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HOW DOES STRONGER PROTECTION OF INTELLECTUAL PROPERTY RIGHTS AFFECT SEED SUPPLY? EARLY EVIDENCE OF IMPACT

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Recent international conventions seeking the stronger protection of intellectual property rights (IPR) have been promoted largely by the OECD countries. Is there evidence to indicate that early benefits have, in fact, been gained by the world's main biotechnology and seed companies? What will be the consequences for developing countries? Will IPR legislation result in better varieties becoming available more quickly? Will it encourage local plant breeding or will IPR predominantly strengthen the market position of foreign seed companies? Will traditional seed diffusion practices become restricted? Most early experience with the implementation of IPR has been gained in developed countries and in Latin America. This paper reviews preliminary evidence against the above questions.

Policy conclusions

- There is little evidence to date that stronger IPR have increased the range of plant material available to ldc farmers, or increased the rate of innovation in plant breeding, but in at least one country IPR have enabled seed companies to maintain their sales and royalty income during difficult periods.
- However, flows of improved genetic material are likely to increase as the licensing and royalty arrangements under stronger IPR become more widespread. Government and donor support for IPR may therefore benefit commercial farmers in ldc's, but are likely to be irrelevant or, at worst, an impediment to middle/low-income farmers by restricting seed-saving and exchange by farmers.
- Commercial pressures to reduce farmers saving of their own seed and so enhance the market for seed companies have partly succeeded, but have had detrimental effects on seed exchange, and related credit systems. However, in many ldc settings it will be impossible to police such restrictions.
- For the future, changes at least as important as IPR which will restrict farmer seed retention include the further spread of hybrids and the introduction of

purchase agreements.

Introduction

In the past two decades interest in patents, copyrights, and plant breeders rights has burgeoned. The shift in OECD countries towards information-intensive products and the relative ease with which information can be copied have made the legal protection of innovations a top priority for OECD countries in international trade negotiations.

A major recent event has been the agreement on Trade- Related Intellectual Property Rights (TRIPs), signed by over 140 countries as a part of the new General Agreement on Tariffs and Trade (GATT). The TRIPs agreement obliges all signatories to provide the same minimum level of protection of intellectual property. Previous conventions had been based on the principle of national treatment, viz. that the protection of intellectual property of foreigners must at least be equal to that provided for nationals. This principle allowed countries considerable room for manoeuvre in framing intellectual property rights (IPR) legislation. In less developed countries (ldcs), the protection of intellectual property has been much weaker than in OECD countries. Specific products, such as medicines, plant varieties and many innovations in information and biotechnology, were often not protectable. Other products were only protected for a relatively short period of time, or the protection was, in practice, not enforceable. The TRIPs Agreement has considerably narrowed the room for national policy. With respect to biological material, the Agreement obliges each member country to provide for patent protection of all types of plant material, except for plant varieties. Varieties must be protected either by patents or by an 'effective *sui generis* system'. This implies a more comprehensive system of plant variety protection (PVP) than that provided by the Plant Breeders' Rights (PBR) already established in some countries.

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This paper asks what impact IPRs have had on the diffusion of plant varieties and seeds in ldcs. The paper first provides an overview of IPRs for plant material in a number of Latin American countries where early experience has been gained. It then examines the influence of IPRs on investment in plant breeding. The third section asks whether farmers efforts to save their own seed will be restricted by the introduction of plant variety protection. Other changes likely to restrict on-farm seed-saving are then briefly discussed.

IPRs for plant material in Latin America

Under the TRIPs obligation to provide legal protection for plant varieties, most Latin American countries have introduced or are considering PVP legislation ([Table 1](#)). This development is in part a response to commercial pressure: subsidiaries of foreign seed companies, supported by their governments, are demanding protection for their varieties and breeding lines before they will enter Latin America. However, there is

also pressure from domestic seed companies wishing to protect their own plant varieties, or who are under pressure from foreign breeders to improve legal protection before they will be given better access to foreign breeding lines and varieties. In several countries public agricultural research has been advocating PVP as a way of strengthening their trading activities in the face of budget cuts.

The PVP system has been in operation in Argentina, Chile and Uruguay for some time, but only in Argentina has it been effectively enforced. PBR are private rights of property, and it is up to individual right holders to control the multiplication of their varieties and to collect royalties. Only from 1990, when Argentinean seed firms started to exercise PBR collectively, did PVP become effective against unauthorised multiplication and distribution of seed. With respect to patent protection, the laws of Argentina, Chile, Mexico and Uruguay follow the European Patent Convention which specifically excludes plant varieties from protection (see Table 2). The Andean Pact countries follow United States legislation and do not exclude plant varieties. No varieties have so far been patented there however. Plant material, other than varieties, seems to be patentable in at least seven Latin American countries. It is excluded in Uruguay and possibly also in Brazil.

