RAFI Translator - 23 October 1998

Dead Seed Scroll?

The USDA's Terminator Defence

The United States Department of Agriculture (USDA) - its back against the wall for the co-development of Terminator Technology - has replied to more than 1850 protest letters from 54 countries with a "Fact Sheet" that is about as useful and sterile as the suicide seeds it is defending.

Text: "Fact Sheet: Why USDA's Technology Protection System (a.k.a. 'Terminator') Benefits Agriculture - A Discovery to Spur New Crop Improvement", USDA, October, 1998

Fora: 1) The US Congress and the USDA are being asked to ban the Terminator and to refuse to surrender the US patent to Monsanto's subsidiary. 2)The Terminator patent is pending at the EPO in Canada, Australia, Japan, and South Africa. The owners of the patent have indicated they will apply for patent monopoly in 87 countries worldwide. 3) Article 27(2) of the Trade-Related Intellectual Property section of GATT allows for patents to be rejected on the basis of public morality and threats to the environment. The Terminator offers WTO members the ideal opportunity to reject not just a single patent - but an entire technology as morally unacceptable. The WTO's TRIPs Council meets in Geneva 1-2 December 1998.

Summary: Embarrassed by the deluge of more than 1850 letters from concerned farmers, scientists, and other individuals from 54 countries, the USDA's "Fact Sheet" is a muted re-hash with no new arguments or data.

Analysis: The Terminator debate boils down to four issues: Is it needed? Is it safe? How will it be used? Will farmers have a choice? With each of these questions, the fact sheet manages to either miss the point or avoid the question altogether. The Terminator targets the South's farmers and claims to be a benefit to world food security. Yet, overwhelmingly, the international ag science community, including the Consultative Group on International Agricultural Research (CGIAR), has opposed the Terminator insisting that the technology threatens food security. Given this , the issue of safety - in the absence of value - should be obvious. Certainly, the burden of absolute proof rests heavily on the shoulders of those advocating suicide seeds. How will it be used? That's explicit in the Terminator and in "look-alikes" such as Zeneca's Verminator. The technology is a platform upon which agribusiness will stack other proprietary genetic traits. Finally, do poor farmers have choices? Of course not. A defining feature of poverty is the lack of choice. Ask farmers in Zimbabwe, Indonesia and Philippines.

RAFI *Translator*

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RAFI (Rural Advancement Foundation International) is a non-profit Civil Society Organization headquartered in Winnipeg, Canada with an affiliate office in Pittsboro, North Carolina (USA). RAFI's mandate is to explore the socio-economic impact of new technologies as they affect rural societies. RAFI, in particular, addresses issues related to agricultural biodiversity and biotechnology with special regard for the intellectual property and benefit-sharing implications of these issues.

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Translator's Notes

1. Is it needed? Proponents argue that: (1) Terminator will stimulate plant breeding for minority crops and marginal lands; (2) that it will encourage the owners of valuable proprietary traits to load them onto the Terminator platform knowing they can't be stolen or re-used; (3) that it will encourage the use of higher-quality, cleaner seed; (4) that it will end late-season "sprouting" than reduces crop value.

Four fouls: (1) The same argument was used with Plant Breeder's Rights. There is no evidence that proprietary opportunities encourage companies to breed for poor farmers or to develop minor crops. Rather, companies are encouraged to market their high-tech proprietary seeds. But the y may be entirely inappropriate for the needs of resource poor farmers in marginal environments. (2) The Terminator offers no agronomic benefit and will result in enormous socio-economic loss as farmers are stripped of their ability to save, adapt, and develop seed. (3) Farmers don't merely recycle seed - over successive growing seasons, the seed adapts to local soil and climatic conditions and increases in value for local farmers. Women farmers use purchased seed as a source of breeding material to develop improved seed meeting local requirements. All this is lost with the Terminator. (4) Seed "sprouting" is an irregular problem in some regions for some crops, It is hardly a reason to abandon the 12 thousand year practice of seed-saving in favour of suicide seeds.

