10. Should we regulate biotechnology through the patent system? The case of terminator technology

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1 INTRODUCTION

According to the Devil in George Bernard Shaw’s *Man and Superman*, ‘in the arts of life man invents nothing; but in the arts of death he outdoes Nature herself, and produces by chemistry and machinery all the slaughter of the plague, pestilence and famine’ (Shaw 1903 [2000]). Such a dark vision of human nature seems to sum up the views of many people that oppose the patenting of life forms, genetic modification and industrial agriculture, except that the blame is more likely to be placed at the door of industrial capitalism rather than of shortcomings inherent to human beings. This becomes evident when the same people extol the virtues of indigenous peoples and others ‘embodying traditional lifestyles’, in the language of the Convention on Biological Diversity (CBD 1992), for having a more environmentally friendly lifestyle than the rest of us, and for giving so much to the wellspring of human knowledge without getting a cent in return. At the other extreme we have the ‘techno-optimists’ who have a much stronger faith in our inherent creativity to improve on what we have inherited from nature and from past generations of humans.

The so-called terminator technology, or technologies (since there is a growing number of them), would superficially appear to reinforce the Devil’s point of view. Terminator technology, as its name suggests, was coined not by proponents but by a Canadian activist, Pat Mooney, from an organization then known as Rural Advancement Foundation International (RAFI),¹ who was seeking to direct negative publicity towards it. In this he was highly successful.

Terminator first came to Mooney’s attention in 1998 when he saw an announcement that a patent had been granted jointly to the United States Department of Agriculture (USDA) and Delta and Pine Land, a major American cotton seed company, describing molecular biological techniques
for controlling gene expression in plants, plant parts or seeds so that traits can be switched on and off between generations. Conceivably, farmers could benefit from these techniques, depending upon the traits in question whose expression or non-expression may help determine the success of the harvest. But among the claims is a method for producing seed that is incapable of germination, or to be more specific, a technology that would render harvested seed sterile. On the face of it, it seems extraordinary to invest so much effort and expense in developing a means to produce sterile seed. But despite the involvement of a public sector institution, this is strictly business. The purpose is to prevent farmers from replanting saved seed and thereby undercut seed company monopolies. In doing so, it provides a means not only of preventing the infringement of intellectual property protection but of ensuring the continuation of the monopoly beyond the life of any patent or plant variety certificate, assuming such activities require the authorization of the right holder in question. Not only this, but terminator technology has grave implications for the activity of breeding, which requires unrestricted access to plant varieties to be used as sources of initial variation.

The development of this technology seems to reflect the increased determination of the private sector (in this case, and in common with hybrids as we will see below, with the assistance of a public agency) to eliminate the replanting of proprietary seeds, which is also reflected in the increasing use of licensing agreements stipulating that customer-farmers must not replant their patent-protected seeds. Such agreements would, of course, become unnecessary if this technology became widely used. Genetic use restriction technologies (GURTs), of which terminator is just one, are not new. Hybridization is the original GURT. In the early twentieth century, a United States public sector plant scientist called George Shull discovered the phenomenon of (what he called) ‘heterosis’ in the corn plants resulting from his cross-breeding of inbred pure lines. This phenomenon, commonly referred to as ‘hybrid vigour’, is manifested in heightened yields. But because they are hybrids, the offspring cannot breed true and the yield enhancements thus last only for a single generation. So while farmers stand to benefit from seeds providing this hybrid vigour, they need to buy seeds at the beginning of every planting season to enjoy equally productive future harvests. This necessity was and continues to be a boon for the seed companies. Indeed, ‘of the US$15 billion market in commercial seed at present, hybrids account for approximately 40 per cent of sales, and most of the profit’ (Sehgal 1996). But as long as the cost of seed purchases is exceeded by additional revenues obtained through the hybrid vigour, farmers will continue to use hybrids in place of their open pollinating counterparts.

