



Intellectual property rights in plant breeding and the impact on agricultural innovation

Bert Visser, Centre for Genetic Resources, Wageningen, The Netherlands, Wageningen University and Research Centre, Wageningen, the Netherlands

Bram De Jonge, Law and Governance Group, Wageningen University and Research Centre, Wageningen, the Netherlands

Introduction

In plant breeding, two types of intellectual property rights (IPRs) play a major role; plant breeders' rights (PBRs), developed between 1900 and 1950; and patent rights, which emerged with the rise of modern biotechnology. This paper examines the impact of both systems on breeders, farmers and agricultural innovation.

IPRs can be regarded as constituting a contract between the "inventor" and society. In return for "disclosure" of the invention, the IPR holder obtains the exclusive right to market the invented product for a defined period of time (usually 20-30 years), allowing them to realize returns on his/her investments. Others can make use of the public description of the product and the manufacturing process to develop their own products. Plant breeders regard the use of IPRs as a fair mechanism to regain their investments and as a prerequisite for continued investments in plant breeding.

PBRs are sometimes referred to as *sui generis* rights – meaning that they are "of themselves" – i.e. they stand alone. In 1961, the International Union for the Protection of New Varieties of Plants (UPOV) provided the first international PBR Act – the UPOV Convention which mandated member countries to develop national legislation in line with this Act. The UPOV Convention has been reviewed and changed three times, and the last version, stemming from 1991 (<http://www.upov.int/en/publications/conventions/1991/act1991.htm>), provides the strongest protection for plant breeders, granting the holder the exclusive right to reproduce and market the protected variety. However, there are two exceptions: the breeders' exemption and the farmers' privilege. The breeders' exemption allows other breeders (including farmers) to use a protected variety in his/her own breeding activities. The farmers' privilege allows farmers to use the product of the harvest of a protected variety for reproduction purposes on his/her own holding. UPOV 1991 narrowed both the farmers' privilege and the breeders' exemption (through the introduction of the concept of essentially derived varieties), and this led to a shift in the level of protection towards that offered by patents.

Patents provide a stronger form of protection usually without a breeders' exemption or farmers' privilege. Initially, the patent route remained closed for plants as they could only be obtained for inventions, described in "claims". A notable early exception was the USA, where the 1930 Plant Patent Act limited patents to the protection of asexually reproduced plants, excluding tuber-propagated plants. As plant biotechnology developed, it became possible to protect either plants with certain 'invented' characteristics or processes allowing the manufacture of specific plants. These forms of protection are not mutually exclusive: patents and PBRs can be applicable to the same plant, with a PBR protecting the new plant variety and patents protecting a new trait. Such patents may be granted on genetically modified (GM) plants but also on non-GM plants containing native traits that have been introduced and selected in breeding products or can be identified using biotechnological tools.

Implementation of PBRs is sometimes linked to the implementation of national seed laws. Field tests and associated requirements related to the application for PBR might also serve the registration of varieties for the purpose of marketing.

The World Trade Organisation Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) of 1995 (https://www.wto.org/english/tratop_e/trips_e/t_agm0_e.htm) requires that "patents shall be available for any inventions, whether products or processes, in all fields of technology", but also that "plants and animals other than micro-organisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes" may be excluded from patentability. In such cases, countries "shall provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by any combination thereof". The TRIPS agreement is operational in both developed countries and many developing countries.

A recent development is that regional organisations, such as the regional IP organisations in Africa, Organisation Africaine de la Propriété Intellectuelle (<http://www.oapi.int/>) and African Regional Intellectual Property Organization (<http://www.aripo.org>), serve as promoters of the national implementation of UPOV-harmonised PBR laws. In parallel with a strengthening of IPRs on biological products, the Convention on Biological Diversity (CBD; 1992; <https://www.cbd.int/doc/legal/cbd-en.pdf>) and in particular the Nagoya Protocol to the CBD (2010) have introduced measures relating to Access and Benefit-Sharing (ABS) (<https://www.cbd.int/abs/>), regulating the use and international transfer of genetic resources.

IPRs have therefore gained in importance in plant breeding, and plant patents are playing an increasing role. But in which contexts are IPRs used? What is the impact on agriculture, and in particular on the position of breeders and farmers?

