

PROTECTION OF PLANT GENETIC RESOURCES

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Published 1998

ECHO TECHNICAL NOTE

This technical note is divided into two parts. The first section of this note focuses in on a new technology, called the 'technology protection system' by its developers and 'terminator technology' by its opponents. This technology illustrates the potential for patents to impact society at the fundamental level of food production. The implications to humankind, especially to those producing food in the developing countries of the world, are significant; it behooves missionaries and development workers to be aware of what is happening in the area of patents and the protection of plant genetic resources. The second section provides a broader base of information on related issues such as the rights of plant breeders, seed companies, and nations in regards to plant materials.

PART 1. TECHNOLOGY PROTECTION SYSTEM

The following press release (included here in its entirety) addresses the controversial issue of the property rights of large agribusinesses vs. the rights of farmers to save seed. The press release, published by RAFI, has resulted in a number of other publications both on the Internet and in international newsletters that condemn a new technology that has the potential to significantly limit the ability of farmers to save their own seed. Following the press release, I have attempted to provide a balanced review of what is happening on this front. [The review also was printed in issue no. 61 of *ECHO Development Notes*.]

[RAFI (Rural Advancement Foundation International) is a non-profit international civil society organization headquartered in Canada. The staff assesses the social and economic impact of new technologies as they impact rural societies.] Their March 13, 1998 press release reads-

By the year 2000 – after a 12,000-year history of farming – farmers may no longer be able to save seed or breed improved varieties. The problem is not the Millennium Bug but the “Millennium Seed”.

The twelve thousand year old practice of farm families saving their best seed from one year’s harvest for planting the next season may be coming to an end. On March 3rd (1998), an American cotton seed company and the U.S. Department of Agriculture (USDA) announced they had received a patent on a technique that genetically-disables a seed’s capacity to germinate when planted again. U.S. Patent No. 5,723,765, granted to Delta & Pine Land Co., doesn’t just cover the firm’s cotton and soybean seed business but potentially all cultivated crops.

Under a research agreement with the USDA, the company has the exclusive right to license (or not) the new technology to others. While only cotton and tobacco seeds have been shown to respond to the new technique, the company plans to have what RAFI’s Research Director Hope Shand has dubbed, “Terminator Technology” ready for a much wider range of crops shortly after the year 2000.

According to USDA spokesman Willard Phelps, the primary targets for the Terminator are “Second and Third World” markets. Priority crops include rice, wheat, sorghum and soybeans – crops largely ignored by agribusiness breeders because they aren’t readily hybridized (a tried-and-true biological means of forcing farmers back into the seed market every year). By and large, profit-hungry seed companies have shunned these crops because the returns don’t match those for hybrid crops like maize and many vegetables. With the patent announcement, the world’s two most critical food crops – rice and wheat, staple foods for three-quarters of the world’s poor – potentially enter the realm of private monopoly.

The patent has taken plant breeders by storm. The technique – if it works as advertised – has profound implications for agriculture. But the news has also created division. Some of those contacted by RAFI see benefits to the new technology. “For the first time, private companies will be encouraged to invest in the world’s most vital food crops. We can look to a new flow of investment into crops whose yields have stagnated or even declined in the Nineties. Now such poor people’s crops as rice and wheat will get the research support they so desperately need”, one crop economist advised. The patent’s defenders acknowledge that the Terminator Technology will mean a hefty hike in seed costs as farmers who now only buy seed when they change varieties are forced to make annual purchases. But they defend hiking seed prices by saying farmers will only opt for the “sterile” seeds if they offer a big advantage. Otherwise, farmers will keep with the current publicly-bred varieties.

RAFI's Hope Shand disagrees. "Don't forget, the Terminator was developed by the public sector (USDA) together with the private sector. There will be enormous pressure on public breeders to adopt the technique in order to feed cash-starved government and university research departments with corporate dollars." Edward Hammond of RAFI concurs, "Biotech companies that are already patenting specific crop genes and traits will probably insist that other breeders licensing their germplasm use the Terminator to protect their monopoly. It won't take long", Hammond adds, "before farmers run out of choices. Either they pay for the Millennium Seed or they replant older varieties from abandoned breeding programmes."

