monsanto Co v McFarling* 302 F. 3d 1291 (2002), at p. 1299. See also *Monsanto Co v Scruggs* 249 F. 2d 746 (2001).
[85] In the *Monsanto* decisions, the result was avoided by an express term of Monsanto's Technology Use Agreement which authorised the purchaser to produce a single commercial crop from the patented seed.

the transaction that the implication of such a term is necessary to give efficacy to the contract.[86] In other words, it is likely that a purchaser of patented propagating material would be permitted to produce a single commercial crop.[87] However, the purchaser is likely to require the authorisation of the patent owner to use any further propagating material resulting from that crop.[88]

In the United States, a number of attempts have been made to rely upon the farm-saved seed exception in the *Plant Variety Rights Act 1970* as defence to proceedings for patent infringement. These attempts have met with little success.[89]

In Europe, a limited farm-saved seed exception is provided by Article 11(1) of the European Biotechnology Directive, which states that the sale or other form of commercialisation of plant propagating material to a farmer by the holder of the patent (or with his consent) for agricultural use implies authorisation for the farmer to use the product of his harvest for propagation or multiplication by him on his own farm. In effect, this exception is identical to that provided by section 17 of the Plant Breeder's Rights Act. However, the farmer's privilege under the Biotechnology Directive applies only to certain plant species and groups, including various types of fodder plants, cereals, potatoes, and oil and fibre plants. Moreover, a farmer who purports to rely on the defence must pay an equitable remuneration in respect of the propagating material to the patentee. The remuneration must be 'sensibly lower than the amount charged for the production of the protected material of the same variety on the same area with the

[86] A term may be implied into a contract where it is necessary to give business efficacy to the contract. It is strongly arguable that where production of a commercial crop is the purpose of the sale or licence of propagating material covered by a patent, such production should not to be regarded as patent infringement. In other words, it is necessary to imply a term into the contract of sale or licence that the purchaser is authorised to produce a single commercial crop from the purchased propagating material. In addition to the necessity of giving business efficacy to the contract, the following conditions must also be satisfied before a term will be implied into a contract: 1) it must be reasonable and equitable; 2) it must be so obvious that 'it goes without saying'; 3) it must be capable of clear expression; and, 4) it must not contradict any express term of the contract.

[87] This also represents the position in Europe: see Article 10 of *Directive 98/44/EC of the European Parliament and Council of 6 July 1998 on the Legal Protection of Biotechnological Inventions* ("European Biotechnology Directive). Article 10 provides that the rights of a patent owner with respect to biological material that has been placed on the market by the patent owner does not extend to biological material obtained from the propagation or multiplication of the biological material, where the propagation or multiplication necessarily results from the application for which the material was marketed, provided that the material is not subsequently used for other propagation or multiplication.

[88] This is consistent with the current position with respect to farm-saved propagating material under the *Plant Breeder's Rights Act 1994* (Cth). See, Jay Sanderson, 'Back to the Future: Possible Mechanisms for the Management of Plant Varieties in Australia', *University of New South Wales Law Journal* (2007) 30(3) 686.

[89] Janis and Kesan, above 16.

holder's authority'. The requirement to pay equitable remuneration does not, however, arise if the farmer is a 'small farmer'.[90]

The nature of the farm saved seed provision under both patent law and plant breeder's rights may be a moot point as seed licences are increasingly being used. These licences may include non-propagation clauses that explicitly prevent growers from saving plant material.[91]

4.2.3 Can a grower save propagating material?

It follows from what is said above regarding the limits of the doctrine of implied licence that the use of second generation seed for any purpose without the authorisation of the patentee will generally constitute infringement of patents claiming plant genes, cells, seeds or varieties. Along with the absence of a robust breeder's exemption in the patent laws of most jurisdictions, this is cited as a major influence upon the increasing interest in the use of patents to protect plant innovation.

4.2.4 Will the cost of patented material be more expensive?

While there are no empirical studies into the cost of patented plant material one would suspect that any increase in the expense of research and development would be reflected in the cost to the end-users.

4.2.5 Will using patented material affect farm management practices?

As well as potentially increasing the cost of materials, patent licenses often place controls and restrictions on plant and farm management practices. This may not only dictate to whom you can sell your harvest but also how and with what products you can manage your crops.

One example of a restrictive seed licence is the *Monsanto Seed Licence and Technology Stewardship Agreements*. Generally, Licence Agreements set out a number of provisions that are aimed at outlining the grower's rights, duties and

[90] As defined by Article 14(3) of the *Council Regulation* (EC) No 2100/94 of 27 July 1994 on Community Plant Variety Rights.
[91] For a discussion of attempts to limited farm-saved seed see, Sanderson and Adams, above n 54.

responsibilities.[92] The specific areas covered by the Monsanto Licence Agreement include auditing (providing access to certain documents); royalty payments (when and how they are to be paid) and remedies (limiting damages to the price paid for the plant/technology). In terms of farm management the two main areas that might be impacted are:

Limited use

In certain circumstances the licensor may want to restrict the terms of the licence so as to restrict the particular uses of the patented technology. For example, the Monsanto Technology Agreement limits the licensee's uses to a '*a single commercial crop*'; prohibits '*farm-saved seed*'; and states that the licensee cannot '*transfer material to any other person or entity*'.

Management plans

The licensor may wish to establish (and make the use of) management strategies as a requirement of the licence. Here, Monsanto only allows the use of '*certain products in relation to the patented technology*'.

[92] There are a number of these Agreements including the *2006 Monsanto Technology/Stewardship Agreement*, covering a range of technology including Roundup Ready® Corn, YieldGard® Corn, and Bollgard® Cotton: see, Sanderson, above n 88.

5.0 Conclusions

In recent years, objections to the use of patent protection for plants have been either swept away or marginalised. This has meant that there has been a gradual increase in the use of patent law to protect plant related innovations. While the use of patents is not yet widespread in Australia, it would appear that it is an important time for horticulture industries, both collectively and individually, to consider and assess the appropriateness of utilising both patents and confidential information to protect innovations.

Such a transformation does not come without its challenges. This Report has raised a number of considerations for a shift to the patenting of horticultural innovation. Because there is no farm saved seed or breeder exemption under patent law the horticulture industries generally views patents as providing a greater level of protection and therefore constitute a more robust protection method. Also, growers are concerned about the consequences that the patenting of plant innovations may have on farming practices; they fear that they will be forced to purchase seed that they may otherwise be able to save.

With this in mind, it is essential to stress that there is no hard and fast rule. Plant breeding is a heterogeneous activity and the appropriateness of patent law will depend on the specific needs, aims and objectives of the particular industry involved. What is clear, though, is the need for on-going analysis and assessment and that protecting plant related innovations is not amenable to a one size fits all approach. That said, a number of key messages concerning the patenting of plant related innovation emerged.

