Plant variety rights in New Zealand: A review

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Abstract

A survey was conducted of all known public and private sector breeders of pastoral, arable and horticultural crops to obtain information on the impact of the Plant Varieties Act on plant breeding in New Zealand. Over the 15 year period surveyed, private investment increased dramatically then returned to a level at least twice the original level prior to the Act. In the public sector, plant breeding research also increased but to a lesser extent. A change in the emphasis is noted with more emphasis on horticultural crops and herbage species.

Comment is made on some of the controversial issues which are frequently associated with Plant Variety Rights. No evidence of reduced genetic diversity, increased seed prices, multinational company control and restrictive trade practices could be found.

Additional key words: *plant breeding, patents, impact of PVR, genetic diversity, seed prices, economic effects, social returns*

Introduction

Plant variety protection law in New Zealand effectively began 15 years ago in 1975. The law fits into the general framework of intellectual property law given recognition by the Universal Declaration of Human Rights 1948 Article 27 (2):

> Everyone has a right to the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he is the author.

The Plant Varieties Act (PVA) of 1973 was passed largely to encourage plant breeding work. Later discussion will examine the degree of success this act has achieved in the first 15 years.

PVR law is a specialised branch of patent law having some important, yet poorly understood differences from patents. After many years of attempting to use industrial patents to provide adequate protection for the creators of new cultivars (Heitz, 1987) the concept of a Plant Variety Right was developed. After much negotiation, international guidelines for legislation were developed by the Union of the Protection of New Varieties of Plants (UPOV) which is housed within the World Intellectual Property Organisation (WIPO) headquarters in Geneva.

A brief summary of the development of PVR in New Zealand is given in Table 1.

TABLE 1: PVR development in New Zealand.

1973	-	Plant Varieties Act drafted and passed by Labour Government.
1975	-	Regulations for roses and barley became operative.
1976	-	The first PVR grant made (to a rose).
1980	-	Regulations for most other species enacted.
1981	-	N.Z. joins UPOV.
1981	-	All plants except algae, fungi, bacteria included.
1984	-	First application for a compulsory licence made.
1985	-	New PVR Bill introduced to update legislation.
1987	-	Plant Variety Rights Bill passed.

Investment in Plant Breeding

Changes in plant breeding effort

There was little private plant breeding of arable and horticultural crops prior to 1973. Following the commencement of the PV Act, private breeding developed very rapidly and probably reached a peak in 1984 and has declined to a level approximately twice that in 1975. Figure 1 presents the results of a 1986 survey

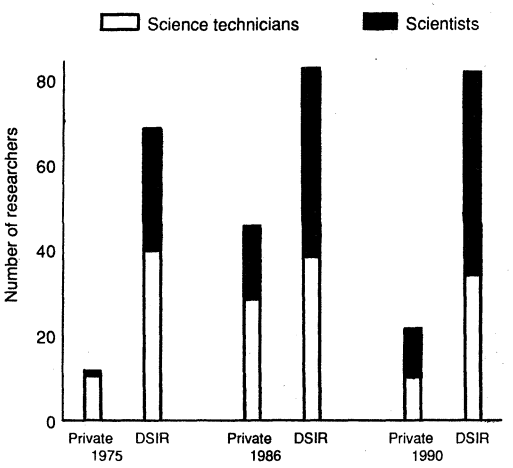

Figure 1: Personnel involved in plant breeding in New Zealand -1975, 1986 and 1990.

(Bezar, unpublished) which was updated in 1990. It includes all known private and public sector breeders of arable crops. Crown breeders of horticultural crops are included but, as horticultural breeders in the private sector are few and largely hobbyist in nature, these were not included.