2. Is it safe? Unknown. But there is no agronomic reason to accept any level of risk. Over 1.4 billion people depend upon saved-seed for their food security. Is it safe to take a risk on a technology that delivers no agronomic benefit? Historically, the USDA and the biotech industry have been reluctant to admit that genes will escape from transgenic crops and pose a risk to the environment. Now they argue that a brand-new genetically-engineered technology, the Terminator, will reduce the risk involved with transgenic crops. Can farmers trust the USDA?

3. ***How will it be used?*** The Terminator will be used to kill seeds and force farmers to return to buy seed again every year. It will deny farmers their role and rights to save seed and improve plants, particularly jeopardizing farmers positions in times of environmental and economic duress. In addition, as USDA and the company make clear, the Terminator is a platform technology. It is the platform upon which proprietary genetic traits will be loaded. Initially, this means herbicide tolerance and Bt resistance. However, the Terminator technique that can activate or de-activate the ability of a seed to germinate may also be used in increasingly complex ways.

4. Will farmers have a choice? More than anything else, the insistence that farmers can always say "no" to the Terminator shows the absolute detachment of the Terminator's proponents from farmers' reality. Some years ago in Zimbabwe, the government decreed that subsistence maize farmers had to abandon their open-pollinated varieties and adopt maize hybrids. The Indonesian government has insisted that the major rice growing regions of that country can only plant High-Yielding Varieties (HYVs) from IRRI or its national counterparts. During the Masagana 99 programme in the Philippines, credit schemes and extension pressure forced many farming communities to surrender their traditional seeds in favour of government-certified varieties. Credit and extension programmes in Chile have sometimes implicitly obliged poor farmers to accept

plant varieties they did not want. In Brazil, poor farmers must select from a restricted government-maintained list of varieties in order to obtain commercial credit. Poor farmers are very often tenant farmers subject to pressure from their landowners, commercial creditors, government extension workers, and those determining access to water irrigation. All of these sources, in turn, are subject to policy whims and political pressure. As every government aid agency and development NGO can affirm, the very definition of poverty is lack of choice.

USDA Fact Sheet **The USDA Text Says:**	**RAFI Translator** **RAFI Translates:**
On March 3, 1998, the U.S. Department of Agriculture's Agricultural Research Service (ARS) and Delta and Pine Land Co., Scott, Miss., a major breeder of cotton and soybeans, received U.S. Patent 5,723,765 entitled "Control of Plant Gene Expression." The patent covers technology referred to as a plant "Technology Protection System" (TPS).	**Update & Broader Picture Conveniently Omitted:** In May 1998 Monsanto announced that it would acquire Delta & Pine Land (D&PL) for $1.8 billion. The acquisition is in its late stages, and once it is complete, Monsanto will be the co-owner of the Terminator patent. Monsanto has spent over $8 billion acquiring seed and biotech companies since 1996. It is the world's second largest seed company (1).
TPS uses a genetic engineering approach to prevent unwanted germination of plant seeds. The patent was based on research conducted under a Cooperative Research and Development Agreement (CRADA) between Delta and Pine Land Co. and the ARS. The CRADA was signed in 1993. The ARS portion of the work was done at the agency's Cropping Systems Research Laboratory in Lubbock, Tex.	**Unwanted Germination? Unwanted by Whom?** "Unwanted germination" of crop seed is an oxymoron unless you happen to own Monsanto stock or are planning an assault on agbiodiversity. The Terminator is a dream come true for the corporate seed industry because it will force farmers to return to the commercial seed market every year. It is wrong to suggest that farmers or consumers will benefit from industry's goal of preventing "unwanted germination." Exactly who decided plant sterilization was an appropriate research goal?
It should be noted that ARS has entered into more than 825 CRADAs since passage of the Federal Technology Transfer Act of 1986. This act and various other Federal laws--including the Stevenson-Wydler Act of 1980 and the Bayh-Dole Act of 1980, make the transfer of new technology to the private sector and industry a responsibility of all Federal research agencies.	**Unwanted by Farmers:** The licensing talks should immediately end and the Terminator technology should banned on the basis of public morality, national and food security. USDA can take steps to make this happen and cannot wash its hands of responsibility for this dangerous technology - which it is trying to patent internationally - by citing its own national legislation. **Corporate Welfare:** The Terminator technology is a shocking example of corporate welfare, and an egregious use of taxpayer money.