"This is a patent that really turns on the greed gene", says Camila Montecinos of the Chilean-based Center for Education and Training, "It's too profitable for companies to ignore. We will see pressure on national regulatory systems to marginalize saved-seed varieties and clear the way for the Terminator. One point four billion farm families are at risk."

Aside from sky-rocketing seed costs, Neth Dano of the Philippines-based civil society organization SEARICE sees a threat to the environment and to long term food security. "We work with farmers who may buy a commercial variety but its breeder wouldn't recognize it five years later. Women select the best seeds every year and – over time – the rice molds itself to the farm's own ecosystem. Women also cross the commercial variety with other rice strains to breed their own locally-adapted seeds. The Terminator could put an end to all this and increase crop uniformity and vulnerability. It poses a threat to the culture of seed sharing and exchange that is led primarily by women farmers."

"Ultimately, the Terminator technology will severely limit farmer options", says Neth Dano of SEARICE. "Will we be left with rice varieties that taste like sawdust and which pest and disease love to devour?" asks Dano.

Camila Montecinos of Chile-based CET is calling for global boycott of the Terminator Technology. "Governments should make use of the technology illegal", she insists. "This is an immoral technique that robs farming communities of their age-old right to save seed and their role as plant breeders. It should be banned." To this, corporate breeders argue that the new technology simply does for hard-to-hybridize crops what the hybrid technique did for maize. Hybrid seed is either sterile or fails to reproduce the same quality characteristics the next generation. Thus, most maize farmers buy seed every year. "Poor farmers can't afford hybrids either", Montecinos points out, "but there's a key difference. The theory behind hybridization is that it allows breeders to make crosses that couldn't be made otherwise that are supposed to give the plant higher yields and vigor. The results are often disappointing but that's the rationale. In the case of the Terminator Technology, there's absolutely no agronomic benefit for farmers. The sole purpose is to facilitate monopoly control and the sole beneficiary is agribusiness."

RAFI will be working with its partners around the world to encourage a global ban on the use of Terminator Technology. "By the time it's ready for the market shortly after the year 2000, we hope that the Millennium Seed will succumb to the Millennium Bug", concludes RAFI's Shand.

HOW DOES THIS TECHNOLOGY WORK?

On March 3rd (1998), an American cotton seed company, Delta & Pine Land Co., and the U.S. Department of Agriculture (USDA) announced they had received a patent on a technique that genetically disables a seed's capacity to germinate when planted again. U.S. Patent No. 5,723,765 covers potentially all cultivated crops.

The technology is genetic in nature. The technology is complicated and difficult to explain in layman's terms. Seed of a variety that is about to be sold is treated with a chemical that acts as a trigger. This chemical interacts with genetic material that has been incorporated into the plant, by genetic engineers, in such a way as to activate a lethal gene. The lethal gene does not affect the crop that is growing, but it does affect seed that is being produced on those plants. As the seed matures in the farmer's field, the lethal gene causes a protein to be produced that destroys the seed's ability to germinate. TERMINATED. The developers of this technology have named it 'technology protection system'.

[The following explanation is more technical; if it isn't of interest you can skip this paragraph.] A site-specific recombinase (enzyme) is expressed in response to a trigger molecule, such as tetracycline. Seed treatment with the trigger molecule begins the process by which a blocking sequence of DNA is excised. This blocking sequence of DNA separates a lethal gene from a gene promoter and as long as they are separated the lethal gene remains inactive. Once the blocking sequence is excised the promoter is brought into contact with the lethal gene and as a result a toxic protein is produced. This occurs late in embryo development because the specific promoter used in this system only is expressed during the late maturation phase of seed development. Plants produce seed, but these seed are incapable of producing new plants when the seed is sown.

Under a research agreement with the USDA, the Delta & Pine Land Co. has the exclusive right to license the new technology to others. While only cotton and tobacco seeds have been shown to respond to the new technique, the company plans to have the technology ready for a much wider range of crops shortly after the year 2000.