Key messages

- plant varieties and related processes or methods are patentable in Australia, the United States and Europe;
- there are a number of important differences between plant breeder's rights and patents including the absence of a breeding/research and farm-saved seed exemption under patent law;

- intellectual property protection is not necessarily an either/or proposition and you may use a combination of plant breeder's rights, patents and confidential information;
- there are a number of potential considerations raised by this Report depending on whether you are a breeder/researcher or grower; and
- specific industries need to assess the merits of patent law and confidential information: there is no single correct approach.

APPENDIX 1: An overview of patent law

The focus of Appendix 1 is on providing a foundation and basic understanding of patent law. In so doing, we answer a range of questions including: What is a patent? What types of patents are available? What are the requirements of a valid patent? We also consider the patent specification and the application process.

A1.1 What is a patent?

A patent is a bundle of exclusive rights granted to the inventor of a product or process that is new, non-obvious and useful. A patent gives its owner the exclusive right to exploit the patent, and to authorise others to do so, for a limited period of time. For most types of invention, the maximum term of a patent is 20 years from the filing date of a complete application.

The number and type of the exclusive rights enjoyed by an inventor depends on the type of invention that is patented. Your rights may depend on whether your invention is a ***product*** or a ***process***.

Where the invention is a product (for example, a new plant variety or a tool): the inventor or owner of the patent obtains the exclusive rights to make, hire, sell or otherwise dispose of the product; offer to make, sell, hire or otherwise dispose of it; use or import it; or keep it for the purpose of doing any of those things.

Where the invention is a process: (eg a new breeding method), the inventor is granted the exclusive right to use the patented process only. However, where the use of the process results in a product (eg a plant variety), the inventor of a patent process also enjoys the exclusive right to make, hire, sell or otherwise dispose of the product of the patented process; offer to make, sell, hire or otherwise dispose of it; use or import it; or keep it for the purpose of doing any of those things.

There is no such thing as a ‘worldwide’ patent so that patents must be obtained from the national patent office of each country in which protection for the invention is

sought.[93] For instance, if you wish to obtain patents in Australia, the United States and Japan you would need to lodge individual applications with the Australia Patent Office, the United States Patents and Trademarks Office and the Japan Patent Office respectively.

A1.2 Standard and innovation patents

The granting of patents in Australia is governed by the *Patents Act 1990* (Cth), which is administered by IP Australia.[94] In Australia, two types of patents are available: **innovation** and **standard** patents. There are a number of important differences between innovation and standard patents including:

- innovation patents are not available in respect of plants and animals, and the biological processes for the production of plants and animals;
- the degree of difference between the prior art base and the invention claimed is also less for an innovation patent than for a standard patent: whereas an invention claimed in a standard patent must involve an inventive step over the prior art base, an innovation patent must involve only an 'innovative step';[95]
- the term of an innovation patent (up to 8 years) is also substantially less than that for a standard patent (up to 20 years);
- an innovation patent is easier to obtain than a standard patent: whereas a standard patent application is examined to ensure that it complies with all the requirements of validity before a patent is granted, an innovation patent is subject only to a formalities check before it is granted.

Given that innovation patents are not available in respect of plants, the emphasis of the remainder of this Report is on standard patents.

[93] See A1.5 for an explanation of 'International Applications'.
[94] See, www.ipaustralia.gov.au.
[95] An invention will involve an innovative step where the difference between the prior art base and the invention claimed makes a substantial contribution to the working of the invention.

A1.3 Patent validity

The requirements for the grant of a standard patent are set out in sections 18(1) and (2) of the Act. Section 18(1) provides that for an invention to be patentable, the invention must:

- be a 'manner of manufacture' (patentable subject matter);
- be novel;
- involve an inventive step (or be non-obvious);
- be useful; and
- not have been secretly used by the patentee before an application is filed.

We discuss each of the requirements below.

(a) Manner of manufacture (patentable subject matter)

The first requirement is that the invention must be a 'manner of manufacture'. An invention will satisfy this requirement if it consists of an 'artificially created state of affairs' that is of some economic benefit.[96] In practical terms, this means that the invention must provide a concrete, tangible, physical or observable effect that is of economic value.

Patentable subject matter has included computer software, business methods and genetic manipulation. On the other hand, discoveries and laws of nature are not considered to be a manner of manufacture. Generally, where something is naturally occurring it is not patentable unless there is some type of human intervention.[97]

There are few limits to what may be patented in Australia. The only per se exclusion is that human beings, and the biological processes for the production of human beings, are not patentable subject matter.

(b) Novelty

The second requirement for a valid patent is that the invention must be new or novel. A patent will lack novelty if all the essential features of the invention have been disclosed

[96] *National Research and Development Corporation v Commissioner of Patents* (1959) 102 CLR 252.
[97] For a discussion see, Charles Lawson and Catherine Pickering. 'Patenting Genetic Materials – Failing to Reflect the Variation in DNA, RNA and Amino Acids' (2000) 11 *Australian Intellectual Property Journal* 69.

in a single document or by a single act anyone in the world before the 'priority date' of the application ('priority dates' are discussed in more detail below).

In addition, the document or act must enable a person skilled in the art to make and use the invention without prolonged study or experiments. In order to destroy novelty, it does not matter that no-one has read the document or observed the act, so long as the document or act is available to the public and any single member of the public is free to use any information obtained from the document or act. This means that if, for example, the invention is demonstrated to a person who is bound by an obligation of confidence not to disclose the invention, the invention will not lack novelty.

All of the relevant information about the invention that is published before the priority date is collectively referred to as the 'prior art base'. However, there are a number of situations in which material that has been published before the priority date is nevertheless excluded from the prior art base.[98] The first situation is where the patent applicant has disclosed information about the invention within 12 months from the date on which a complete patent application is filed (the differences between complete and provisional applications are discussed below in section A1.5).[99] This 'grace period' was first introduced into the Act in 2002 as an attempt to accommodate scientific norms such as prompt and free disclosure of new discoveries, with which the novelty requirement often conflicts by delaying publication (and, in some circumstances, leading to a reluctance to share information). The grace period represents a compromise between these two often competing priorities. However, it is important to recognise that it is only a partial compromise: although United States patent law has a similar provision, the European Patent Convention, which is the primary instrument of patent law for the majority of European Countries, does not. Thus, a disclosure which would not affect the novelty of a patent in either Australia or the United States, will destroy the novelty of any patent sought in the majority of European countries. This significantly diminishes the value of the grace period.