USDA Fact Sheet
The USDA Text Says:

How does TPS work?

Like most genetically engineered plants, TPS plants are transgenic, meaning their new genes come from other species. TPS plants hold three new genes: two derived from bacteria, and one from another plant. The bacterial genes' only function is to help the newly introduced plant gene to work. Before sale, seeds of the plants are treated with a compound that activates a molecular switch in one of the bacterial genes. This switch begins a chain reaction that readies the plant gene for eventual action. The farmer plants the seed and cultivates the crop in the usual manner. When--and only when--the crop's new harvest of seed is almost finished maturing, the new plant gene becomes active. The gene then stops the seed from manufacturing any of the protein it would need to germinate and produce offspring plants.

Aside from the inability of the second-generation seeds to germinate, in all other respects the plants grown from treated TPS seeds should perform normally in terms of growth, maturation, harvest and quality. Also, if seeds of TPS plants do not undergo the seed treatment before planting, the TPS plants produce second-generation seeds that are capable of germination.

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The Rest of the Story For a more complete discussion of how the Terminator terminates, see paper by Dr. Martha Crouch, Professor of Biology, Indiana University, published by the Edmonds Institute (2):

http://www.bio.indiana.edu/people/terminator.html

Irrelevant Detail Designed to Make You Feel Better about Sterility: So what if the terminator gene only kicks in "When - and only when" the see is mature? It makes no difference. The seed is still dead. This little phrase was probably added to sound reassuring, to make you think the Terminator is relatively conservative, when it fact it is a risky technology designed to transform agriculture, globally.

Hostage Seeds: USDA's explanation reveals a particularly frightening scenario for the future, one that it also alluded to in a recently leaked internal document. If there is anything worse than the Terminator, it would be the USDA following up on its suggestion - at left - that the Terminator gene could be set loose without activation. The unactivated Terminator might proliferate through the environment and into all sorts of plants and places, potentially without farmer's knowledge. Either by accident or design, it might be subsequently turned on and manifest itself in very unwanted and unanticipated places.
In essence, Terminator technology and its relatives like the Verminator can be used to restrict the food production capacity of farmers. The seed company has the ability to determine when to trigger the Terminator effect. Once perfected, seed companies may have the technology in hand to genetically program seed so that it will not properly perform unless cultivated under carefully prescribed conditions (requiring the use of a proprietary herbicide, treated with a specific fungicide or fertilizer)(3). The implications are far-reaching and could give multinational seed

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	and agrochemical firms an unprecedented and extremely dangerous capacity to control the world's food supply.
What is the commercialization status of the technology and what is the role of the Agricultural Research Service in TPS research? The discovery of TPS was a joint invention by Delta and Pine Land Co. and ARS, which means each party is a co-owner and may act independently from the other. Furthermore the discovery was made under a CRADA. This law provides that government owned CRADA inventions will be licensed exclusively to the cooperator. Currently the two parties are negotiating a license for the use of ARS' rights to the technology. As these negotiations evolve, ARS will be an active participant in deciding how the technology is applied. ARS' involvement will ensure that the public interest is represented.	**Public Trust?** The public interest was violated when USDA initiated research on the Terminator. It is not reassuring to know that ARS will be an active participant in deciding how the technology is applied. How will ARS involvement ensure that the public interest is represented when it is already failing to do so?
It is ARS policy that technology in which it has an ownership interest will be made widely available. Therefore, this technology will be widely available for research purposes by public and private researchers. In line with ARS policy, Delta and Pine Land Co. has agreed to make the technology widely available for sublicensing to other seed companies. Delta and Pine Land Co. researchers are further developing the technology to ready it for commercial use. However, even the most optimistic predictions estimate that commercial cotton with built-in TPS technology may not be available until 2004.	**Ban and Abandon!** In RAFI's view, the public's interest will only be protected if USDA: 1) ceases negotiations with Monsanto on the licensing of this dangerous technology; 2) abandons all patent applications on Terminator that are pending in 87 foreign jurisdictions; 3) prohibits public research or use of genetic seed sterilization technology.
What are the potential benefits of TPS technology? Hybrid seeds found in corn, sunflower, sorghum and other crops provide a conventional genetic protection system that allows seed companies to protect their investment	**Hybridization Cannot be Equated to the Terminator** Hybrids, while often used to farmers' detriment, at least theoretically provides the agronomic benefit of hybrid vigor and do not kill the second generation. The Terminator provides no agronomic benefit and kills the second generation. The USDA knows this; but it