Investment in private plant breeding was estimated by private breeders at $2.2 million in 1986. The generally accepted reason for the decline in effort since that time was an over optimistic view of the financial rewards available from royalties and controlled marketing. However, a decline in the area of major crops between 1985 and 1990 has also contributed to the decline with the volume of seed sales being considerably reduced. The annual investment in private crop breeding in 1990 was also estimated at about $2.2 million, representing a substantial decline in real spending from 1986 but 83% above that prior to PVR.

In the public sector plant breeding increased by approximately 20% between 1975 and 1986 and has remained constant since. This represents an investment of about $12 million including horticultural crops. While the majority of plant breeding undertaken by the crown is done by the DSIR, there has been an increase in plant breeding within MAF Technology, figures for which are not available.

Lesser (1991) in his review of the economic arguments for and against PVR concludes that patents and PVR contribute at least slightly to incr private investment and there is little evidence public R & D is cut in response to private invest He suggests some synergistic or competitive be and some re-direction of efforts.

R & D expenditure by type

In both the 1986 and 1990 survey, research development expenditure in both the public and pr sectors was partitioned into broad crop types. most significant change in emphasis in the p sector was the increase in fruit breeding, from 16 total effort in 1986 to 38% of the effort in 1 Numbers of staff in arable crops has been reduce 38% (Table 2).

TABLE 2: Distribution of plant breeding effo percentage of total effort in each p breeding sector.

Crop type	Crown (%)		Private (%	
	1986	1990	1986	19
Grasses	6	5	14	3
Amenity grasses	-	-	-	1
Clover/lucerne	13	13	6	
Forage crops	6	2	9	
Cereals	26	18	20	2
Maize	5	2	18	
Grain legumes	8	6	19	1
Fruit	16	38	-	
Vegetables	-	13	-	
Other crops	20	3	14	1

In the private sector, 36% of the total effort i pasture and forage plants and there is an incre effort in amenity grasses. There has also been a sv away from arable crops since 1986.

There are now 2 crown and 4 private gr breeding pasture plants where only one existed pri the Plant Varieties Act.

Impact of PVR

PVR grants

Figure 2 gives the number of grants issued from 1 to 1990. At 1st January 1990 there had been grants from 790 applications with 368 current v grants.

There was an increase in the number of gr made annually up to 1984. Since then there has b an average of about 50 per annum. Initially m grants were for ornamentals and crops, however c

grants have declined and ornamentals, fruit and herbage grants have increased. It is interesting to note that a record number of 96 applications (28 of which were for fruit) was received in 1989 (F.W. Whitmore, pers. comm.).

R & D output: New cultivar introductions

Table 3 provides data on the number of significant cultivars commonly available (those with over 5% of the crop area) from private and crown breeders. The table provides a summary of all significant cultivars commercially available in that year and categorises introductions separately from locally bred cultivars. Private industry has clearly been more successful in breeding pasture grasses, however most of the introductions for 1985 and 1990 are from the private breeders. The success in identifying overseas germplasm which is of use to New Zealand agriculture has been aided by the protection PVR provides for overseas breeders or breeding partners.

One of the benefits frequently ascribed to PVR is access to germplasm and cultivars which would otherwise have been unavailable (Dunbier and Wynn-Williams, 1983). In excess of 60% of PVR applications in 1990 were for cultivars bred overseas. Access to these cultivars is important for many sectors and is frequently dependant on PVR protection being available. For example in the late 1970's the Canterbury Malting Company obtained the New Zealand agency for Triumph barley (Wynn-Williams, 1988). Triumph was bred in East Germany and was only available to country's with PVR protection. Australia did not have a PVR scheme at that time and did not gain access to the cultivar until much later. Maltsters internationally buy barley by known cultivar and as a result New Zealand was able to grow 100,000 tonnes for export earning in excess of $20m annually for a number of years. Clearly access to an overseas bred, internationally recognised cultivar demonstrates one of the 'public good' benefits of PVR.