Trends in plant breeding

Recent technological developments have contributed to an increased pace and new ways in plant breeding. The high investments needed to apply such technologies have resulted in a significant consolidation among breeding companies. So far, a limited number of GM crops have been introduced in a growing number of countries. Maybe even more importantly, hybrid varieties have been introduced and become dominant, offering biological protection rather than legal protection in the form of IPRs.

In many developing countries, the economic crisis of the 1980s initiated the decreasing role of the public plant breeding sector. Many public breeding institutions only kept a mandate for the breeding of major staple crops, important for national food security. In some countries, the public sector is also requested to earn part of its own income from revenues on marketed plant varieties. Because of the concern for food security, many countries have opened up their markets for varieties produced by foreign (international) breeding companies. Especially for maize, soya and vegetable seeds, the private sector has become the main provider of seeds. Given a decreasing role of the public breeding sector and a lack of availability of appropriate crop varieties for the small-scale farmers, the concept of participatory plant variety selection and participatory plant breeding was developed, allowing farmers to regain a role in plant breeding and to develop and select the varieties best fitting their agro-environmental conditions, cultural preferences and market options.

Impact of plant patents and PBRs on breeders

The increasing use of patents in plant breeding is strongly contested in the sector itself. Since patents are mainly used on plants or processes involving biotechnology and since the drafting and application of patents require specialist expertise, many smaller breeding companies feel they are in a disadvantaged position in relation to big multi-national corporations that can afford the necessary investments. Also, smaller companies fear that a new category of plant patents in Europe, protecting native traits in conventionally bred varieties, will limit the genetic material they can use in their traditional breeding programmes. These smaller companies defend PBRs as the system of choice and as best adapted to the special needs of the plant breeding sector, but also challenge the use of patents in plant breeding *per se*. Geographical differences can be noted in that in Europe PBRs are more strongly regarded as the system of choice for the plant breeding sector than in other developed countries, and with the exception of GM varieties, only a few plants protected by patents have so far been introduced in developing regions. The schism between patents and PBRs can generally be regarded as a schism between the large and the smaller breeding companies.

Impact of plant patents and PBRs on farmers

Whereas IPRs are an instrument with which plant breeders can protect the use of their varieties and biotechnological inventions by other breeders, they also limit the use of protected varieties and plants by farmers. In Article 15 (Exceptions to the Breeder's Right - [http://www.upov.int/upovlex/en/conventions/1991/act1991.html# 15](http://www.upov.int/upovlex/en/conventions/1991/act1991.html#_15)), UPOV 1991 rules that "the breeder's right shall not extend to acts done privately and for non-commercial purposes" and provides the option that "each Contracting Party may, within reasonable limits and subject to the safeguarding of the legitimate interests of the breeder, restrict the breeder's right in relation to any variety in order to permit farmers to use for propagating purposes, on their own holdings, the product of the harvest which they have obtained by planting, on their own holdings, the protected variety... ." Many stakeholders have argued that this provision is in conflict with the practices of farmers of freely exchanging and selling seeds (for consumption or for sowing) in local markets. They also argue that the term "farmers' privilege" creates a wrong connotation, and that it would be more correct to speak of the "farmers' exemption". In the same vein, plant patents forbid the reproduction and marketing of protected materials by farmers.

In response to the strengthening of PBRs, the concept of "farmers' rights" was introduced and incorporated, first in the FAO International Undertaking on Plant Genetic Resources for Food and

Agriculture (1989), and then in the legally binding FAO International Treaty on Plant Genetic Resources for Food and Agriculture (2001). In particular, Article 9 of the International Treaty provides in a complex formulation that there should be no limitations to "any rights that farmers have to save, use, exchange and sell farm-saved seed/propagating material, subject to national law and as appropriate". Implementation of this provision is, left to national governments. Article 15 of the UPOV convention and Article 9 of the International Treaty create an interface in international law that requires further interpretation.