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in developing and marketing new varieties. But other crops produce seed that can be saved and replanted in the next growing season. Because of this seed-saving practice, companies are often reluctant to make research investments in many crops because they cannot recoup their multiyear investment in developing improved varieties through sales in one year. Farmers will also lose since saved seed has lower seed quality than material developed to meet the standards for certified or commercial markets.	has chosen a deceptive analogy to try to downplay criticism and allay citizen concerns. **Rudderless Research** The USDA has lost its research focus. If the corporate seed industry is reluctant to make research investments in certain crops because they think they can't make money, then this is precisely an area where USDA plant breeders could be providing a valuable service to farmers. USDA has a uniquely public role to play in plant breeding. Historically, USDA has made an invaluable contribution to agriculture by releasing public varieties. Why does USDA now believe its mandate is to boost seed industry profits? **With Terminator, Not Only Farmers Lose, We All Do:** Farmers have been saving seed from their harvest for millennia. To suggest that farmers "lose" when they save seed is a grossly distorted view of agriculture, and an insensitive assault on the fundamental right of farmers to save seed and breed crops. According to the United Nations, over 1.4 billion farmers depend on farm-saved seed as their primary seed source.(5) The on-farm diversity of crops - which would be threatened by the Terminator - is the lynchpin of the global efforts to conserve agricultural biodiversity.
TPS would protect investments made in breeding or genetically engineering these crops. It would do this by reducing potential sales losses from unauthorized reproduction and sale of seed. The knowledge that the seed companies could potentially recoup their investment through sales will provide a stronger incentive for the companies to develop new, more useful varieties that the market demands. Today's emerging scientific approaches to crop breeding--especially genetic engineering approaches--could be crucial to meeting future world food needs, conserving soil and water, conserving genetic resources, reducing negative environmental effects of farming, and spurring farm and other economic growth. TPS technology will	**Whose Investment?** Protect whose investment? Monsanto's? Is that the goal of USDA-supported research? **Get real.** The Terminator technology has nothing to do with feeding hungry people, cleaning up the environment, or improving nutrition. This is a patented, proprietary technology and that means whoever owns the patent has an exclusive monopoly --the right to determine who will get access to it, and how much they will pay for it. The Terminator offers no agronomic benefits to farmers - it is designed to force farmers to return to the commercial seed market every year. Like many other genetically engineered products for agriculture - such as bovine growth hormone, longer shelf-life tomatoes, and high-nicotine tobacco - this is a product that serves the needs

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contribute to these outcomes by encouraging development of new crop varieties with increased nutrition to benefit consumers and with stronger resistance to drought, disease and insects to benefit farmers for example. **Limiting the Spread of Genes** A concern has often been expressed that transgenes might escape from genetically modified plants into "wild" populations. The TPS could greatly reduce the likelihood of such an occurrence. Plants that contain active TPS genes can't reproduce. Because TPS is self-limiting, the system cannot be transmitted to subsequent generations of other plants. What plants will it work with? The patent covers all plants. The genetic molecular switch was originally inserted into tobacco cells as a model for later research. The ARS researchers subsequently inserted TPS genes into cotton cells, which grew into normal cotton plants in a greenhouse. TPS will initially be used with self-pollinated crops such as cotton, soybeans and wheat. It would generally not be used with cross-pollinated crops such as corn, grain sorghum, sunflower, and canola. These crops usually have hybrid varieties whose seed is not saved because it is not uniformly like the parent seed, which causes yield and quality losses. The TPS system might, however, be used with these hybrids to prevent the spread of novel genes from conventional hybrids into "wild populations." Essentially, the TPS technology gives self-pollinating crops a similar varietal protection to that currently enjoyed by hybrid varieties of cross-pollinated crops.	of industrial agriculture. Simply put, Terminator technology is designed to increase profits of the multinational seed industry. **PR (Bio)Safety** In the past, the biotechnology industry has been reluctant to admit that cross-pollination between transgenic crops and non-engineered crops could pose serious ecological risks. Now that Terminator has come along, the USDA and industry conveniently argue that the Terminator's built-in safety feature can be used to reduce that risk. In RAFI's view, biosafety at the expense of food security is no solution. **BioUnsafety Criticism Conveniently Ignored** The Terminator technology comes with its own set of ecological risks. Scientists have expressed concerns that the Terminator may be bio-unsafe, that the Terminator gene may spread via pollen and infect neighboring plants. USDA ignores the issue. See Science Fiction below.