The second situation in which information about the invention that has been disclosed before the priority date will not affect the novelty of the invention is where information about the invention has been disclosed without the applicant's consent by someone other than the applicant within 12 months of the filing date of the provisional

[98] For guidance as to the question of whether you can publish your research see 4.1.6).
[99] *Patents Act 1990* (Cth), s 24(1)(a), *Patents Regulations 1991*, reg. 2.2(1A); 2.3(1A).

application.[100] This situation therefore differs from the grace period in that the applicant retains the opportunity to file a provisional application: this opportunity is lost where the grace period is relied on.

The final situation in which information about the invention that is disclosed before the priority date will not adversely affect the novelty of the invention is where the information is disclosed as a result of public use of the invention for the purpose of reasonable trial, and the invention is of such a nature that it is necessary for the prior use to have occurred in public (eg in field trials).[101] However, the novelty of any subsequent application will only be preserved if the application is made within 12 months of the date on which the invention was first used in public for the purpose of reasonable trial.[102] A number of other requirements must also be met where this provision is relied on:

- the experiment was conducted in an open area in order to determine the utility of the invention;
- the performance of the experiment involved unavoidable disclosure of the invention;
- where the inventor derives profit or advantage from the experiment, the profit or advantage must be accidental; and
- the use of the invention was genuinely experimental.

(c) Inventive step

The third requirement of a valid patent is that the invention must involve an inventive step: it must not be obvious to a person of ordinary skill in the applicable field (or fields) of technology. Thus, it is not sufficient that the invention is novel or different from previously published information on the subject - the difference between the prior art and the invention must also involve an inventive step.

In essence, the inventive step requirement ensures that only inventions that are not a predictable or natural progression from previously published information are patentable. Unlike novelty, it is possible to consider a combination of 2 or more documents, or 2 or more acts, when assessing whether or not an invention involves an inventive step. However, the same material that is excluded from the assessment of

[100] *Patents Act 1990* (Cth), s 24(1)(b), *Patents Regulations 1991*, reg. 2.3(2).
[101] *Patents Act 1990* (Cth), s 24(1)(a), *Patents Regulations 1991*, reg. 2.2(2)(d).
[102] *Patents Regulations 1991*, reg. 2.3(1)(c).

novelty is also excluded from the prior art base for the purpose of assessing inventive step.

In order to answer the question of whether or not an invention involves an inventive step, a patent examiner or judge must assume the mantle of a person of ordinary skill in the relevant field (or fields) of technology. The question for the decision-maker is whether the invention is obvious in light of the 'common general knowledge' that is available to such a person, together with any other information that was published before the priority date which the skilled person would have been expected to have 'ascertained, understood and regarded as relevant' to the problem addressed by the applicant or patent owner. The concept of 'common general knowledge' involves the background knowledge and experience which is available to all in the relevant field. It will often include information derived from such sources as standard educational or training courses in the field, standard text books, technical manuals, dictionaries, magazines and periodicals that are frequently referred to by those in the field.

A number of factors are relevant to the question of whether or not the invention involves an inventive step, including:

- whether the invention satisfies a 'long-felt need' or solves a problem that has remained unsolved for a period of time;
- whether the invention provides surprising or unexpected results;
- whether the invention is commercially successful;
- whether competitors of the inventor were trying (unsuccessfully) to solve the same problem that the invention provides a solution to;
- whether the prior art 'teaches away' from the direction taken by the inventor; and,
- whether the invention has been copied once placed on the market.

In practice, inventive step is the most uncertain and fiercely contested issue when prosecuting patent applications and in patent litigation. It is also the ground of validity to which patents and patent applications most frequently succumb.

(d) Useful

The fourth requirement of validity is that the invention must be useful. An invention is useful if it does what the inventor intended it to do, and the end attained is practically useful. Unless cheaper production is promised by the inventor, considerations of whether the invention is commercially feasible or commercially successful are irrelevant to the question of whether or not an invention is useful. Likewise, it is not essential that the invention is an improvement over existing technology, unless that is promised by the inventor. Nor is it relevant that the products of the invention are of poor quality: provided that the invention gives to the public a useful choice, it will satisfy the usefulness requirement.

(e) Secret use

The final requirement of a valid patent is that the invention must not have been secretly used by the applicant before. The object of this requirement is to prevent the inventor from obtaining a de facto extension of the patent term by keeping details of the invention secret and then filing for patent protection when s/he anticipates that those details are likely to be discovered by another person – for example, a competitor. In practice, this means that an inventor must not derive a commercial benefit from his/her invention before s/he files a patent application for the invention. For example, if the inventor offers the invention for sale before a patent application is filed, or enters into a contract for the sale of products of the invention before a patent application is filed, the patent will be invalid. In effect, the secret use requirement forces the inventor to choose between attempting to obtain patent protection for their invention, and attempting to maintain the secrecy of their invention and rely upon the action for breach of confidence.

Some types of secret use before the filing date of a patent application will not affect the validity of the patent. This includes: use of the invention for the purpose of reasonable trial and experiment; and, use of the invention in the course of a confidential disclosure (eg demonstrating the invention to a potential investor or manufacturer).

A1.4 The patent specification

In addition to the requirements referred to above, the Act also imposes a number of requirements relating to the form and content of patent specifications. These are set out in section 40 of the Act. This section requires that a complete patent specification:

- describe the invention fully, including the best method known to the applicant of performing the invention; and
- end with a claim or claims defining the invention.

The claim or claims must also be clear and succinct and be 'fairly based' on the matter described in the specification. These concepts are explained below. Failure to comply with any of these requirements will render the patent invalid. In addition, the claim or claims must relate to one invention only. Unlike the other requirements of relating to patent specifications, failure to comply with this requirement will not result in the patent being invalid.

(a) Describing the invention: The body of the specification

A patent specification is composed of two parts: the body and the claims. The function of each section of the specification is distinct. The function of the body of the specification is to describe the invention in sufficient detail to enable a person skilled in the relevant art to make and use the invention. This is often referred to as the 'sufficiency' requirement.

The body of the specification will usually also provide a description of the prior art, and the way(s) in which the invention differs from or improves upon the prior art. In addition, the body of the specification must disclose the best method known to the inventor of performing the invention as at the date on which the application is filed.

Whilst most inventions may be adequately described in writing and through the use of drawings, such is not the case for living organisms. Patent offices in most countries around the world, including IP Australia, accept that living organisms may be 'described' by depositing with an accredited depositary authority a representative sample of the invention, such as a seed or other propagating material of a plant variety. The deposited sample must remain open to public inspection for the duration of the patent.