Plant variety protection and innovation

Whether intellectual property protection speeds innovation remains uncertain. The theory of intellectual property provides no robust guide to the appropriate level of protection under various circumstances. It has been argued, however, that market incentives alone tend to lead to under-investment in R&D (Primo Braga, 1990). What is of interest here is whether IPR legislation stimulates the markets towards innovation in plant breeding.

IPR entitles holders to prevent unauthorised commercial use of the protected innovation. They are likely to stimulate innovation because: (a) they increase imitation costs and (b) they enable owners to diffuse the innovation.

- *Increase of imitation costs.* Under IPR, potential competitors must either obtain a licence to copy the protected process or product, or invent an alternative themselves. The innovator will naturally try to raise the highest possible barriers to imitation: some biotechnology companies have filed for patents with claims that are extremely wide in scope, and disputes have inevitably arisen over how far a variety retains the characteristics of its source

Box 1. Definitions and concepts

Plant Variety Protection is a form of **Intellectual Property Right**. It embraces the practice in most industrialised countries of allocating **Rights to Plant Breeders** over the varieties they produce, and the more recent and contentious efforts to **patent** plant varieties. Efforts to patent components and processes involved in the production of varieties are also the subject of major debates (see NRP No.7), but these are somewhat tangential to that over PVP. There are distinctions between **conventional varieties** and **hybrids** which, in terms of seed markets, may be more important than whether PVP can or cannot be introduced. Both must satisfy the criteria of distinctness, uniformity and stability. However, hybrids are produced by the backcrossing of inbred lines maintained (by commercial organisations) as trade secrets. Further, they rapidly lose their hybrid vigour from one generation to the next, placing a high premium on the purchase of new seed and making seed-saving unattractive to farmers. For as long as trade secrecy can be maintained, there will be less pressure to introduce PVP among those crops where hybrids are easily produced than among others.

material. The higher the imitation costs, the better are the prospects for innovators to recoup their investment.

- *Defining ownership enables diffusion of innovations.* The right of exclusive exploitation of the innovation under IPR, combined with opportunities to enforce the right, makes it less necessary for innovators to keep the innovation secret. This opens the way for firms which lack the capacity or incentive to scale-up or market their innovation to license it out. One aim of some Idcs introducing patents and PVP is precisely to increase the inflow of foreign plant varieties and other plant material. The question is whether these mechanisms do indeed stimulate innovation in plant breeding. Because the patenting of plants has only recently been introduced, this question can only be explored for PBR. Even here, the information is meagre: only a small number of studies have been carried out in the US and in Argentina.

Despite the claims of the seed industry, the positive effect on R&D investment of the US Plant Variety Protection Act (PVPA) has been limited. It has stimulated new varieties of wheat and soya bean, but it has scarcely affected R&D in most other self-pollinating crops. The American Plant Patent Act had little impact on private investment in fruit breeding, because the Act allows only a very narrow product space, and because enforcement costs are high. In Argentina, where PVP has been enforced from 1990 onwards, it has enabled domestic wheat and soya bean companies to increase their sales and royalty income and to survive difficult economic periods but has not stimulated additional R&D expenditure. Nor has there been significant benefit for foreign seed companies: these predominantly deal with hybrids and do not feel competition from unauthorised seed trade. These firms protect their inbred lines largely by conventional trade secrecy. Their presence is more likely to increase when commercially viable hybrids are available for more crops than through any influence of PVP.

In sum, PVP enables seed firms to get a better return on existing investments. In Argentina and the US, however, there is little evidence that it has led to increased plant breeding. It remains difficult to assess the precise impact of PVP, not least because it is almost impossible to know what the R&D behaviour of seed companies would have been in the absence of PVP.

Restrictions on seed-saving by PVP

Farmers have basically three options for acquiring seed:

- to obtain quality seed each season from public institutes, seed companies or dealers;
- to save part of their own harvest as seed;
- to trade part of their harvest for seed from grain dealers. All three channels are often used simultaneously by farmers but in Idcs more than 80% of farmers seed requirements are met by saving or exchanging part of their harvest (Srivastava and Jaffee, 1993).

Self-pollinating crops, such as wheat and soya bean, or vegetatively reproducing crops, such as potatoes and cassava, offer the best opportunities for seed-saving. Only when vigour begins to decline, making plants susceptible to insects and diseases, or

when a much better variety is released, are the seed or vegetative parts of these crops replaced by fresh certified seed from official distributors. Farmers growing crops under contract to the processing industry may be obliged to purchase fresh seed for every crop. In the three Southern Cone countries of Latin America the main commercial crops where seed-saving is widespread include soya bean, some grains (notably wheat) and potato.