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Commercial production of TPS plants - as with any gene-engineered Plant - would require approval by USDA's Animal and Plant Health Inspection Service. Food crops must also conform to rules of the U.S. Food and Drug Administration. These approvals are expected because there appear to be no crop or food safety risks to the new technology. There also appear to be no environmental risks.	**Science Fiction** No safety risks? No environmental risks? On what basis does USDA make this conclusion? It is irresponsible and highly unethical for the USDA to conclude that regulatory "approvals are expected" on a technology that has only been tested in the laboratory by an institution/company that has a vested interest in its commercial success. Independent scientists have raised serious concerns about the Terminator technology (6). They warn that, under certain conditions, the sterility trait from Terminator crops will spread via pollen to surrounding plants and it will make seeds of those plants sterile. There are many unanswered questions. For example, will the Terminator gene mutate and change characteristics in some dangerous way? Will seeds containing the toxin made by the Terminator be safe to eat? Will the massive quantity of antibiotics that is used to trigger the Terminator gene be harmful to soil organisms, to wildlife, to human health? These questions have not been raised or even acknowledged by USDA. Go here for a more in-depth discussion of the issues: http://www.bio.indiana.edu/people/terminator.html
Because of the cost of developing improved varieties, it is doubtful if the time and expense would be justified for incorporating TPS into many varieties. Also, ARS has no plans to insert the system into improved plant materials it publicly releases for variety development programs and will continue its policy of an extra level of review for projects utilizing TPS genes. The nonprofit international agricultural research centers' breeding programs will probably not do so either. Thus, farmers will continue to have a choice of varieties with and without the TPS.	**Just Say No** This statement is unclear and contradictory. One USDA official told RAFI that USDA scientists are interested in developing Terminator technology for use with apomictic hybrids. An internal USDA memo says that some ARS scientists want to use terminator in a "stacking mode" to create plants with other transgenic features (7). If USDA has "no plans" to use the Terminator technology for material it publicly releases, then why are USDA researchers continuing to do research on Terminator? Informal statements are not sufficient. USDA must instead adopt a clear policy prohibiting the use of Terminator technology in its research. The same is true for the Consultative Group on International Agricultural Research, whose international research centers which will hold their annual meeting October 26-30. As the largest public agricultural research effort in the Third World, it is urgent that CGIAR ban the use of Terminator technology and uphold the right of poor farmers to save and exchange seed and breed crops.

USDA Fact Sheet
The USDA Text Says:

What are the implications for small farmers in the U.S. and abroad?

Small farmers may benefit greatly if the invention stimulates the extension of biotechnology to "minor crops" such as tomatoes. Many minor crops-- so-called because they don't occupy a large share of the crop acreage in the U.S. or abroad, even if high-value--are limited by lack of technology to manage pests or produce and harvest the crop efficiently. The private sector sees too low a rate of return to justify the plant breeding research investment in varietal improvement. As a result, growers' productivity--and crop quality--may be lower than their potential.

But the new TPS technology could change the equation.

Could the new technology hurt small farmers by ending "brown-bagging," the practice of collecting seed at harvest and bagging it to use as the next year's planting stock? Few U.S. farmers do this; it is much more common in other countries.

Countries where brown bagging is common practice will still be able to save their traditional seeds and other public varieties.

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Frmer-Savr Tomatoes? The Terminator won't be a serious factor in determining levels of research support for smaller crops. Even if Terminator were applied to minor crops, it does not follow that small farmers would benefit from increased productivity and crop quality. Patented terminator seed will be more expensive, and small farmers will be less likely to afford it. Private companies are not interested in developing plant varieties for poor farmers because they know the farmers can't pay. Moreover, the seed industry can be expected to use Terminator in major commercial crops where it stands to make the greatest profits.