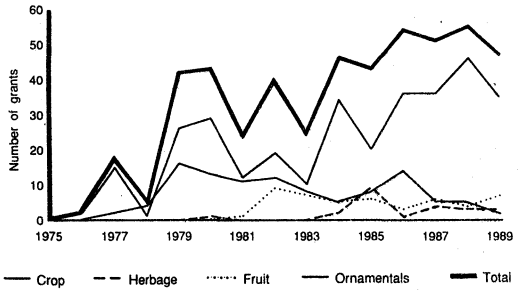

Figure 2: Number of PVR grants issued from 1975 to 1 January, 1990.

Costs and benefits

The cost of breeding cultivars in New Zealand are similar to other countries in the world but the internal royalty market is small. For example the DSIR Crop Research wheat breeding programme currently costs about $0.5m per year and produces about one cultivar per year (10 cultivars from 1980-1989). The total royalty return over ten years from the two wheats, Oroua and Rongotea, which dominated the market over a number of years, has been $993,000. These

TABLE 3: Origin of significant[1] cultivars available in the years 1973, 1985 and 1990.

	Bred in New Zealand								
	Crown (DSIR/MAF)			NZ Private Sector			Introductions		
	1973	1985	1990	1973	1985	1990	1973	1985	1990
Wheat	4	3	4	0	0	1	1	4	4
Barley	1	2	0	0	0	0	5	7	5
Oats	5	5	5	0	0	0	0	1	2
Brassicas	3	3	4	0	0	0	6	8	8
Clovers	3	6	8	0	0	0	0	0	0
Lucerne	1	3	2	0	0	0	0	4	3
Pasture grass	5	8	13	0	1	4	0	0	3
Turf grass	0	0	3	0	0	1	0	12	8
Total	22	34	35	0	1	6	12	37	33

[1] More than 5% of the crop area
Source: NZ Certified Seed Statistics

very successful and long lived cultivars did not return their costs in total royalties.

However, the social benefits from the DSIR Crop Research wheat breeding programme in some years have returned 14 times the cost when royalties, increased yield and improved quality are taken into account (Wratt, 1986). The value of the CIMMYT germplasm contribution to wheat yield alone has recently been estimated at $338,000/annum (Burnett *et al.*, 1990).

Controversy Surrounding PVR

There has been relatively little controversy in New Zealand by comparison with other countries. The probable reason for this has been the general public acceptance of plant 'patenting' as indicated in a recent survey where 'plant patenting' was supported by 71% of the public and 83% of farmers (Couchman and Fink-Jensen, 1990). Animal (59% public support) and genetic material (51%) patenting are likely to be much more contentious issues in future.

The most common controversies are:

* increased crop uniformity and reduced genetic diversity
* restricted access to seed and information
* increased control by multinationals and the linking of seed companies and chemical companies
* higher seed prices
* protection of biotechnology
* protection of native species

Genetic diversity

Many critics of PVR have objected on the basis of reduced genetic diversity both within cultivars and between cultivars (Bell, 1984). However, there are good reasons for limiting variation within a cultivar. Genetic diversity within cultivars is controlled to meet international certification requirements and the uniformity is necessary for quality control reasons to accurately distinguish between cultivars rather than for DUS requirements for PVR. Market forces also dictate uniformity for consistency of the product for processing reasons.

Total genetic diversity within species in New Zealand has almost certainly increased as a wider range of cultivars has been grown. PVR provides increased access to cultivars and germplasm from a wider range of sources thus providing breeders with the opportunity to increase diversity. The number of cultivars of common knowledge has increased dramatically (G.A. Sparks, pers. comm.) and Table 4 illustrates a substantial increase in the number of readily available cultivars, many of which are introductions from non-traditional sources (see Table 3). Thus any decline in plant breeding is likely to be detrimental to genetic diversity.

TABLE 4: Number of cultivars of economically important crops in general commercial use (cultivars of common knowledge) in New Zealand in 1973 (the time of introduction of PVR legislation), 1985 and 1990.