(b) Defining the invention: The claims

On the other hand, the function of the claims is to define the essential features of the invention for which protection is sought. Patent claims may be likened to fences erected to mark the boundaries of real property: providing the patent is valid, the claims

set out the territory within which third parties who have not been granted permission by the patent owner to exploit the patent will be 'trespassers' or infringers. Typically, a patent specification will contain a number of claims, commencing with a primary claim drafted as broadly as the prior art permits, followed by a number of subsequent claims that define particular features of the invention in greater detail. The validity of each claim of a patent is assessed independently of each of the other claims. The logic behind this form of claim drafting is therefore to preserve some area of protection for the patent owner in case one or more claims is invalid, e.g. for lack of novelty or inventive step.

In contrast to innovation patents, which can contain no more than five claims, there is no restriction on the number of claims a standard patent may contain. However, the claims must be written in language that is clear and succinct, and be 'fairly based' on the matter described in the body of the specification. In broad terms, the fair basis requirement aims to ensure that the scope of protection claimed by the inventor is not greater than is warranted by the extent of the disclosure in the body of the specification. For example, if a plant breeder discovers a new breeding method that may be used to produce a new plant variety, a claim to the use of the breeding method to produce any plant variety may be open to an objection that the claim is not fairly based on the matter disclosed in the specification.

Patent specifications are complex, technical documents and should only be prepared by, or after consulting, a registered patent attorney. Patent specifications cannot be prepared by a solicitor. Patent attorneys must have a degree in a field or science or technology and be certified by the Patent and Trademarks Standards Board to practice as patent attorneys. There are over 1000 patent attorneys in Australia.

A1.5 Overview of the patent application process

In this section, we briefly consider the fundamental stages of the patent application process. Chronologically, the stages in the patent application process are as follows:

1. Application;
2. Publication;
3. Examination;
4. Acceptance/Refusal;

5. Opposition; and,
6. Grant.

An overview of the typical steps involved in obtaining an Australian patent is contained in Appendix 1. We consider each of these stages in turn.

The patent application

In Australia, patent rights are allocated on a first-to-file basis. (The United States is the sole country to allocate rights on a first-to-invent basis). This means that patent rights in an invention are granted to the first person to apply for a patent, rather than the first person to invent the technology. Therefore, it is crucial to file for protection at the earliest possible opportunity in order to establish priority.

In Australia, there are two types of patent application: *provisional* and *complete* applications. A *provisional* application differs from a *complete* application in two ways: first, a *provisional* application must contain only a general description of the invention, as opposed to a complete application which must fully describe the invention, including the best method known to the applicant of performing the invention. Secondly, unlike a *complete* application, it is not necessary for a *provisional* application to contain claims defining the invention.

The less rigorous requirements for *provisional* applications enables an applicant to prepare and file a *provisional* application quicker than is the case with *complete* applications. This enables the applicant to establish priority over other applications as quickly as possible. For this reason, the majority of patent applications filed in Australia commence as *provisional* applications.

Once a *provisional* application has been filed, the applicant must file a *complete* application within 12 months. If the applicant does not do so, they will lose the 'priority date' established by filing the *provisional* application. The 'priority date' is the temporal reference point against which novelty and inventive step is assessed. If the *complete* application is not filed within this time frame, the application's priority date becomes the filing date of the *complete* application. This means that any information about the invention that has been published since the *provisional* application was filed, either by the applicant or any third parties, may adversely affect the novelty and nonobviousness of the invention.

Another potential pitfall to be aware of when filing a *provisional* application is the fair basis requirement. In this context, the test of fair basis involves a comparison between the claims of the *complete* application and the description of the invention provided in the *provisional* application. As long as the invention claimed in a *complete* application is described in a general sense in an associated *provisional* application, no objection that the claim is not fairly based will arise. Where, however, the *provisional* application contains material which is inconsistent with the invention claimed, or the *complete* application claims a feature or features as to which the *provisional* application is silent, an objection that the claims lack fair basis may arise.

In this context, the fair basis requirement aims to ensure that applicants do not file for protection too early. Where a claim of a *complete* application is found to lack fair basis in the *provisional* application, this does not necessarily result in the patent being invalid: it means only that the claim loses the priority date established by filing the *provisional* application. The priority date then becomes the filing date of the *complete* application.

Who can apply for a patent?

While anyone may apply for a patent, a patent may only be granted to a person who is entitled to a patent for the invention. The primary person entitled to a patent is the inventor(s). While the Act does not define who is an 'inventor', the Patent Office takes the view that a person has an entitlement to an invention if that person's contribution, either solely or jointly with others, had a material effect on the final concept of the invention. The crucial question is whether the invention would have occurred without the person's involvement. However, the contribution must consist of something more than merely following the instructions of others.

Apart from the inventor(s), the most common class or persons that are entitled to a patent are employers. In the absence of an express term in a contract of employment to the effect that any inventions created in the ordinary course of employment shall be the property of the employer, the law implies such a term into employment contracts. An employer will therefore be entitled to an assignment of any patent applied for by an employee-inventor.

Where there is more than one inventor, each individual has an equal, undivided share in the patent, irrespective of their individual contributions. It is important that every inventor is identified in the patent application. Failure to do so may result in the patent being invalid, with the consequence that all of the inventors lose their rights to the patent.

International applications

As mentioned above, there is no such thing as a 'world-wide' patent. However, a number of international treaties assist inventors to obtain protection in a number of different countries. The most important of these is the Patents Cooperation Treaty (PCT), which is administered by the World Intellectual Property Organization (WIPO). Under the PCT, an applicant may apply for protection in a number of different countries by filing an international application designating the countries in which patent protection is sought. This may be done at the time of filing for protection in Australia, or no later than 12 months after the priority date of an Australian application. Provided that the applicant enters what is referred to as the "national phase" in each of the designated countries within 31 months of the Australian application, the priority date of the application in each of the designated countries will be the same as that of the Australian application.

The application is then forwarded to WIPO, who performs an international search report, which is in turn transmitted to the national patent offices of each of the designated countries. Together with the 31 months period within which the applicant must decide whether they intend to proceed with the application in each of the designated states, this provides the applicant with the opportunity to consider whether to proceed with the application in each of the designated states. Given that the costs of obtaining protection in a number of countries can be considerable, this can be of great assistance.

An applicant enters the national phase by furnishing the designated patent offices with a certified translation of the specification (where necessary) and payment of a prescribed fee (which varies from country to country). The application is then examined according to the procedures and requirements of the designated countries.

Examination of patent applications

The Australian patent system is based on the principle of 'deferred examination': the applicant must request the Patent Office to examine the application. The applicant must request examination of their application within 5 years of the filing date of the complete application or the application will lapse. In practice, the Patent Office will usually direct an applicant to request examination of their application within 1 to 2 years of the filing date of the complete application. Failure to comply with such a direction within 6 months of it being made will also result in the application lapsing.