WHAT DO OPPONENTS OF THE TECHNOLOGY FEAR?

RAFI published the press release reprinted above because it wanted to warn others of the potential of this new technology to significantly limit the ability of farmers to save their own seed. RAFI's Research Director, Hope Shand, dubbed the technology the 'Terminator Technology'. RAFI and other NGOs are calling for a global ban on the use of this technology. In the succeeding paragraphs some of their major objections are summarized.

Opponents of this technology fear that farmers (especially in the developing world) may no longer be able to save seed or breed improved varieties. "According to USDA spokesman Willard Phelps, the primary targets for the Terminator are "Second and Third World" markets. Priority crops include rice, wheat, sorghum and soybeans – crops largely ignored by agribusiness breeders because they aren't readily hybridized (a tried-and-true biological means of forcing farmers back into the seed market every year)."

The opponents of the technology accurately point out that seed companies have shunned crops that aren't readily hybridized. Seed companies have had little incentive to devote research to these crops (i.e., self-pollinated crops such as wheat and rice) because their returns don't match those for hybrid crops like maize and many vegetables. Farmers regularly purchase new seed of hybrids every year whereas they save their own seed for replanting of crops that aren't readily hybridized. With the patent announcement, the world's two most critical food crops – rice and wheat, staple foods for three-quarters of the world's poor – potentially enter the realm of commercial interest by private agribusiness. Both systems, hybrids and technology protection, ensure that the farmer returns to the seed company on an annual basis to purchase seed if he/she wants to plant the variety again. The consequence of not doing so is significantly reduced yield in the first case (hybrids) and no yield in

the second case (technology protection system). [Note: Although hybrid seed and varieties protected by the terminator technology both promote a strong seed industry, they do differ in one significant aspect. Hybrids are more productive than the inbreds from which they are produced; whereas, self-pollinated varieties carrying the technology protection system aren't inherently more productive than those without it.]

Another fear concerning this technology is that farmers might lose their ability to develop their own locally adapted varieties. This is seen as both a threat to the environment (i.e., reduced genetic diversity) and to long term food security. Farmers throughout history have functioned as plant breeders by selecting the best seeds every year from the varieties they plant. Over time, through this process of mass selection, the varieties can be significantly altered and improved. If varieties carrying the Terminator technology are widely adopted by local farmers, it poses a threat to the culture of seed selection and exchange that occurs among farmers. In addition, it would also increase crop uniformity and vulnerability to pests and climatic extremes.

There also may be significant consequences upon public breeding endeavors. RAFI's Hope Shand believes "There will be enormous pressure on public breeders to adopt the technique in order to feed cash-starved government and university research departments with corporate dollars." Edward Hammond of RAFI concurs, "Biotech companies that are already patenting specific crop genes and traits will probably insist that other breeders licensing their germplasm use the Terminator to protect their monopoly."

Biosafety issues also are a concern. There are differing views on this, but the concern is that the sterility trait will infect neighboring fields of the same crops and/or wild relatives of a crop through pollen that is produced by plants carrying this technology. So the threat here is that the technology would escape and result in the production of sterile seed beyond the boundaries of the fields planted to these protected varieties.

IS THIS TRULY A DOOMSDAY TECHNOLOGY?

The patent's defenders acknowledge that the technology will mean an increase in seed costs as farmers who now only buy seed when they change varieties are forced to make annual purchases, but they defend hiking seed prices by saying farmers will only opt for the "sterile" seeds if they offer a big advantage. So will the up to 1.4 billion resource-poor farmers in the South that depend on farm-saved seed and seeds exchanged with farm neighbors as their primary seed source be forced to soon begin purchasing seed every year? We need to remember that varieties produced with the technology protection system will not be inherently more productive than other varieties. New varieties produced via this technology will be most attractive when they are superior in yield. Only when farmers are able to recoup considerably more than the added cost of annual seed purchases will they choose to plant varieties with the technology protection system. Otherwise farmers will stay with crop varieties for which they can save their own seed. In addition, farmers will continue to be plant breeders by both saving seed of indigenous land races and varieties and improving these genotypes through mass selection.