	1973	1985	1990
Wheat	5	18	17
Barley	4	25	10
Peas - green	12	22	23
- dry	8	17	11
Lucerne	4	10	6
Ryegrass	6	10	9
Forage brassicas	25	46	34
Total	64	148	110

Restrictive trade practices

Bell (1984, 1989) and others (Fraser, 1983) have frequently stated that PVR 'locks up' access to and information on plant varieties. However, they ignore the fact that the PV Act states that seed must be available to the public, 'plants of reasonable quality of the variety ....to the public in reasonable quantities and at a reasonable price' (Sect. 23(1)). DSIR was successfully challenged in court (Wynn-Williams, 1988) for restricting the availability of two new feijoa cultivars to commercial orchardists. DSIR and its head licensee have also been criticised (Bell, 1988) for restricting the supply of seed of Titore lentil to contract growers shortly after its release. Both these actions were justified by DSIR on the basis of giving preference, in a temporary short supply situation, to those people deemed to make best use of limited supplies. However, no preferential treatment is permitted.

It should be noted that cultivars without PVR protection can be restricted in any way that the breeder sees fit.

Information about all varieties is available from the Commissioner of Plant Variety Rights and is more detailed than was available prior to the Act.

Multinational conspiracy

Concern is often expressed that PVR legislation tends to concentrate the control of seeds into the hands of a few large multinational companies involved in the production of chemicals. While in the late 1970's until 1987 there were many company mergers both in the seed industry and other industries, since that time, it is the view of the authors that the trend has been reversed. Many smaller independent seed companies have begun operation as they are able to provide a competitive service. Clearly this is not a current concern in New Zealand as very few local seed companies have links with multinational chemical companies.

Seed price

Increased seed prices have been attributed to PVR by growers and others (Fryer, 1974) but an analysis of the relative price of seed wheat to commodity wheat between 1958 and 1989 shows no indication of having been affected by reasonable quantities of royalty bearing cultivars becoming available in 1981 (Fig. 3). Detailed, historical information on other crops is not available, however the effect of royalties and controlled marketing is also likely to be small. These price fluctuations are less than the fluctuations due to supply and demand. The relative seed price (1958=1000) is based on the average wholesale ex-store price (Department of Statistics). The New Zealand Wheat Board price for milling grade wheat until 1985 was converted to a relative (1958 = $42.26/t = 1000) and the two relatives expressed as a ratio. From 1985 an average 100 index points price was used.

The stability of the milling wheat price changed in 1974 (Fig. 4). Over the period 1958 to 1974 the price rose by only 2.6% per year but from 1974 until 1985 rose by 32.4% per year. The seed price showed a similar rise although the ratio of the two deviated sharply from 1 in 1972 and has averaged 1.15 since.

The discontinuity in the ratio of seed price to commodity price from 1972 is likely to relate to a number of factors including systemic seed treatments, general price increases and higher interest rates.

Farmers privilege

Under current PVR legislation growers of protected agricultural cultivars are free to retain seed they have harvested and resow it. The breeders of protected varieties do not receive a royalty on such seed. This has become known as the 'farmers privilege' or the 'farmers exemption'. Because of the extent of the practice by growers, breeders of certain crop varieties are finding it impossible to collect a fair return through royalties that will compensate them for development costs. Figure 5 shows the estimated proportion of the commercial crop area of two popular wheat cultivars which were sown from seed on which a royalty was collected.

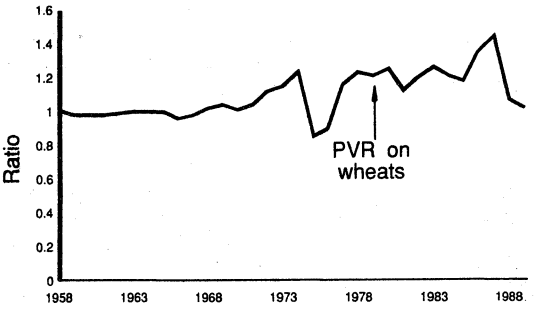

Figure 3: The ratio of the price of seed wheat to commodity wheat.