The hybrid route to the breeding of better seeds is generally assumed to be a very good thing for the development of the seed industry, and in the
opinion of many, but not all people, also for farmers. In fact, several of the world’s major twentieth-century seed companies first came to prominence through their successful breeding of hybrid corn varieties. These include Pioneer Hi-Bred, DeKalb, Pfister and Funk. But sceptics argue that the massive investments in the development of hybrid varieties that were made in the 1920s and 1930s could have been allocated to breeding based on more conventional techniques that would have achieved similar yield increases but without preventing farmers from being able to replant their harvested seeds. Berlan and Lewontin are particularly negative (as they are about terminator), arguing that hybridization is a kind of ‘deterioration technique’ that not only enables seed companies to eradicate on-farm saving and exchange but actually eliminates all opportunities to improve crops through selective breeding (Berlan and Lewontin 1998). Farmers may gain in the short term, but widespread adoption of hybrid varieties may not necessarily best favour their long-term interests. Moreover, it may be true that breeders sometimes take advantage of lack of competition in certain seed markets profitably to deploy hybrid technology without needing to produce any significant productivity increases.

In the early days hybrid productivity was not much greater than their conventionally bred counterparts (Bugos and Kevles 1992). However, from the middle of the century, increased private investment had considerably improved the yields of hybrid corn. Unfortunately for breeders, hybridization does not work so easily for some of the most widely cultivated crops like wheat and rice, and is consequently less commercially viable. This, of course, presents problems for breeders. Plants are self-reproducing. With no law to prevent it, there is nothing to stop farmers from replanting harvested grain as seed, or even multiplying seed for the purpose of selling it in competition with the breeder (assuming this would be more profitable for them than selling harvested produce).4

Terminator technology appears to provide the solution to the problem (see Table 10.1). But unlike this earlier biotechnology protection system and other GURTIs under development that seek merely to control the expression of specific traits, terminator, which uses seed sterility as the basis of its use restriction, provides no productivity or agronomic benefits to the farmer who buys the seed. Worse still, it is actually a net loss, since it removes a freedom but offers no compensating gains as did hybrid corn and as the so-called trait-specific GURTIs promise to provide.

This point gives rise to some important questions. The most basic one is that of whether the terminator controversy affects the future of agriculture or is much ado about nothing? Second, if patenting is about promoting inventive activity for the benefit of the public, is terminator the kind of invention we should be encouraging in this way? Third, if not, are there
sufficient legal grounds for preventing its legal protection through the patent system? Finally, if these grounds are lacking, ought countries to ban such technologies by expanding the applicability of the *ordre public* and morality exclusions available to World Trade Organization (WTO) Member States by virtue of Article 27.3(b) of the Agreement on Trade-related Aspects of Intellectual Property Rights (TRIPS), according to which WTO ‘Members may exclude from patentability inventions, the prevention within their territory of the commercial exploitation of which is necessary to protect *ordre public* or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment’? The rest of this chapter seeks answers to these questions.

It puts forward three arguments. First, countries have the sovereign right to determine whether or not it is appropriate to extend a patent monopoly to inventions it deems as morally objectionable or contrary to the public interest. Nonetheless, one must keep in mind that the commercialization of the technology in question is a matter for national regulatory and competition authorities to decide upon and not the patent-granting office.
Second, countries need to adopt rational, well-conceived and consistent competition, agricultural development and seed regulation policies. The objective of these policies should be to prevent GURTs from encouraging excessive concentration in the seed production and distribution markets, and to ensure that farmers can choose the seed they wish to plant, GURT-protected, modern, traditional or otherwise, without undue interference. Finally, but perhaps most importantly, as business becomes better able to maximize returns from its agro-biotechnological research outputs through legal and technological means, it becomes ever more vital to support public sector research targeted not just at commercial agriculture but also at poor subsistence farmers in the developing world.