Whether or not this technology is widely used will greatly impact its profitability for Delta & Pine Land Co. Normally one might question whether a company would wish to share coveted technology with others; however, because the trait doesn't improve the quality (or quantity) of recipient varieties, it is in the interest of its owner to sell as many licenses for the technology as it can. RAFI quotes an USDA spokesman as saying "the USDA wants the technology to be widely licensed and made expeditiously available to many seed companies. The goal is to increase the value of proprietary seed owned by U.S. seed companies and to open up new markets in Second and Third World countries."

As was stated earlier, Delta & Pine Land Co. has the option to exclusively license the patented technology to other seed companies. Since the patent was announced (March 3, 1998) Delta & Pine Land Co. has been purchased by Monsanto. Seed companies purchasing a license from Monsanto also will profit as the technology is more widely used and they can take a longer perspective on the profitability of a variety because seed must be purchased every year over the lifetime of the variety. Patents for this technology have been applied for in at least 78 countries according to article printed in the Seed Savers 1998 Summer Edition (Decorah, Iowa, USA).

Much of the plant breeding effort that has occurred in self-pollinated crops in the 20th century has occurred in the public sector, within national and international agricultural research centers. I believe this will continue to be the case at least to some degree. However, as the partnership between public and private sectors grows and public funding for plant breeding declines, the mandate and the clientele of public research institutions will be in flux. Current trends in seed industry consolidation, coupled with rapid declines in public sector breeding, mean that farmers are increasingly vulnerable and will have far fewer options in the marketplace. One thing we can do is to lobby for more government support for breeding non-hybrid, non-terminator varieties; without this support our public breeding programs will languish or be drawn to the private sector for funding.

Some of those contacted by RAFI see benefits to the new technology. "For the first time, private companies will be encouraged to invest in the world's most vital food crops. We can look to a new flow of investment into crops whose yields have stagnated or even declined in the Nineties. Now such poor people's crops as rice and wheat will get the research support they so desperately need", one crop economist advised.

Finally, I doubt that there is much biosafety risk associated with this technology. An escape would be most likely to occur within a species rather than across species. For example, the natural outcrossing rate for some self-pollinating crops can be up to 5%. If two rice fields, one planted to a variety carrying the technology protection and the other planted to a conventional variety, were planted adjacent to one another you could expect a small percentage of outcrossing which would result in seed produced on the conventional variety that is sterile. For this to happen, the fields must be planted in close proximity and the flowering dates must be similar. The likelihood of the trait being passed to another species is even lower because normally foreign pollen is unable to fertilize an unrelated species. Even when an escape does occur, it should be self-limiting because the progeny are sterile and the trait shouldn't be passed throughout another population of plants.

A DEVELOPMENT WORKER'S PERSPECTIVE (BY TRACEY HENDERSON, PH.D.)

I would like to offer my perspective as a development worker to the current debate about the "technology protection system/terminator gene". Based on my experience in agricultural development in Mozambique and the former Zaire, I have serious concerns about the effects of this technology on resource-poor small-scale farmers in sub-Saharan Africa and throughout the developing world. Having witnessed some unfortunate consequences of the introduction of hybrid seed in developing countries, it is easy to imagine the potential for similar consequences of introducing "technology-protected" seed.

Proponents of the technology protection system say that farmers will only choose to use technology-protected seed if they predict, based on careful economic analysis, that they will be able to more than recoup their seed costs with returns from the added productivity. Therefore, the argument goes, this technology will not affect farmers who do not have the resources to purchase new seed every year. I believe this argument is flawed on several counts.

First, farmers in severe crisis situations do not always have a choice about the varieties they plant. In cases where most of the existing seed supply has been wiped out due to war, drought, or flood, government programs or NGOs often step in with much-needed seed distributions to allow farmers to plant the following season. The choice of varieties is generally made by the distributing agency, and this choice determines to a great extent the most important crop varieties grown in the region for years to come. I have seen a case where a well-meaning NGO chose to distribute hybrid maize seed because its productivity was considerably higher than that of the available open-pollinated varieties. Obviously, this choice left farmers in a difficult situation in subsequent seasons. One would hope that in a similar situation, technology-protected varieties would not be distributed, but the potential for such inappropriate use does exist, and may become increasingly likely if yields of technology-protected varieties are greatly improved.