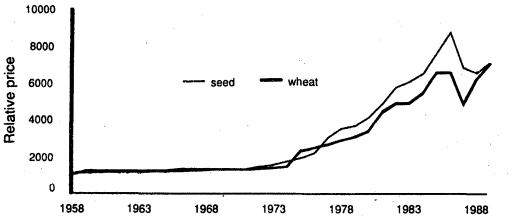

Figure 4: The relative price of seed wheat and milling wheat, 1958 - 1988. Index for 1958 = 1000.

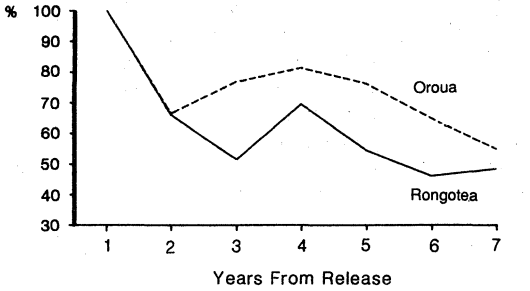

Figure 5: Estimate of the relative area of the wheat cultivars Rongotea and Oroua grown from traded seed.

The PVR Act (1987) and the subsequent Plant Variety Rights (Grantees Rights) order essentially removed the farmers privilege from vegetatively propagated fruit and ornamental plants. In recent times there have been moves in Europe and New Zealand (Anon. 1989) to limit or remove the farmers privilege from all species. Farmers as well as breeders acknowledge that the current situation has harmful consequences for the agricultural industry as a whole. The issue is likely to be resolved with agreement on the right to retain seed subject to payment of royalty.

Biotechnology

Techniques which enable the insertion of a gene or a number of genes directly into the genome without many generations of selection and purification have raised the controversy of the protection of the resulting cultivar. Should the breeder who inserts the gene into a protected cultivar then be able to protect the resulting cultivar? This has raised an international debate which is still unresolved and which is centring on the concept of 'essentially derived' cultivars. The debate suggests that if a change is made to a protected cultivar, then it will be eligible for rights but the owner of the essentially derived cultivar must negotiate a royalty split with the original owner of the cultivar.

Controversy also continues on the patenting of gene sequences which would preclude other breeders using this material without consent (Wynn-Williams, 1987), which undermines what has become known as the 'breeders privilege' or the absolute right to use protected cultivars for breeding purposes.

Native species.

The opponents of PVR fear that PVR poses a threat to native plants. However, only new cultivars can be protected. That means that native species, subspecies and botanical varieties cannot be protected. A cultivar as defined by the 1987 Act is a cultivated variety of a plant and includes a clone, hybrid, stock or line of such a plant. As a safeguard the Commissioner refers native plant applications to a recognised expert to judge if the application is for a new cultivar. To date there have been 8 applications for protection of native cultivars of which 5 received grants and only three are current.

Conclusion

PVR has achieved a measure of success in achieving the two major goals of providing access to overseas germplasm and stimulating plant breeding in New Zealand. Over the 15 year period there was a breeding boom but the breeding effort has returned to a level 83% above that prior to PVR. Butler and Marion (1985) reported a similar result in their study of PVR in the USA and, in an international context, Lesser concludes that rights do have a positive effect.

Royalty income is not a major goal in New Zealand for public or private breeders, of greater importance is the ability to market cultivars more effectively. Importantly, PVR is one of several essential options for a technologically advanced industry. PVR together with certification and merit testing provide consumers and breeders with the necessary tools to effectively market quality seed of quality cultivars.

The public interest is more difficult to assess. The PVR scheme is run at very little cost to the nation, however, the nation receives major social benefits through improved genetic diversity and greater competition which results in higher yields, better quality and improved pest and disease resistance.

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