Once a request to examine an application has been submitted, the Patent Office will proceed to examine the application. The Patent Office does not examine an application for compliance with all of the requirements of validity. The Patent Office examines applications to ensure:

- compliance with the requirements of section 40 (sufficiency of description, best method, clarity and succinctness, fair basis, and unity of invention);
- that the invention is a manner of manufacture;
- that the invention is novel;
- that the invention involves an inventive step; and,
- that the applicant is entitled to be granted a patent.

Further, some types of 'prior art' are not considered by IP Australia when assessing novelty and inventive step: namely, undocumented use of the invention before the 'priority date'. IP Australia consults only written information when carrying out its assessment of novelty and inventive step, although undocumented information about an invention that has been disclosed before the priority date can be raised in opposition and revocation proceedings.

The time-frame for completion of examination depends on the type and complexity of the invention. In general, however, the Patent Office will issue an examination report within 14 months of receipt of a request for examination. Likewise, the cost of prosecuting a patent application will depend on the type and complexity of the invention.

For simple mechanical or electrical inventions, the cost of a patent application (including patent attorney's fees) will range from $3000-$5000. For complex biotechnology inventions, the cost may range upwards of $10,000. Fees will vary across jurisdictions, and, more information can be found on the relevant Patent Office website, for example:

> **Australia**: more information about patent fees can be found at IPAustralia: http://www.ipaustralia.gov.au/patents/fees_index.shtml#roughguide
>
> **United States**: more information about patent fees can be found at the United States Patent and Trademark Office: http://www.uspto.gov/go/fees/

Publication

Approximately 18 months after the priority date, the application is published in the Australian Official Journal of Patents ('Official Journal'). This publication enables 'public inspection' of the application.

Acceptance

If the Patent Office is satisfied that no lawful ground of refusal exists, then it must accept the application. A notice of acceptance is then published in the Official Journal.

The fact that a patent application has been accepted by the Patent Office does not necessarily mean that a patent will be granted. The application may be opposed within a limited period of time following acceptance.

Opposition

Within 3 months of publication of the notice of acceptance in the Official Journal, the Minister or any other person may oppose the grant of a patent for the invention. The grounds on which a patent may be opposed are broader than those on which the Patent Office may refuse to accept an application: an opponent may object to the grant of a patent by relying on any of the grounds of validity, including that the invention is not useful and has been used, either in secret or in public, before the priority date of the application.

Opposition proceedings are determined by a Deputy Commissioner of Patents. However, opposition is not a highly used process.

Grant

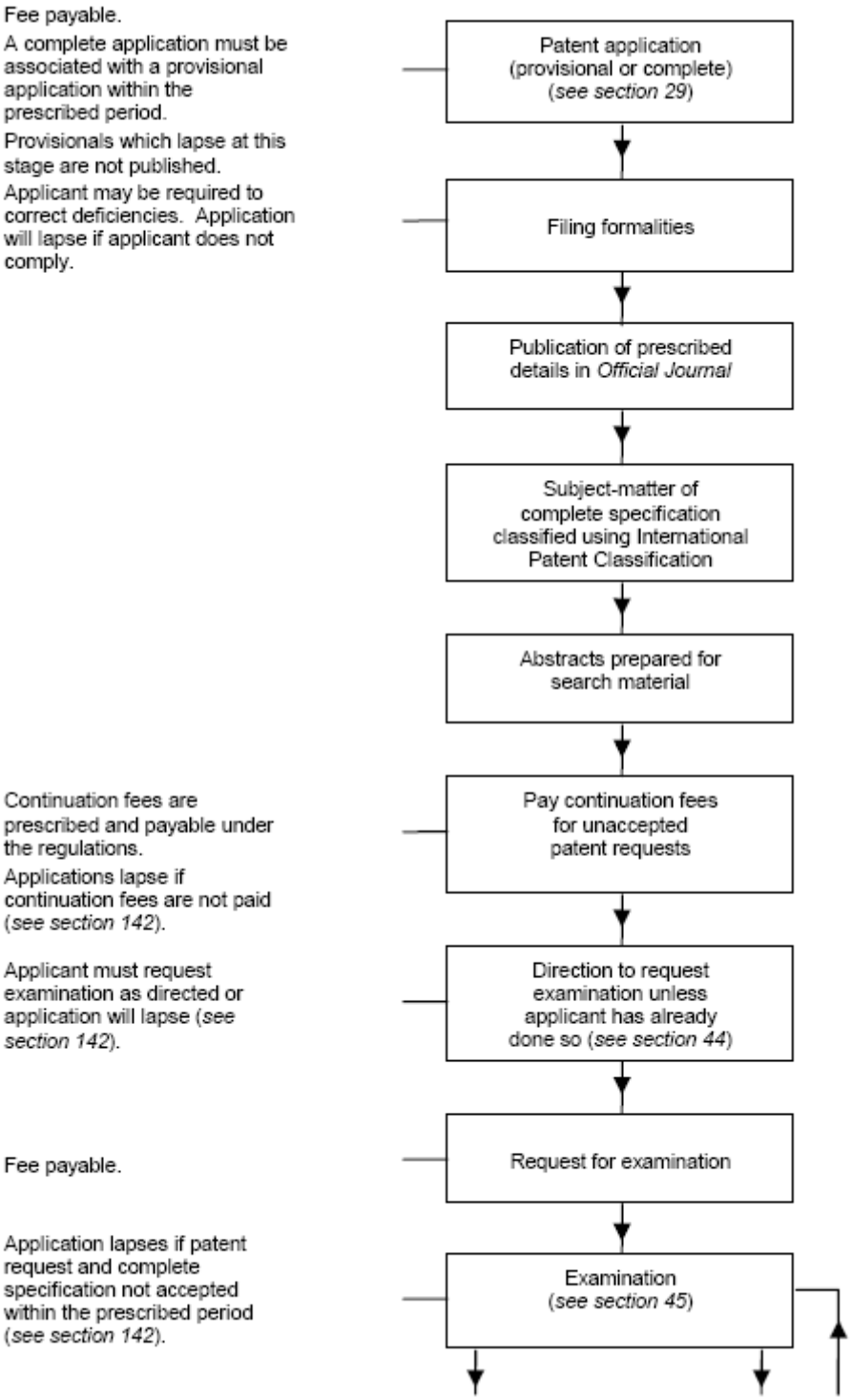
If acceptance of the application is not opposed or any opposition is unsuccessful, a patent will be granted. The maximum term of a standard patent is 20 years from the date of filing the complete application. Maintenance fees become payable from the 5th anniversary of the patent, and increase with each year the patent is maintained, commencing at $180 and increasing to $1000 by the 19th anniversary.