Second, most small-scale farmers in developing countries, even if they are not in a crisis situation, still have a very narrow margin for error. I have seen farmers invest in improved varieties of seed, only to lose their first and second plantings to drought and pests. Without any more seed for a third planting (or any more money to buy seed), they resorted to planting either food maize of unknown origin or grain produced from the previous season's hybrid variety. When questioned about their choices, the farmers explained that they knew it wasn't good seed but they had no other options and so "decided to give it a try anyway." The resulting yields were disastrous, and these farmers who had invested scarce resources to purchase improved varieties did not produce enough food to feed their families for more than a month or two. Farmers without a thorough understanding of this new technology could easily find themselves in a similar situation.

A third concern is the potential for intentional misrepresentation of the nature of this seed in the local marketplace. In developing countries, it is a common practice for improved seed to be divided into smaller quantities and sold again, without labels, in local markets. The potential exists for local marketers, either due to lack of understanding or unscrupulous motives, to sell this seed to farmers without informing them that it cannot be saved and replanted in subsequent seasons.

Fourth, I am concerned about the effect on farmers' ability or willingness to select and save their own seed and continue to grow and develop their locally-adapted varieties. We must remember that for many farmers in the developing world, limited land area is a very serious production constraint. With a small farm, farmers may choose to devote more and more of their limited field space to higher-yielding varieties at the expense of indigenous varieties. The result would be less biodiversity, leading to increased vulnerability to pest problems as well as increased dependence on purchased seed.

Finally, we should consider the effect of this technology on the availability in the marketplace of improved varieties that do not require annual seed purchases. Will the introduction of technology-protected varieties result in a further lack of improved but non-protected varieties for sale? Improved varieties that can be used for several years before replacement is necessary represent an important intermediate-level technology for farmers struggling to move beyond the subsistence level. Without this intermediate step toward variety improvement, farmers may be left with an "all-or-nothing" option that they cannot afford.

The key element in these situations is information. For every farmer in the developing world who has access to sound technical assistance from an extension professional who keeps the farmer's best interests at the forefront, there are many others who are not as fortunate. Let's face it, in much of the developing world, access to adequate information is the exception, not the rule. Farmers who do not have access to enough information to fully understand the issues involved cannot be expected to always choose the most beneficial options. While proponents of the technology protection system may have the best of intentions, the unfortunate reality is that there is great potential for misunderstanding or misrepresentation of the technology at the local level in developing countries if farmers are not adequately informed.

I am sure there are many of you out there, more experienced than I, who will disagree with my assessment of the implications of the technology protection system. But whatever our opinion of this technology, the reality is that it once it has been "let out of the box" it is probably here to stay. It therefore behooves those of us serving as agricultural missionaries or development specialists to learn as much as we can about it and, in turn, assist the farmers with whom we work in becoming fully informed about the implications of this technology so they can make the best possible decisions.

PART 2. PROPERTY RIGHTS & LAW

SOVEREIGN RIGHTS OF COUNTRIES OVER PLANT MATERIALS

The sovereign rights of a country over plant materials originating in the country has become another hot issue that has polarized developed and developing nations. The conflict arises over balancing plant breeders' rights with the desired principle of free exchange of plant genetic material. Traditionally, plant materials (e.g., seed) have had unobstructed access across national borders. People have identified plants that are wild or weedy relatives of cultivated crops, plants that have a trait that is desirable, and improved varieties in other parts of the world. They have taken seed of these plants to other countries where they have been used in plant breeding programs. The centers of the greatest plant genetic diversity are largely located in the tropics, in the developing countries of the world. Leaders in these countries have questioned the fairness of outsiders taking genetic resources indigenous to their lands, using them to create improved varieties, and then obtaining royalties and profits from the sale of the new varieties in their own country and others.