Seed-saving by farmers brings them three potential benefits: lower seed costs; access to informal credit, and a braking effect on the prices for fresh seed.

Saved seed and seed costs

The cost advantage of saving seed is eroded by the deterioration of saved seed, causing yield losses over time. Deterioration is especially rapid with hybrids, but even here, the wide gap between new seed prices and the cost of seed-saving has encouraged some farmers in Latin America to save hybrid maize for a second generation. Cost savings vary widely but have been estimated at between 30-40% for wheat and soya bean in Argentina.

Saved seeds and informal credit

In some transactions, high quality grain (often from wealthier farmers) is purchased by grain dealers, selected and conditioned, and then provided as a credit in kind to other farmers who use it as seed. Credit obtained in this way at planting time, is then paid off at harvest with the double quantity of grain. The seed may not perform as well as that from specialist seed companies, but is much cheaper and payments in kind provide farmers with some protection against currency fluctuations.

Table 1. Plant variety protection in twelve Latin American countries (situation May 1996)

Country	Adoption and regulation of PVP law	Start effective enforcement of the law	Accession to UPOV
Andean Pact countries	1993	In process	Unknown
Argentina	1973/78	1990	1994
Brazil	PVP law in drafting process	-	Unknown
Chile	1977; new law in 1994	1994	1995
Costa Rica	PVP law in drafting process	-	Unknown
Mexico	PVP law in drafting process	-	Unknown
Paraguay	PVP law in drafting process	-	Unknown
Uruguay	1984/87	1994	1994

Seed companies are concerned over the market share taken by this system, but it is set to continue for several reasons: prices to farmers are kept low, and traders can avoid paying taxes and royalties.

The price effects of saved seeds

Seed-saving acts as a check on seed prices: efforts by seed companies to raise prices are likely to be met by an increase in saved seed.

Seed-saving and patents

Since the 1980s, plants have been eligible for protection under utility patent law in the main OECD countries. With the imminent spread of genetically engineered varieties in Latin America and elsewhere, the first patents on plants or plant parts are likely to be filed there soon. What effect this will have on seed-saving is not yet clear. In most Latin American countries all plant material, except for plant varieties, is or soon will be patentable in principle. If patents for plant parts are filed, they may trigger disputes on the scope of the claims of the patentee, similar to those which have recently been occurring in Europe. Patenting plant parts may hamper innovation as breeders will then be unable to use a protected variety for any commercial purpose without authorisation from the patent-holder. Unauthorised seed-saving of patented plants is also forbidden, but this is in any case unlikely to be attractive since most patented plants are hybrids.

Wider issues in seed-saving

Seed-saving by farmers farmers privilege was formerly permitted to member countries of the International Union for the Protection of New Varieties of Plants (UPOV). However, it has been disputed within UPOV ever since its founding, partly because seed dealers and food processors have exploited the exemption for unauthorised large-scale seed production. International breeders organisations have argued that this results in unfair competition to breeders who have to cover development costs and comply with costly seed quality requirements. The 1991 UPOV agreement therefore rescinded farmers privilege, through the provision that production or reproduction (multiplication) of propagating material of a protected variety requires the authorisation of the breeder. In an additional optional clause, however, member states are allowed to exempt farmers under certain conditions, but the intention of this clause was to legalise the existing situation, not to enlarge the use of farmers privilege.

Both in Europe and the United States seed-saving has become one of the most hotly disputed aspects of IPR in agriculture. US farmers were previously allowed to save and sell seed of protected varieties, but in September 1994, Congress repealed the farmer sales provision. In January 1995, in a highly-publicised test-case, the Supreme Court limited farmers exemption to the amount of seed a farmer needs to replant a crop, with allowable sales of any surplus of this saved seed.

Table 2. Protection of plant material under patent law in nine Latin American countries

Argentina

The 1996 patent law excludes plant varieties from protection.

Brazil

The 1996 patent law refers only indirectly to plants. (Parts of) living material as found in nature, including their genome, are not patentable, even if they are isolated from nature. On the other hand, all transgenic micro-organisms, including those auto-reproductive organisms derived from plants and animals, isolated in laboratories, are patentable.

Chile

The 1991 patent law excludes from protection plant varieties and animal races.

Andean Pact countries

The common patent regime for Andean Pact (Decision 344, 1993) excludes from protection (among other things): (a) inventions which are evidentially contrary to: the health or to the life of persons or animals, the preservation of plants, or the preservation of the environment; (b) animal species and races and essential biological procedures to obtain them.

Mexico

The 1991 patent law, amended in 1994, excludes from protection (among other things): (a) essential biological processes for production, reproduction and propagation of plants and animals; (b) biological and genetic material as found in nature; (c) plant varieties and animal races.