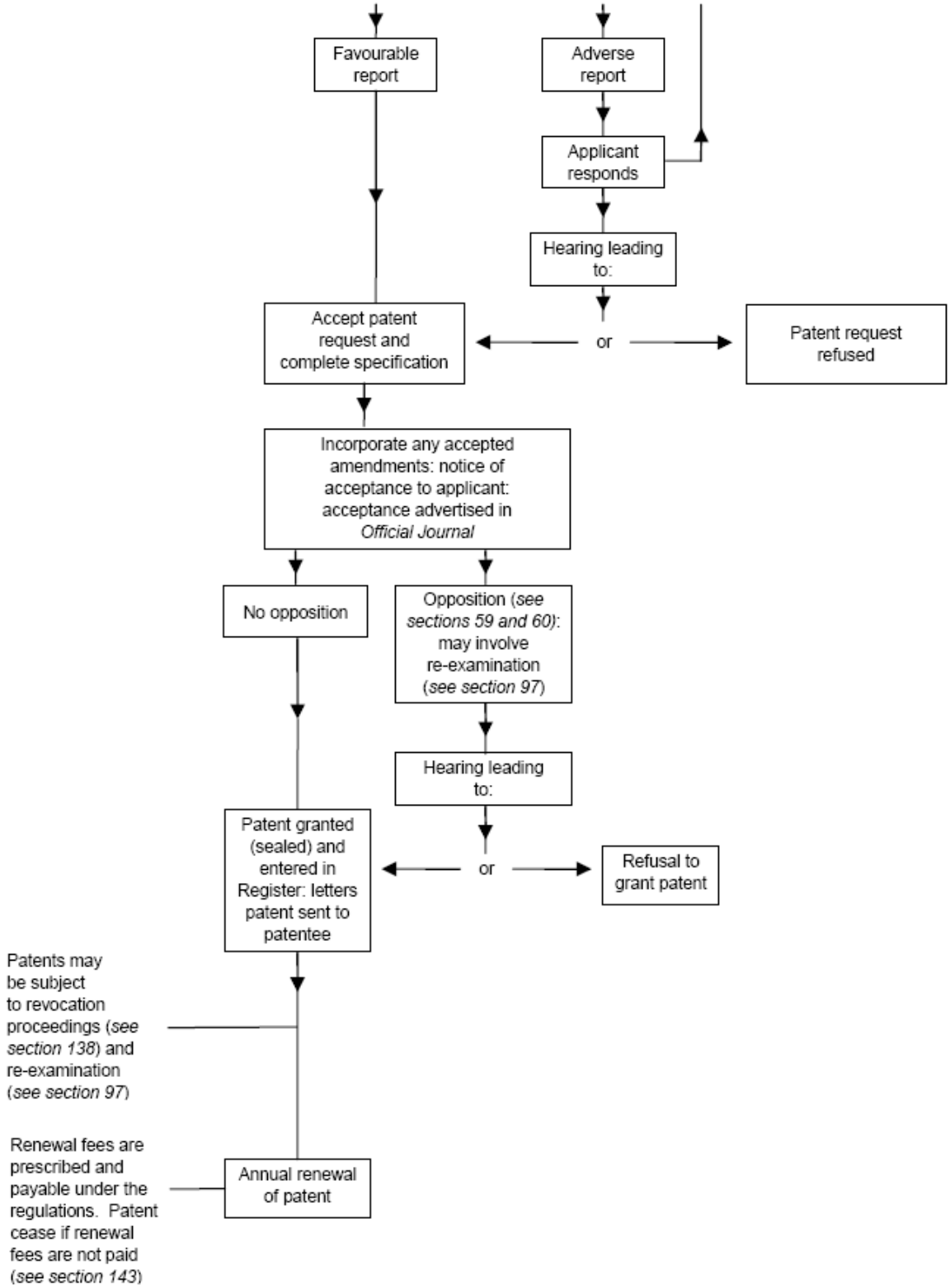
Revocation

Once a patent has been granted, this provides prima facie evidence that the patent is valid. However, a patent is still liable to be revoked at a later stage. However, a patent may only be revoked by a court. Revocation proceedings can be commenced at any time after a patent has been granted, although they are usually brought as a cross-claim to proceedings for patent infringement (ie that the patent that is alleged to have been infringed is invalid).

The grounds on which a patent may be revoked are the same as those on which the grant of a patent may be opposed. In addition, a patent may be revoked on the additional ground that the patent was obtained by fraud, false suggestion or misrepresentation.

APPENDIX 2: Typical Steps in Getting and Maintaining a standard patent (section 4 *Patents Act 1990* (Cth))




Favourable report
Adverse report
Applicant responds
Hearing leading to:
Accept patent request and complete specification
or
Patent request refused
Incorporate any accepted amendments: notice of acceptance to applicant: acceptance advertised in *Official Journal*
No opposition
Opposition (*see sections 59 and 60*): may involve re-examination (*see section 97*)
Hearing leading to:
Patent granted (sealed) and entered in Register: letters patent sent to patentee
or
Refusal to grant patent
Patents may be subject to revocation proceedings (*see section 138*) and re-examination (*see section 97*)
Renewal fees are prescribed and payable under the regulations. Patent cease if renewal fees are not paid (*see section 143*)
Annual renewal of patent

APPENDIX 3: Extract from US Plant Patent PP17, 770 P3, 'Mango tree named "B74"'

Abstract

A new and distinct ***mango*** tree variety that possesses late season maturing fruits with predominately yellow and red skin, and pale yellow, firm flesh having a low amount of non-fleshy fiber attached to the stone.

Claims

A new and distinct ***mango*** tree named `***B74***` as herein described and illustrated.

Description

Latin name of the genus and species of the ***plant*** claimed: Mangifera indica.

Variety denomination***:*** `***B74***`.

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to the discovery and asexual propagation of a new variety of ***mango*** tree, as herein described and illustrated. The new variety was first hybridized by controlled pollination. The new variety is a precocious, heavy-cropping, upright tree yielding red-skinned, medium-sized, terpinolene-flavored fruit.

The seed parent is `Sensation` and the pollen parent is `Kensington Pride.` The new variety was selected and evaluated at the fruiting stage on the property of Mr. And Mrs. L. W. Dorrian at Childers, in Queensland, Australia.

The new ***mango*** tree variety was first asexually propagated by grafting onto seedling rootstocks in Childers, in Queensland, Australia.

The new ***mango*** tree variety cv. `***B74***` has been shown to maintain its distinguishing characteristics through successive asexual propagations.

DETAILED BOTANICAL DESCRIPTION OF THE INVENTION

Throughout this specification, color names beginning with a small letter signify that the name of that color, as used in common speech, is aptly descriptive.