The instrument of international law governing issues of sovereignty over plant resources is the Convention on Biological Diversity that had been ratified by 168 countries as of April 1997. It reaffirms and builds upon the principle that nations have sovereign rights over their own biological resources. At the same time, it promotes the fair and equitable sharing of the benefits arising from the use of plant genetic resources.

What are the implications of this law? First, the sovereign rights of a country over plant materials found there only are exclusive when those genetic materials do not occur in more than one country. Second, maintaining exclusive control over a country's plant resources may be difficult. A small number of seeds taken illegally out of a country deprives the country of this control. Third, although the sovereign right of states over their plant genetic resources implies the right to grant or refuse access to plant genetic resources, the codes requires that countries provide free access for the purposes of scientific research, plant breeding and genetic resource conservation.

An intent of this law is to protect a country and its people from losses incurred when nationals of other countries commercialize plant genetic material. Members of ECHO's network should be cognizant of the laws of the country in which they reside when it comes to transporting samples of seed or other plant materials across national borders.

WAYS IN WHICH PLANTS ARE PROTECTED BY LAW

The following laws pertain specifically to the U.S., but as you will read later in this paper these or similar property rights laws are utilized and respected by most of the countries of the world. There are three separate intellectual property systems covering plants in the United States. They are:

- The 1930 Plant Patent Act (PP)
- The 1970 Plant Variety Protection Act (PVP)
- Utility plant patents

The **Plant Patent Act** provides patent protection for new varieties of asexually reproduced plants (plants produced from vegetatively propagated materials; i.e., buds, cuttings, slips). Because these plants are asexually reproduced all progeny are identical to the parent and therefore it is easy to maintain the identity of a superior plant type. Both the PP and PVP Acts originally provided protection for 17 years. During recent years, as a result of the GATT world trade talks, this protection was changed to 20 years.

Until the era of genetic engineering, plants usually were not patented (the exception being for asexually propagated plants mentioned previously). Instead new plant varieties in the U.S. were protected by the **Plant**

Variety Protection Act. PVP provides an owner with exclusive privileges regarding sale, reproduction, import, and export for 20 years. Varieties receiving plant variety protection can not be sold without the owner's permission; enforcement of this is either the responsibility of the U.S. government or the owner, depending on what certification option the owner chooses. However, farmers can plant a protected variety on their farm and save seed from the harvest to plant the next season without paying any money to the owner. In addition, a protected variety can be used by any individual or company as parental material in a plant breeding program.

What types of plants have been protected by PVP? We will come back to this question, but first we need to review the different variety types that are characteristic of self-pollinated and cross-pollinated crops. There are three that will be touched on here:

- Homozygous lines
- Hybrid varieties
- Open-pollinated varieties

Plant breeders of both self-pollinated and cross-pollinated crops develop highly inbred lines (also called homozygous lines). Plant breeders may initiate the process by making a cross between two parent lines, each often having several desirable characteristics. Progeny from the cross will exhibit a wide array of traits, but it would not be possible to isolate a superior variety at this point because the line would not be true breeding. Inbred lines are developed through the selfing process. Selfing ensures that a variety is stable – that it can be reproduced for multiple generations of seed production without changes in its characteristics. For self-pollinated crops like wheat and rice, these inbred lines can be released as varieties and the breeder responsible for development can choose to protect it with PVP certification.

For cross-pollinated crops, like maize and sorghum, a hybrid variety is often the final goal. In this case, inbred lines are crossed to produce a high-yielding variety. The hybrid can be produced again at will because the inbred lines are stable. Hybrids can not be protected by PVP.