2 HIGH STAKES

When even mild criticism of the technology irritates the US government enough for it to become heavy-handed with intergovernmental organizations, it becomes clear that the stakes are high. Terminator does matter, although it is difficult to be certain about its long-term impacts. The Conference of the Parties to the CBD has for several years been concerned about GURTs and at its sixth meeting in 2002 adopted a decision that, among other things, invited the International Union for the Protection of New Varieties of Plants (UPOV) to examine ‘the specific intellectual property implications of genetic use restriction technologies, particularly in respect of indigenous and local communities’. The UPOV Office’s memorandum, submitted to the CBD secretariat in January 2003, was a fairly tame document that expressed some mild scepticism of the benefits of GURTs but did not condemn them outright, and was mostly concerned to uphold the integrity of the UPOV system of plant variety protection (UPOV 2003a). The United States Patent and Trademark Office was nonetheless alarmed about this sufficiently to write to UPOV Vice Secretary-General Rolf Jördens expressing its objection to the submission of the document and its disagreement with the views expressed concerning GURTs, and requesting that it be withdrawn. UPOV complied and in April 2003 sent the CBD Secretariat a rather bland position paper, which curiously barely even mentioned GURTs (UPOV 2003b).

Perhaps the main indicator of terminator’s importance, though, lies in the fact that the USDA has been developing GURTs with the private sector as part of the US government’s wider and long-term effort to protect the intellectual property of its businesses in overseas markets including developing countries. Indeed, according to a spokesman from the USDA, the aim is for the technology to be ‘widely licensed and made expeditiously
available to many seed companies’ in order ‘to increase the value of proprietary seed owned by US seed companies and to open up markets in Second and Third World countries’ (RAFI 1998). Dr Harry Collins of Delta and Pine Land, co-owner of the patent with the USDA, claimed that the patent ‘has the prospect of opening significant worldwide seed markets to the sale of transgenic technology for crops in which seed currently is saved and used in subsequent plantings’.

3 PROS AND CONS

Terminator has some potential benefits. For one thing, it could allay one of the concerns of some opponents of genetically modified crops, which is the risk that genes from these plants may cross over to other species, a phenomenon called horizontal gene transfer that, ironically, many advocates of GM agriculture dismiss as being nothing to worry about anyway. In addition, secure protection might encourage further investment in agricultural biotechnology and plant breeding including in directions that benefit small farmers. This is a serious matter. To date, far too little welfare-enhancing scientific research is targeted at the poor, who tend to find that scientific revolutions tend to pass them by.

The former potential benefit is certainly plausible. However, the latter is, at this stage, completely speculative. There is some anecdotal evidence that weak plant variety protection in the US, which until quite recently allowed ‘brown-bagging’ (the sale of harvested seed by farmers), led to the closing down of at least one commercial seed production programme (Srinivasan and Thirtle 2002). But this was before the law was tightened up in the mid-1990s and when the patenting of plants was less common than it is today. Besides, if their public justifications are anything to go by, the USDA and Delta and Pine Land are more interested in applying terminator in foreign markets than the domestic one. Swanson and Goeschl support a more sceptical view when they note that ‘the 40 year long experience with hybrid (use restriction) technologies is one of enhanced rent appropriation but little change in investment patterns’ (emphasis added) (2004). The authors explain this phenomenon on the basis that so much of the public sector research investments during this time have been targeted at the improvement of non-hybrid crops.

Perhaps the main problem with terminator, if we suppose for a moment that the technology will encourage small farmer-oriented research, is its restriction on seed replanting, exchange, diffusion and on-farm breeding activities. To explain why, it is important to understand that developing country subsistence farmers generally acquire their seeds from their own
farms or those of neighbours. Maintaining the freedom to do this is very important for two reasons. First, subsistence farmers often lack funds or credit to buy seed at the start of each planting season. For them, buying seed is a considerable investment. If it turns out that the benefits of terminator-protected seed are insufficient to compensate for its higher price, farming may become even more risky for the poor. Admittedly, farmers can presumably return to their traditional varieties, but one poor harvest accompanied by increased debt may be enough to cause destitution. Second, many developing country small-scale farmers do much more than simply grow seed produced elsewhere. Indeed, local varieties are themselves the result of generations of improvement through on-farm selection and experimentation, and nowadays such practices can involve modern varieties that may need to be adapted to suit local conditions. Turning such farmers into mere customers of companies selling terminator-protected seed will halt such practices. This may not only be detrimental to local food security but, if it became a global phenomenon, could weaken plant breeding efforts worldwide by reducing the variety of germplasm available.