The descriptive matter which follows pertains to `***B74***` ***mango*** trees (as well as the comparative varieties `Sensation,` `Kensington Pride`, and `R2E2`, each of the foregoing which is unpatented) grown in the vicinity of Childers, Queensland, Australia. The scions of the candidate and comparator varieties were topworked to `Keitt` trees (unpatented) that were originally grafted to polyembryonic seedlings of `Kensington Pride.` Ten single tree replicates of each cultivar were planted at 6.times.10 m intervals in red basaltic soil (kraznozem) following a completely randomised design. Pest and disease treatments were applied as required. Irrigation and fertilizer application followed commercial practice. 10-20 random measurements of each characteristic were obtained from each replicate. Redness of skin color was determined using a Minolta Chroma Meter CR-200 to measure the hue angle (H). Mean values were taken

from measurements at three points from the shoulder to the basal end of the sun-exposed side of each fruit. The lower the hue angle, the greater the red coloration. The observations described herein are believed to apply to plants of the variety grown under similar conditions of soil and climate elsewhere.

Ten single tree replicates of each cultivar were planted at 6.times.10 m intervals following a completely randomised design. The trees were grown on a red basaltic clay loam (kraznozem) near Childers in south east Queensland, Australia (latitude 25.degree. S., altitude 40 m). Irrigation was available to supplement the average rainfall of 900 mm. Daily light interception (measured as photosynthetic photon flux) by tree canopies during the period of fruit development (October to February) ranges from 15.5 to 59.5 mol quanta m.sup.-2 at this site. The mean annual maximum/minimum temperatures at this site are 24/15.degree. C. (Australian Bureau of Meteorology).

Pest and disease treatments were applied as required. Irrigation and fertilizer application followed commercial practice. 10 to 20 random measurements of each characteristic were obtained from each replicate.

Redness of skin color was determined using a Minolta Chroma Meter CR-200 to measure the hue angle (H). Mean values were taken from measurements at three points from the shoulder to the basal end of the sun-exposed side of each fruit. The lower the hue angle, the greater the red coloration. Elsewhere throughout the specification, color references are made to The Royal Horticultural Society Color Chart. The observations described herein are believed to apply to plants of the variety grown under similar conditions of soil and climate elsewhere.

The new ***mango*** tree cultivar, `***B74***` is quite distinct from its seed parent `Sensation`, and may be distinguished from its seed parent in the following characteristics: The average fruit weight of `***B74***` (457 g) is larger than `Sensation` (360 g). Additionally, the new ***mango*** tree cultivar matures 3-4 weeks earlier than the seed parent `Sensation`, which is a very late variety. The skin color of the new ***mango*** tree cultivar is red and yellow, while the skin color of the seed parent `Sensation` has a bright yellow background with a dark red to purple blush that covers most of the surface. Further, while the new ***mango*** tree cultivar has a terpinolene aroma in both the leaves and fruit, the seed parent `Sensation` has no distinguishable terpinolene aroma in either leaves or fruit.

The new ***mango*** tree cultivar may be distinguished from the pollen parent, `Kensington Pride,` by the following characteristics. The tree of the new ***mango*** cultivar `***B74***` has a more erect form and lower vigor than the tree of the pollen parent `Kensington Pride`. The fruit of the new ***mango*** tree cultivar matures in late season, while the fruit of `Kensington Pride` matures early to mid-season. The predominant skin color of ripe fruit of the new ***mango*** tree cultivar is approximately equal amounts of yellow and red blush (approximately 30% to 55% red blush), while the predominant skin color of ripe fruit of `Kensington Pride` is yellow with a small proportion of red blush. The fruit flesh of the new ***mango*** tree cultivar is pale yellow in color, while the fruit flesh of `Kensington Pride` is yellow. The fruit shape of the new ***mango*** tree cultivar is broad elliptic, while fruit shape of the pollen parent `Kensington Pride` is medium elliptic. The sinus proximal of the stylar scar of the new ***mango*** tree cultivar is absent, while it is present in the pollen parent `Kensington Pride.` The fruit of the new ***mango*** tree cultivar is somewhat smaller than that of `Kensington Pride` (457 g as compared to 475 g). The seed of the new ***mango*** tree cultivar is of the monoembryonic type, while the seed of the pollen parent `Kensington Pride` is polyembryonic.

The new ***mango*** tree variety `***B74***` may be distinguished from presently available cultivars. The new ***mango*** tree cultivar `***B74***` can be compared, for example, to `R2E2`, which is commonly grown in Australia, by the following distinguishing characteristics: The leaves of the new ***mango*** tree variety are shorter and wider than the leaves of `R2E2.` The new ***mango*** tree cultivar has a higher percentage of bunch bearing inflorescences than `R2E2.` The fruit of `***B74***` is smaller than that of `R2E2.` The flesh color of the new ***mango*** tree variety is pale yellow, while the flesh color of `R2E2` is yellow. The skin color of ripe fruit of the new ***mango*** tree variety is approximately equal amounts of yellow and red blush (approximately 30% to 55% red blush), while the predominant skin color of ripe fruit of `R2E2` is predominantly yellow with a small proportion of red blush.

FRUIT

General harvest characteristics: General fruiting characteristics.--Bunch bearing with 2-4 fruits commonly carried on each inflorescence. Bearing.--When well-managed, `***B74***` is a regular cropping variety producing consistent yields each year. Season maturity.--Mid-late season maturity. Fruit yield.--Field planted nursery-grown trees begin commercial fruiting following their 3rd flowering anniversary in the ground. For example, a nursery-grown `***B74***` tree planted at Childers in the spring of 2001 will pass its first flowering anniversary in July/August 2002. The third flowering anniversary is July/August 2004 when it will set its first commercial crop. Yields recorded for the first three cropping years in a trees life are: Year 1.--11.5.+-.1.13 kg/tree. Year 2.--28.84.+-.1.93 kg/tree. Year 3.--37.83.+-.1.11 kg/tree. At Childers orchard, spacing is 8.times.3 m (412 trees/ha). The original small orchard planted in 1993 has a fully mature canopy producing 27 t/ha in its 10th cropping year. Shipping and keeping characteristics of fruit: Shipping and keeping quality of fruit.***--`B74` mango*** fruit typically reached the eating ripe stage within 9-10 days of harvest under the following ripening conditions: 10 ppm ethylene for two days at 20.degree. C. followed by holding at 20.degree. C. (no ethylene) until eating ripe stage. Once fruit reaches the eating ripe stage, it remains firm and in an acceptable saleable condition for a further 9-10 days when held at 20.degree. C. Long term storage.--Long term storage assessments have not been completed on this variety but early indications are that it will hold in a firm condition for 18-21 days at 12.degree. C. and then ripen to an acceptacle saleable condition. Bruising.--Bruising of mature green `***B74***` fruit in transit has not been of commercial significance, with fruit traveling up to 3000 km by road transport.