Uruguay

The patent law of 1941 does not explicitly exclude plant material from protection. It is, however, not possible to protect such material because of specific patent requirements concerning the industrial nature of the subject matter.

Sources: De Alençar and van Ree, 1996; World Intellectual Property Report, 1996.

Despite these restrictions, farmers privilege in the USA remains broader than in the EU. In Europe, farmers were allowed to save seed only to replant their own farms, but no agreement among farmers and industry organisations on this privilege could be achieved in preparation for the establishment of a European PVP system. On-farm seed- saving from EU protected varieties is now the subject of a complicated compromise. Farmers privilege applies only to certain crops, and breeders must be paid a royalty on saved seed, but this is lower than for fresh commercial seed, and small farmers are exempt.

In Latin America, farmers privilege has been included where PVP legislation has been introduced but the large- scale use of the exemption is controversial. In Argentina, as in Europe, on-farm seed-saving is only permitted for the purposes of replanting. The Argentinean PVP authority attached specific conditions to the exemption from PVP in order to reduce commercial trade in saved seed:

- seed that is propagated must have been legally acquired;
- the seed must have been produced on the farmer s land;
- the farmer must replant the saved seed on his own land;

- the farmer must prove that the transport of saved seed to any other place is for preparation purposes only. In Argentina up to 1990 only one third of wheat and soya bean seed requirements were legally supplied through saved seeds. In order to reduce the substantial black market in saved seeds, the authorities and seed companies joined forces and began to register seed dealers and the entire seed trade. They succeeded in reducing the unauthorised trade of wheat seed from 83% of the total commercial market in 1990, to 22% in 1994, and of soya bean seed from 75% in 1992, to 48% in 1994.

But this success for the seed companies is potentially disadvantageous to farmers. Now that this segment of the seed market is officially registered, seed dealers have to pay royalties and taxes on their sales. These costs could be passed on to farmers, with higher seed prices (and more individual on-farm seed-saving) as a likely result. The seed diffusion and informal credit features of systems are potentially threatened by these changes. However, despite PVP enforcement, the grain/seed swap still exists as a means of seed distribution, and seed prices have not increased: two bags of grain can still be swapped for one bag of seed. It seems that the cost increase of seed caused by PVP has so far been borne by middlemen.

Restrictions on seed-saving by other means

Plant variety protection restricts seed-saving, although there are several means other than PVP for plant breeders to prevent unauthorised multiplication and trade in their varieties, including: (a) the breeding of hybrids, (b) patents, and (c) purchase agreements.

Hybrids

Historically, the seed industry in OECD countries has expanded through the development and sale of hybrids, which now account for nearly 40% of the total global commercial seed business of about US\$ 15 billion. Hybrids are available for many important commercial crops, such as maize, sunflower, sorghum, oilseed rape, and various vegetables. One of the characteristics of hybrids is that they do not breed true to type, making them unattractive for seed-saving. The yield attractions of fresh seed have outweighed this, giving hybrids an increasing market share, and many see this trend continuing, with adverse effects on what companies see as the problem of seed-saving by farmers.

Purchase agreements

A relatively new development in the USA which restricts seed-saving practices is the use of Purchase Agreements. Rather than rely on PVP, a number of American seed companies make contract provisions which enable the company to use breach of contract claims in local courts to enforce ownership of the seeds. Labels on the seed bags inform purchasers that they are entering into an agreement with the seed company, which typically provides that the purchaser hereby acknowledges and agrees that the production from Brand X Seeds herein sold will be used only for feed or processing and will not be used or sold for seed, breeding or any variety improvement purposes. Such restrictions on the exploitation of protected varieties have a far wider scope than restrictions ensuing from PVP. Farmers purchasing Brand X seed are not allowed to save seed, nor can the variety be used for further breeding

by other breeders. These restrictions are becoming widespread in the USA despite their inconsistency with the provisions of UPOV, of which the USA is a member.

Concluding comments

PVP may help the domestic seed industry in ldc's to restrict the trade in seed saved from their varieties and to increase their income. There is little evidence, however, that this additional income leads to the availability of more and better varieties for farmers. Seed multinationals work with hybrids and suffer little competition from saved seed. PVP's explicit arrangements for licensing and royalties may stimulate the transfer of commercial inbred lines to ldc's, hitherto restricted by trade secrecy.

In all parts of the world, on-farm seed-saving seems likely to become more restricted in the future as PVP is more widely introduced. Under PVP, seed-saving is considered to be a privilege which may be restricted, as PVP regulation in the European Union shows. However, the increasing use of hybrids in ldc's seems likely to have a stronger adverse effect on seed-saving than PVP.

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