For these reasons, subsistence farmers are unlikely to be sympathetic to, or gain much comfort from, Collins’s assertion that ‘the centuries-old practice of farmer-saved seed is really a gross disadvantage to Third World farmers who inadvertently become locked into obsolete varieties because of their taking the “easy road” and not planting newer, more productive varieties’. If yields from GURT-protected seed prove to be disappointing, and if such seed is more dependent on inputs like agrochemicals than traditional varieties (which is often the case with modern varieties), then farming communities could suffer destitution. Defenders will no doubt argue that farmers still have a choice; that they can simply return to their traditional varieties if they prefer to avoid GURT-protected seed. But certain policies may erode their freedom to choose what they can plant in their fields. In many developing countries, government support for farmers including credit is sometimes made conditional on the planting of particular crops and types of seed, such as hybrids. Also, seed aid may be used by providers as a way to promote the use of particular crops and seeds. In addition, seed regulations in some countries require farmers to sow seed from an official list of approved varieties.

4 CONCLUSION: TERMINATOR AND THE PATENT SYSTEM

The widespread adoption of terminator technology, something that denial of a patent could ironically hasten, is unlikely to be the disaster that its
strongest critics claim. Undeniably, it is a rational solution to the failure of existing IPRs and GURTs such as hybrids to ensure that breeders secure profitable returns on their investments in more than just a few crop species. Nonetheless, there are good reasons to be concerned that it may weaken plant breeding efforts worldwide by reducing the variety of germplasm available, undermine public sector research targeted at, and sometimes carried out with, poor farmers, and threaten the freedom that millions of farmers depend on to acquire their seed for free or at very low cost. Indeed, terminator technology has the genuine potential to seriously disrupt poor world agricultural systems that support the livelihoods of hundreds of millions of people.

For many critics, being able to patent such a technology is an indictment of the patent system. One may indeed reasonably question whether or not society should be encouraging such research through the promise of a patent monopoly. Moreover, it is legitimate to be concerned that protecting seeds through both patents and GURTs is overprotective in a similar way that support for encryption through copyright law in the form of banning circumvention devices is overly generous to owners. In addition, countries might well consider such inventions to be immoral or contrary to ordre public, and this is a decision that deserves to be respected. Legally, they are on secure ground since they have the right to determine their own criteria for what is immoral or contrary to ordre public. India has already banned terminator and one can easily envisage other developing countries following suit. For such countries, terminator is clearly not the sort of technology they want their patent systems to encourage.

However, it seems to the present author that there is no particular need to respond to terminator-type patents by broadening the application of these exceptions. In fact, if terminator could not be patented on these or other grounds, this might encourage research in this area even more. After all, GURTs would appear to be especially useful in jurisdictions where IPR protection is weak. Besides, the patent itself is not a right to commercially exploit. The freedom to use such technologies should not be automatic but subjected to an approval process founded on sound science, socio-economic and environmental assessments of its impacts and, arguably, the precautionary principle. Patent-granting authorities are not qualified to do any of this.

There are two main issues highlighted by the terminator patent, even though these have often been ignored in the sound and fury. First, terminator technology exemplifies the way agricultural research is more and more expensive, commercially oriented and technologically advanced. The consequence of this is that the sector is becoming one in which an ever smaller number of companies is able to enter it, while those that are already
in it and can compete come to dominate it. In fact, terminator may accelerate this process of corporate concentration, which is already quite noticeable,\textsuperscript{9} while further undermining public sector research. It may do this by tightening the locks on plant genetic resources so others must either do without them or pay licence fees that might prove too financially burdensome for competitors or potential competitors and public sector institutions (Swanson and Goeschl 2002). If so, countries need to adopt competition and seed regulations that ensure that farmers and consumers continue to have a choice and that maintain the public sector’s freedom to operate in agricultural research. One possible measure they might consider is compulsory licensing. However, one should bear in mind that if companies cannot easily capture the benefits from technological innovation through the patent system, this may make them even more determined to control markets through other means, such as by taking over supply networks and by integrating horizontally so they can market ‘packages’ of products that need to be used together (Rangnekar 2002).\textsuperscript{10} This issue is difficult to resolve but at least forces us to reflect upon what should be considered an appropriate rate of return on private investments.