The two primary reasons for producing a hybrid are: 1) interest in the increased productivity of hybrids as compared to inbred lines, and 2) ability to have a seed product that must be purchased every year. The commercial use of hybrids is generally limited to those crop species in which the amount of hybrid vigor (reason 1) is sufficient to justify the extra cost required to produce hybrid seed (reason 2). Hybrid vigor is greatest in cross-pollinated crops (such as maize) and least in self-pollinated crops (such as wheat). I'm going to use maize and wheat as examples to illustrate this principal. Two inbred lines of maize (inbreds A and B) yield 80 and 100 bu/acre in Iowa, respectively. The maize hybrid AB shows a high level of hybrid vigor with yields of more than 140 bu/acre. Contrast that to two selfed lines of wheat (lines C and D) that produce 45 and 50 bu/acre in Kansas. Their hybrid CD yields 56 bu/acre. Although the hybrid yield for wheat is 20% greater than the mid-parent value (47 bu/acre), it may not justify the added cost the seed company experiences in the development and testing of hybrid varieties. And in fact this has proven true for most self-pollinated crops; hybrid vigor is insufficient to warrant the added costs associated with hybrid seed production.

For crops where hybrid vigor is significant and justifies the added production costs, farmers must repurchase seed every season because hybrid vigor is maximized during the first generation. If a farmer replants seed he saves from the harvest of a hybrid maize variety, he will find that each succeeding year yields will decline due to inbreeding depression. Essentially what is happening is the slow process of selfing in which some of the plants in the population will become more like the inbred lines from which the hybrid was derived. This is not a surprise – it is predicted based on the principles of genetics – nor is it a planned obsolescence on the part of the seed company.

Open-pollinated varieties are another variety type that has been utilized in cross-pollinated crops. Open-pollinated varieties have the advantage of being generally higher yielding than inbred lines and seed can be harvested and replanted without realizing the deleterious effects of inbreeding depression. The open-pollinated maize variety has been popular with many farmers in developing countries because they can reuse their seed for

planting and thereby reduce annual seed costs. In addition, some studies have shown that the open-pollinated variety may provide more yield stability than a hybrid. This has been explained in part, by presence of genetic diversity within a field of plants – some may possess resistance to a pest and others may tolerate another type of stress – the net result being more stable yields over years.

Only variety types that allow for production of multiple generations of seed without changes occurring in variety characteristics can be protected by PVP. This essentially limits PVP use to self-pollinated crops where the seed produced in a field has the same genetic constitution as the parent plants.

Utility Patents grant an inventor the right to exclude others from producing or using the inventor's discovery or invention (this protection also is provided for 20 years). Anyone wanting to use a process or plant part that is patented is unable to do so without the permission of the owner of the patent. However, this exclusive privilege is much broader in scope than PVP. Plant utility patents are not restricted to claims on a single variety; instead that can extend across one or more plant species. Plant patents can cover all plant biological material as well as processes and include protection for recombinant processes, genes, culture techniques and plant parts. To be patented the product or process must be a new invention, involve an inventive step, and be able to be replicated by a person skilled in the art. This excludes patents for living material that has merely been discovered or whose use is already known.

IS THIS PROTECTION RECOGNIZED OUTSIDE THE ORIGINATING COUNTRY?

On January 1, 1995 the Marrakech Agreement establishing the World Trade Organization (WTO) went into force. As of June 1997, 131 countries had accepted the Agreement and a further 29 countries were in the process of negotiating their accession to it. It is safe to say that we essentially have a set of trade agreements that are honored by most countries of the world.

The specific issues of plant patentability and variety protection are addressed by the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). Member states were obliged to apply all provisions of the TRIPS Agreement from January 1, 1996 (with a nine-year transition period available for developing countries). While the agreement allows countries to provide patent protection to plants and biological processes for the production of plants, it does not mandate that countries must do so. To date, most of the plant patents resulting from genetic engineering programs have occurred in the developed countries of the world. If a developing country should decide that it does not intend to provide patent protection for plants, it still would be responsible for honoring plant patents issued by other member nations. Trade disputes and differences in the interpretation of trade law ultimately are settled by the WTO Dispute Settlement Body.

The TRIPS Agreement, however, does require member nations to provide “for the protection of plant varieties either by patents or by an effective *sui generis* system or any combination thereof”. What this means is that every country will have to develop a system that either allows patents and/or a rights regime similar to the Plant Variety Protection Act in the U.S. for the protection of plant varieties.