APPENDIX 4: Extract from Australian Plant Breeder's Rights Application for the mango variety 'B74'

'B74'

Application No: 1998/018 Accepted: 30 Jan 1998.
Applicant: **The State of Queensland through its Department of Primary Industries,** Brisbane, QLD and **Promised Land Avocados Pty Ltd,** Childers, QLD.

Characteristics Tree: open, upright, vigour low to moderate, fruit maturity season mid-late. Young expanding leaf: strong red anthocyanin present. Fully expanded leaf: smooth, length medium (mean 204mm), width medium to broad (mean 62mm), low length/width ratio (mean 3.5), horizontal attitude, medium petiole (40mm), shape elliptic with acuminate tip and acute base, concave cross section, apical curvature of midrib, blade not twisted, leaf edge not undulated, terpenolene aroma present when crushed. Fruit: mid-late season maturity, length medium (mean 101.3mm), width medium (mean 91.3mm), length/width ratio medium (mean 1.1), shape ovate, cross section broad elliptic, stalk cavity shallow, sinus absent, bulge proximal stylar scar absent, skin develops high levels of red anthocyanin where sun-exposed, flesh firm when ripe, texture smooth with low fibre, flesh colour pale yellow. Sap exudation at harvest with sap burn and skin browning. Fruiting characteristic is bunch bearing with 2-4 fruits commonly carried on each inflorescence. Seed: small, monoembryonic.

Origin and Breeding Controlled pollination between seed parent 'Sensation' x pollen parent 'Kensington Pride' followed by seedling selection. Seedlings from controlled pollinations were established on the property of Mr & Mrs J.W. Dorrian at Childers, QLD and the candidate selected at the fruiting stage. Selection criteria: precocious, heavy-cropping, upright tree, with red-skinned, medium-sized, terpinolene-flavoured fruit. Propagation: monoembryonic cultivar vegetatively propagated by grafting on to seedling rootstocks. Breeder: Queensland Department of Primary Industries, Brisbane and Mr J.W. Dorrian and Mrs J.R. Dorrian, Childers, QLD.

Choice of Comparators 'Kensington Pride' was chosen, as it is the pollen parent of the candidate while 'R2E2' was chosen as the variety of common knowledge most similar to the candidate. In addition, 'Kensington Pride' and 'R2E2' are the most common varieties grown in Australia. The seed parent 'Sensation' was not included in the trial because it is quite distinctive to the candidate. For example, the mean fruit size of 'Sensation' is smaller (360 g) than the candidate while the skin colour is bright yellow (background) with a dark red to purple blush that covers most of the surface. 'Sensation' is a very late variety, maturing 3-4 weeks later than the candidate. 'Sensation' has no distinguishable terpinolene smell (leaves) or flavour (fruit).

Comparative Trial Location: Childers, QLD 1997 - 2001. Conditions: scions of the candidate and comparator varieties were topworked to 'Keitt' trees that were originally grafted to polyembryonic seedlings of 'Kensington Pride'. Trees were grown on a red basaltic soil (kraznozem) planted at 6 x 10m. Pest and disease treatments applied as required. Fertiliser and irrigation followed commercial practice. Trial design: ten single tree replicates of each cultivar; planted in a completely randomised design. Measurements: 10-20 random measurements of each characterisitic from each replicate. Redness of skin colour was determined using a Minolta Chroma Meter CR-200 to measure the hue angle (H). Mean values were taken from measurements at

three points from the shoulder to the basal end of the sun-exposed side of each fruit. The lower the hue angle the greater the red colouration.

Description: **Dr. A.W. Whiley,** Queensland Horticulture Institute, Department of Primary Industries, Nambour, QLD.

***Mangifera* varieties**

	'B74'	***'Kensington Pride'**	***'R2E2'**
MATURE LEAF			
Terpinolene aroma	present	present	absent
Cross-section shape	concave	concave	straight
Relief of upper surface	slightly sunken between veins	raised between veins	raised between veins
Shape of tip	acuminate	attenuate	acuminate
Shape of base	acute	acute	rounded
Petiole length (mm)			
mean	39.8	21.3	35.5
std deviation	0.7	0.7	1.0
LSD/sig	0.6	P≤0.01	P≤0.01
Lamina length (mm)			
mean	203.9	181.5	236.8
std deviation	3.9	6.2	4.4
LSD/sig	2.0	P≤0.01	P≤0.01
Lamina width (mm)			
mean	62.3	39.7	51.8
std deviation	0.8	1.1	0.8
LSD/sig	1.30	P≤0.01	P≤0.01
Length/width ratio			
mean	3.44	4.00	4.00
std deviation	0.89	1.11	0.96
LSD/sig	0.21	P≤0.01	P≤0.01
INFLORESCENCE			

Percentage of bunch-bearing inflorescences			
mean	66.4	22.9	34.3
std deviation	9.0	9.1	10.1
LSD/sig	11.7	P≤0.01	P≤0.01

MATURE FRUIT			
Ripe fruit: predominant skin colour	red and yellow	yellow and red	yellow and red
Ripe fruit: predominant flesh colour	pale yellow	yellow	yellow
Ripe fruit: amount of fibre in flesh attached to stone	low	medium	low
Ripe fruit: terpinolene flavour	present	present	absent
Length (mm)			
mean	101.23	113.52	117.11
std deviation	2.68	2.14	3.34
LSD/sig	3.43	P≤0.01	P≤0.01
Width (mm)			
mean	91.28	87.94	111.98
std deviation	2.80	2.71	2.43
LSD/sig	3.17	P≤0.01	P≤0.01
Length/Width ratio			
mean	1.11	1.29	1.05
std deviation	0.01	0.03	0.01
LSD/sig	0.02	P≤0.01	P≤0.01
Weight (g)			
mean	457.4	475.1	802.7
std deviation	38.1	37.0	53.0
LSD/sig	50.5	ns	P≤0.01
*Ripe colour (hue angle)			
mean	44.73	67.36	53.50
std deviation	4.18	2.05	2.58

LSD/sig			3.41	P≤0.01	P≤0.01
Embryonic type			mono embryonic	poly embryonic	mostly poly embryonic
TREE					
Form	erect	spreading	erect		
Vigour			low - moderate	high	moderate
Fruit maturity season					
	late	early - mid	mid - late		

* Redness of skin colour was determined using a Minolta Chroma Meter CR-200 to measure the hue angle (H)

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