Second, we allow the private sector to monopolize agricultural research at our peril, and the peril especially of developing country farmers, who are bound to be ignored in the same way that drug companies ignore the diseases of the poor for sound economic reasons. Terminator could even make the situation worse for the poor because even if GURT-protected seeds are developed for the use of poor farmers, this may backfire on them because the scope for on-farm breeder experimentation, which is often necessary to adapt varieties so they better meet the specific needs of farmers, will be reduced. It is also a very bad thing if public sector researchers in other countries have the same motivations as the USDA in supporting terminator. Public sector agricultural research is declining worldwide (Knight 2003). Yet research targeted at poor farmers is as necessary as it has ever been. Not all public sector research does this, as the terminator research amply demonstrates, but we can be sure that even less will be done if business is left to conduct all the research. Indeed, the termination of public sector research may be a bigger problem for poor farmers than terminator technology. If we allow this to happen, we may well prove the Devil was right about us after all.

NOTES

2. US Patent No. 5 723 765 (issued 3 March 1998) (Control of Plant Gene Expression).
3. In a discussion on private appropriation in the business of plant breeding, Rangnekar (2002) identifies four methods employed. These are (1) IPRs and seed market regulation; (2) organizational solutions; (3) discontinuous heritability; and (4) planned obsolescence. He classes hybrid and terminator technologies as methods of discontinuous heritability.

4. Growing for seed is more costly but, on the other hand, seed prices are significantly higher than grain prices (Rangnekar, personal comment 2003).

5. The correspondence between the United States Patent and Trademark Office and the Office of the Union and the US government’s response to the memorandum is incorporated in UPOV document CAJ/7/7 as Annex II.

6. Transcript of presentation made at side event of the fourth meeting of the Conference of the Parties to the Convention on Biological Diversity at Bratislava, Slovakia in June 1998 (on file with author).

7. Art. 8 of the 1996 WIPO Copyright Treaty and Arts. 10 and 14 of the 1996 WIPO Performances and Phonograms Treaty.

8. This is not to deny the possible existence of other grounds for doing this.

9. According to the activist group, Action Group on Erosion, Technology and Concentration, ‘the top 10 seed companies control approximately 30% of the $24.4 million commercial seed markets worldwide’ (ETC Group 2001, p. 9). Tansey notes that ‘the US seed industry, once the preserve of many small firms, has become dominated by five major firms – in part as a response to litigation over broad patents awarded in the early days of GM in the USA’ (Tansey 2002).

10. As early as 1987, it was noted that ‘a substantial amount of plant research in private firms has been aimed at developing various types of seed-chemical packages that reinforce rather than threaten sales of agricultural chemicals’ (Buttel and Belsky 1987). For example, Monsanto developed and patented transgenic soybeans, canola, cotton and corn containing a gene providing resistance to its Roundup (glyphosate) herbicides. Monsanto’s patents protect the gene for Roundup resistance and all plants containing it, and these have several more years to run. As farmers who buy these ‘Roundup Ready’ seeds are contractually obliged to purchase Monsanto’s patented herbicides, sales of the seeds are good for sales of the herbicides and vice versa. It is unclear, however, that this strategy will work in the long term. Roundup Ultra went off patent in 2000 and farmers may well turn to cheaper versions sold by competitors (Dutfield 2003, p. 149).

REFERENCES


Swanson, T. and T. Goeschl (2004), ‘The Impacts on Poor Countries of Technological Enforcement Within the Biotechnology Sector’. Unpublished manuscript on file with author.