Fairness for farmers and breeders

What is regarded as fair assumes a moral judgment that aims to balance the interests of different stakeholders, and can also be associated with the effectiveness of legal measures. In the International Treaty (Article 9.1), it is noted that the creation of farmers' rights have been motivated by "the enormous contribution that the local and indigenous communities and farmers of all regions of the world, particularly those in the centres of origin and crop diversity, have made and will continue to make for the conservation and development of plant genetic resources which constitute the basis of food and agriculture production throughout the world". This text suggests that the role of farmers in conserving and developing plant genetic resources should be recognised and result in the rights further detailed in this Article. The capacity for farmers to save, use, exchange and sell farm-saved seed and other propagating material are considered fundamental to the realisation of farmers' rights (Preamble). In the respective Article, however, these rights are made "subject to national law" (Article 9.3), which would include any IPR law.

Patent and PBR laws aim to protect the rights of inventors, in this case the breeders. Indeed, UPOV's mission is to "provide and promote an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants, for the benefit of society." The only reference to farmers is the aforementioned "farmers' privilege". In Article 26 of the Explanatory Note "it is emphasised that it is a matter for each member of the Union to decide if, and how, it wishes to implement Article 15(2) (on the "farmers' privilege", note the authors). Amongst the factors which may be considered are the impact on breeding, the costs and mechanisms required for implementation and the overall economic impact on agriculture. Consultation with the interested parties, notably breeders and farmers, to assess such effects might be an important means of ensuring successful implementation." Reference to the overall economic impact on agriculture and the suggestion of consulting both farmers and breeders might be regarded as including a reference to fairness of legal measures. It is clear that "breeders' rights" and "farmers' rights" are strongly interrelated, implying that establishing fairness between both of them is a precondition for realising either of them.

Achieving fairness & stimulating innovation

It is generally considered fair if a person that invests time and resources in developing a new invention can acquire certain rights over the invention that enable the person to recoup the investments made. In addition, this is often regarded a precondition for investment and, thus, innovation in any industry. Protecting the IP rights of plant breeders can form a stimulus or even a necessary condition for sufficient innovations and investments in new crop varieties. In countries where enforcement of IPR laws has been low or non-existent, private sector investments in the development and marketing of new varieties have predominantly targeted hybrids, which have an

inbuilt protection against copying, or crops for which reproduction of seed is technically difficult or demanding. In those markets where breeders' IP rights are not respected or cannot be enforced, no private investments are likely to be made, which will negatively impact innovation. Too strong a protection may, however, have the same effect. The increasing number of patents, which do not allow for the breeders' exemption and which are costly to acquire and maintain, has contributed to a concentration in the plant breeding industry, and this in turn may impact on the number of breeding programmes and the breadth of diversity that they actively use.

The fact that private investments are only made in crops with a sufficient market share leads to a partition in crop production, since yield increase and the introduction of other useful traits takes place much faster in those crops than in those crops for which only local markets exist. This development might also push for a tendency to cultivate crops for which active private breeding takes place. Maintenance and improvement of local (e.g. neglected and underutilised) crops is thus left to public breeding programmes and to farmers' initiatives, including participatory plant breeding.

Limitations to the rights of farmers to reproduce, exchange or sell seed of protected varieties, if enforced, may result in a decreased affordability and availability of good-quality varieties in local markets and communities, since logistical problems regularly limit the availability and accessibility of registered and protected seeds in such local markets and communities. This may also limit the use of such seeds in farmers' own selection and breeding initiatives, and the adaptation of diversity to local needs and agro-ecological conditions, thus limiting innovation in farmers' fields.

Intellectual property rights are all about setting the right balance between the interests of the inventor and society, in order that they are a tool for stimulating and not blocking innovation. In today's agriculture sector, it is about finding the right balance between patents and PBRs, and between breeders' and farmers' rights. With respect to the former, several solutions have been proposed over the last couple of years, ranging from proposals to include a full or limited breeders' exemption in patent laws (Louwaars et al., 2009), to the establishment of an International Licensing Platform to improve global access to and use of plant breeding traits for vegetables (Rijk Zwaan. 2014). With respect to the latter, some countries have aimed to harmonise the rights of breeders and farmers in one 'Protection of Plant Varieties and Farmers' Rights Act - such as India (<http://www.wipo.int/wipolex/en/details.jsp?id=2401>), whereas another proposal is to broaden the definition of the private and non-commercial use exemption under the UPOV Convention (De Jonge et al., 2015). Given the strong interrelations and dependencies amongst the major stakeholders in agriculture, achieving fairness amongst them may well be a precondition for securing continued innovation in the sector.

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