True, the practice of farm-saved seed is much more widespread in the developing world. But USDA dismisses the fact that many US farmers routinely save a portion of some crops for re-planting especially wheat, soybeans and some cotton. By some estimates, 20% to 30% of all soybean fields in the US mid-west are typically planted with saved seeds; up to 50% of soybeans in the South are planted with farmer-saved seed. North American wheat farmers typically rely on farm-saved seeds and return to the commercial market periodically (8) This is hardly "a few" farmers!

Not Brown-Bagging - Breeding!

USDA reveals a naïve, ill-informed view of the role of poor farmers in conserving and using diversity, the complexity of their farming systems, and about the survival strategies and economic realities of poor farmers in marginal farm environments. Poor farmers are not "brown bagging." That term generally refers to North American farmers who save seed and re-sell it in unlabeled brown bags. In the developing world, 80% of all farmers rely on farm-saved seed as their primary seed source. These farmers are not just saving seeds, they are selecting and adapting plants to specific farming conditions and needs. They are plant breeders who are also maintaining rich reservoirs of crop genetic diversity.

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Furthermore, loss of cost savings from brown bagging also must be weighed against the productivity gains to the farmer from having superior new varieties that could increase crop values such as yield and quality, input. Cost reductions such as for fertilizers and pesticides, and reduce losses such as those due to pests or adverse soils and weather. Raising the economic incentive for minor crop improvement and crop development will raise the rate of return for growers. Market forces will limit the spread of TPS in the seed market to levels that are cost effective. If the cost of the improved seeds does not result in greater value to the producer, there will be no market for the TPS varieties.	**Poor Choices** Farmers are not stupid, and they will not buy seed that does not bring them benefits. But market choices must be examined in the context of privatization of plant breeding and rapid consolidation in the global seed industry. Today, the top 10 seed companies control 30% of the global seed trade (9). With the takeover of Delta & Pine Land, Monsanto will control 85% of the US cotton seed market and over one-third of the US soybean market. Monsanto already controls one-half of the Argentine maize market. Meanwhile, public plant breeding is declining all over the world. Does this mean more choice for farmers? In light of seed industry oligopoly and technologies like Terminator, farmers are increasingly vulnerable and have far fewer options in the marketplace. Free choice is not always an option. In some countries farmers are required to use certain plant varieties as a condition of government or commercial credit (see Translator's Notes). It is likely that public breeders wanting access to patented genes and traits controlled by the private sector could be forced to adopt the Terminator as a licensing requirement.

Notes

1. *RAFI Communique*, "Seed Industry Consolidation: Who Owns Whom?" July/August, 1998.
2. Crouch, Martha L., "How the Terminator terminates: an explanation for the non-scientist of a remarkable patent for killing second generation seeds of crop plants," *An Occasional paper of The Edmonds Institute*, 1998.
3. For further insight into this issue, see PCT patent number WO 94/03619, the so-called "Verminator" patent issued to Zeneca for molecular control of plant development through to maturity and seed production.
4. Freiberg, B. "Is Delta and Pine Land's Terminator Gene a Billion Dollar Discovery?" *Seeds and Crop Digest*, May/June, 1998.
5. Food and Agriculture Organization of the United Nations, "The State of the World's Plant Genetic Resources for Food and Agriculture," (Background documentation prepared for the International Technical Conference on Plant 6. Genetic Resources, Leipzig, Germany 17-23 June 1996), Rome, 1996.
6. Crouch, Martha L., "How the Terminator terminates: an explanation for the non-scientist of a remarkable patent for killing second generation seeds of crop plants," *An Occasional paper of The Edmonds Institute*, 1998.
7. K. Darwin Murrell, Deputy Administrator, National Program Staff, U.S. Department of Agriculture, Agricultural Research Service, *Internal USDA-ARS Memo*, "ARS Research Incorporating the Technology Protection System," September 14, 1998.
8. *RAFI Communique*, "The Terminator Technology: New Genetic Technology Aims to Prevent Farmers from Saving Seed," March/April, 1998.
9. *RAFI Communique*, "Seed Industry Consolidation: Who Owns Whom?" July/August, 1998